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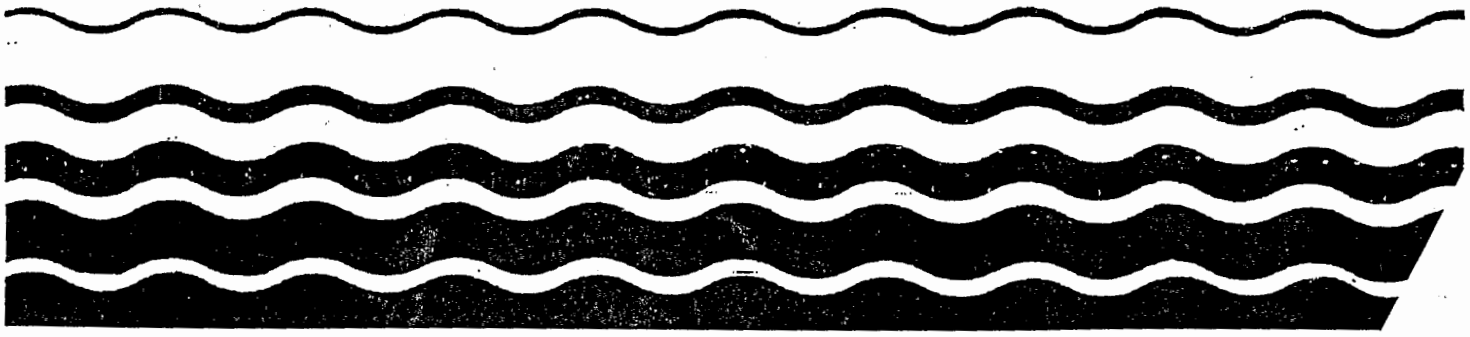
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# Technical Support Document for Land Application of Sewage Sludge

## Volume II



# TECHNICAL SUPPORT DOCUMENT

# FOR

# LAND APPLICATION OF SEWAGE SLUDGE

## VOLUME II

## APPENDICES

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# APPENDIX A

## 40 CFR Part 503 Standards for the Use or Disposal of Sewage Sludge, Subparts A, B, and D

Subchapter O in chapter I of title 40 of the Code of Federal Regulations is amended by adding part 503, which reads as follows:

SUBCHAPTER O—SEWAGE SLUDGE

## PART 503—STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE


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### Appendix A to Part 503—Procedure to Determine the Annual Whole Sludge Application Rate for a Sewage Sludge

### Appendix B to Part 503—Pathogen Treatment Processes


**Authority:** Sections 405 (d) and (e) of the Clean Water Act, as amended by Pub. L. 95-217, Sec. 54(d), 91 Stat. 1591 (33 U.S.C. 1345 (d) and (e)); and Pub. L. 100-4, Title IV, Sec. 406 (a), (b), 101 Stat., 71, 72 (33 U.S.C. 1251 *et seq.*).

### Subpart A—General Provisions

**§ 503.1 Purpose and applicability.**

(a) *Purpose.* (1) This part establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site.

(2) In addition, the standards in this part include the frequency of monitoring and recordkeeping requirements when sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are reporting requirements for Class I sludge management facilities, publicly owned treatment works (POTWs) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more.

(b) *Applicability.* (1) This part applies to any person who prepares sewage sludge, applies sewage sludge to the land, or fires sewage sludge in a sewage sludge incinerator and to the owner/operator of a surface disposal site.

(2) This part applies to sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

(3) This part applies to the exit gas from a sewage sludge incinerator stack.

(4) This part applies to land where sewage sludge is applied, to a surface disposal site, and to a sewage sludge incinerator.

**§ 503.2 Compliance period.**

(a) Compliance with the standards in this part shall be achieved as expeditiously as practicable, but in no case later than February 19, 1994. When compliance with the standards requires construction of new pollution control facilities, compliance with the standards shall be achieved as expeditiously as practicable, but in no case later than February 19, 1995.

(b) The requirements for frequency of monitoring, recordkeeping, and reporting in this part for total hydrocarbons in the exit gas from a sewage sludge incinerator are effective February 19, 1994 or, if compliance with the operational standard for total hydrocarbons in this part requires the construction of new pollution control facilities, February 19, 1995.

(c) All other requirements for frequency of monitoring, recordkeeping, and reporting in this part are effective on July 20, 1993.

**§ 503.3 Permits and direct enforceability.**

(a) Permits. The requirements in this part may be implemented through a permit:

(1) Issued to a "treatment works treating domestic sewage", as defined in 40 CFR 122.2, in accordance with 40 CFR parts 122 and 124 by EPA or by a State that has a State sludge management program approved by EPA in accordance with 40 CFR part 123 or 40 CFR part 501 or

(2) Issued under subtitle C of the Solid Waste Disposal Act; part C of the Safe Drinking Water Act; the Marine Protection, Research, and Sanctuaries Act of 1972; or the Clean Air Act. "Treatment works treating domestic sewage" shall submit a permit application in accordance with either 40 CFR 122.21 or an approved State program.

(b) Direct enforceability. No person shall use or dispose of sewage sludge through any practice for which requirements are established in this part except in accordance with such requirements.

**§ 503.4 Relationship to other regulations.**

Disposal of sewage sludge in a municipal solid waste landfill unit, as defined in 40 CFR 258.2, that complies with the requirements in 40 CFR part 258 constitutes compliance with section 405(d) of the CWA. Any person who prepares sewage sludge that is disposed in a municipal solid waste landfill unit shall ensure that the sewage sludge meets the requirements in 40 CFR part 258 concerning the quality of materials disposed in a municipal solid waste landfill unit.

**§ 503.5 Additional or more stringent requirements.**

(a) On a case-by-case basis, the permitting authority may impose requirements for the use or disposal of sewage sludge in addition to or more stringent than the requirements in this part when necessary to protect public health and the environment from any adverse effect of a pollutant in the sewage sludge.

(b) Nothing in this part precludes a State or political subdivision thereof or interstate agency from imposing requirements for the use or disposal of sewage sludge more stringent than the requirements in this part or from imposing additional requirements for the use or disposal of sewage sludge.

**§ 503.6 Exclusions.**

(a) *Treatment processes.* This part does not establish requirements for processes used to treat domestic sewage or for processes used to treat sewage sludge prior to final use or disposal, except as provided in § 503.32 and § 503.33.

(b) *Selection of a use or disposal practice.* This part does not require the selection of a sewage sludge use or disposal practice. The determination of the manner in which sewage sludge is used or disposed is a local determination.

(c) *Co-firing of sewage sludge.* This part does not establish requirements for sewage sludge co-fired in an incinerator with other wastes or for the incinerator in which sewage sludge and other wastes are co-fired. Other wastes do not include auxiliary fuel, as defined in 40 CFR 503.41(b), fired in a sewage sludge incinerator.

(d) *Sludge generated at an industrial facility.* This part does not establish requirements for the use or disposal of sludge generated at an industrial facility during the treatment of industrial wastewater, including sewage sludge generated during the treatment of industrial wastewater combined with domestic sewage.

(e) *Hazardous sewage sludge.* This part does not establish requirements for the use or disposal of sewage sludge determined to be hazardous in accordance with 40 CFR part 261.

(f) *Sewage sludge with high PCB concentration.* This part does not establish requirements for the use or disposal of sewage sludge with a concentration of polychlorinated biphenyls (PCBs) equal to or greater than 50 milligrams per kilogram of total solids (dry weight basis).

(g) *Incinerator ash.* This part does not establish requirements for the use or disposal of ash generated during the firing of sewage sludge in a sewage sludge incinerator.

(h) *Grit and screenings.* This part does not establish requirements for the use or disposal of grit (e.g., sand, gravel, cinders, or other materials with a high specific gravity) or screenings (e.g., relatively large materials such as rags) generated during preliminary treatment of domestic sewage in a treatment works.

(i) *Drinking water treatment sludge.* This part does not establish requirements for the use or disposal of sludge generated during the treatment of either surface water or ground water used for drinking water.

(j) *Commercial and industrial septage.* This part does not establish requirements for the use or disposal of commercial septage, industrial septage, a mixture of domestic septage and commercial septage, or a mixture of domestic septage and industrial septage.

**§ 503.7 Requirement for a person who prepares sewage sludge.**

Any person who prepares sewage sludge shall ensure that the applicable requirements in this part are met when the sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

**§ 503.8 Sampling and analysis.**

(a) *Sampling.* Representative samples of sewage sludge that is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator shall be collected and analyzed.

(b) *Methods.* The materials listed below are incorporated by reference in this part. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The materials are incorporated as they exist on the date of approval, and notice of any change in these materials will be published in the Federal Register. They are available for inspection at the Office of the Federal Register, 7th Floor, suite 700, 800 North Capitol Street, NW., Washington, DC, and at the Office of Water Docket, room L–102, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC. Copies may be obtained from the standard producer or publisher listed in the regulation. Methods in the materials listed below shall be used to analyze samples of sewage sludge.

(1) *Enteric viruses.* ASTM Designation: D 4994–89, "Standard Practice for Recovery of Viruses From Wastewater Sludges", 1992 Annual Book of ASTM Standards: Section 11—Water and Environmental Technology, ASTM, 1916 Race Street, Philadelphia, PA 19103–1187.

(2) *Fecal coliform.* Part 9221 E. or Part 9222 D., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(3) *Helminth ova.* Yanko, W.A., "Occurrence of Pathogens in Distribution and Marketing Municipal Sludges", EPA 600/1–87–014, 1987. National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB 88–154273/AS).

(4) *Inorganic pollutants:* "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW–846, Second Edition (1982) with Updates I (April 1984) and II (April 1985) and Third Edition (November 1986) with Revision I (December 1987). Second Edition and Updates I and II are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB–87–120–291). Third Edition and Revision I are available from Superintendent of Documents, Government Printing Office, 941 North Capitol Street, NE., Washington, DC 20002 (Document Number 955–001–00000–1).

(5) *Salmonella sp. bacteria.* Part 9260 D., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005; or

Kenner, B.A. and H.P. Clark, "Detection and enumeration of *Salmonella* and *Pseudomonas aeruginosa*", Journal of the Water Pollution Control Federation, Vol. 46, no. 9, September 1974, pp. 2163–2171. Water Environment Federation, 601 Wythe Street, Alexandria, Virginia 22314.

(6) *Specific oxygen uptake rate.* Part 2710 B., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(7) *Total, fixed, and volatile solids.* Part 2540 G., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

**§ 503.9 General definitions.**

(a) *Apply sewage sludge or sewage sludge applied to the land* means land application of sewage sludge.

(b) *Base flood* is a flood that has a one percent chance of occurring in any given year (i.e., a flood with a magnitude equalled once in 100 years).

(c) *Class I sludge management facility* is any publicly owned treatment works (POTW), as defined in 40 CFR 501.2, required to have an approved pretreatment program under 40 CFR 403.8(a) (including any POTW located in a State that has elected to assume local program responsibilities pursuant to 40 CFR 403.10(e)) and any treatment works treating domestic sewage, as defined in 40 CFR 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for its sewage sludge use or disposal practice to affect public health and the environment adversely.

(d) *Cover crop* is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

(e) *CWA* means the Clean Water Act (formerly referred to as either the Federal Water Pollution Act or the Federal Water Pollution Control Act Amendments of 1972), Public Law 92–500, as amended by Public Law 95–217, Public Law 95–576, Public Law 96–483, Public Law 97–117, and Public Law 100–4.

(f) *Domestic septage* is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

(g) *Domestic sewage* is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

(h) *Dry weight basis* means calculated on the basis of having been dried at 105 degrees Celsius until reaching a constant mass (i.e., essentially 100 percent solids content).

(i) *EPA* means the United States Environmental Protection Agency.

(j) *Feed crops* are crops produced primarily for consumption by animals.

(k) *Fiber crops* are crops such as flax and cotton.

(l) *Food crops* are crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

(m) *Ground water* is water below the land surface in the saturated zone.

(n) *Industrial wastewater* is wastewater generated in a commercial or industrial process.

(o) *Municipality* means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal Agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management Agency under section 208 of the CWA, as amended. The definition includes a special district created under State law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201(e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use, or disposal of sewage sludge.

(p) *Permitting authority* is either EPA or a State with an EPA-approved sludge management program.

(q) *Person* is an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

(r) *Person who prepares sewage sludge* is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

(s) *Place sewage sludge or sewage sludge placed* means disposal of sewage sludge on a surface disposal site.

(t) *Pollutant* is an organic substance, an inorganic substance, a combination of organic and inorganic substances, or a pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could, on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction), or physical deformations in either organisms or offspring of the organisms.

(u) *Pollutant limit* is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of a pollutant that can be applied to a unit area of land (e.g., kilograms per hectare); or the volume of a material that can be

applied to a unit area of land (e.g., gallons per acre).

(v) *Runoff* is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off of the land surface.

(w) *Sewage sludge* is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

(x) *State* is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian Tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

(y) *Store or storage of sewage sludge* is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

(z) *Treat or treatment of sewage sludge* is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

(aa) *Treatment works* is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature.

(bb) *Wetlands* means those areas that are inundated or saturated by surface water or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

## Subpart B—Land Application

### §503.10 Applicability.

(a) This subpart applies to any person who prepares sewage sludge that is applied to the land, to any person who applies sewage sludge to the land, to sewage sludge applied to the land, and to the land on which sewage sludge is applied.

(b)(1) *Bulk sewage sludge.* The general requirements in § 503.12 and the management practices in § 503.14 do not apply when bulk sewage sludge is applied to the land if the bulk sewage sludge meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in § 503.12 and the management practices in § 503.14 to the bulk sewage sludge in § 503.10(b)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(c)(1) The general requirements in § 503.12 and the management practices in § 503.14 do not apply when a bulk material derived from sewage sludge is applied to the land if the derived bulk material meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in § 503.12 or the management practices in § 503.14 to the bulk material in § 503.10(c)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(d) The requirements in this subpart do not apply when a bulk material derived from sewage sludge is applied to the land if the sewage sludge from which the bulk material is derived meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(e) *Sewage sludge sold or given away in a bag or other container for application to the land.* The general requirements in § 503.12 and the management practices in § 503.14 do not apply when sewage sludge is sold or given away in a bag or other container for application to the land if the sewage sludge sold or given away in a bag or other container for application to the land meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(f) The general requirements in § 503.12 and the management practices in § 503.14 do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the derived material meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(g) The requirements in this subpart do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the sewage sludge from which the material is derived meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

### §503.11 Special definitions.

(a) *Agricultural land* is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

(b) *Agronomic rate* is the whole sludge application rate (dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

(c) *Annual pollutant loading rate* is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

(d) *Annual whole sludge application rate* is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

(e) *Bulk sewage sludge* is sewage sludge that is not sold or given away in a bag or other container for application to the land.

(f) *Cumulative pollutant loading rate* is the maximum amount of an inorganic pollutant that can be applied to an area of land.

(g) *Forest* is a tract of land thick with trees and underbrush.

(h) *Land application* is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

(i) *Monthly average* is the arithmetic mean of all measurements taken during the month.

(j) *Other container* is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

(k) *Pasture* is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

(l) *Public contact site* is land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

(m) *Range land* is open land with indigenous vegetation.

(n) *Reclamation site* is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

**§ 503.12 General requirements.**

(a) No person shall apply sewage sludge to the land except in accordance with the requirements in this subpart.

(b) No person shall apply bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) to agricultural land, forest, a public contact site, or a reclamation site if any of the cumulative pollutant loading rates in § 503.13(b)(2) has been reached.

(c) No person shall apply domestic septage to agricultural land, forest, or a reclamation site during a 365 day period if the annual application rate in § 503.13(c) has been reached during that period.

(d) The person who prepares bulk sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall provide the person who applies the bulk sewage sludge written notification of the concentration of total nitrogen (as N on a dry weight basis) in the bulk sewage sludge.

(e)(1) The person who applies sewage sludge to the land shall obtain information needed to comply with the requirements in this subpart.

(2)(i) Before bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) is applied to the land, the person who proposes to apply the bulk sewage sludge shall contact the permitting authority for the State in which the bulk sewage sludge will be applied to determine whether bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993.

(ii) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has not been applied to the site since July 20, 1993, the cumulative amount for each pollutant listed in Table 2 of § 503.13 may be applied to the site in accordance with § 503.13(a)(2)(i).

(iii) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is known, the cumulative amount of each pollutant applied to the site shall be used to determine the additional amount of each pollutant that can be applied to the site in accordance with § 503.13(a)(2)(i).

(iv) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is not known, an additional amount of each pollutant shall not be applied to the site in accordance with § 503.13(a)(2)(i).

(f) When a person who prepares bulk sewage sludge provides the bulk sewage sludge to a person who applies the bulk sewage sludge to the land, the person who prepares the bulk sewage sludge shall provide the person who applies the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(g) When a person who prepares sewage sludge provides the sewage sludge to another person who prepares the sewage sludge, the person who provides the sewage sludge shall provide the person who receives the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(h) The person who applies bulk sewage sludge to the land shall provide the owner or lease holder of the land on which the bulk sewage sludge is applied notice and necessary information to comply with the requirements in this subpart.

(i) Any person who prepares bulk sewage sludge that is applied to land in a State other than the State in which the bulk sewage sludge is prepared shall provide written notice, prior to the initial application of bulk sewage sludge to the land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge is proposed to be applied. The notice shall include:

(1) The location, by either street address or latitude and longitude, of each land application site.

(2) The approximate time period bulk sewage sludge will be applied to the site.

(3) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who prepares the bulk sewage sludge.

(4) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who will apply the bulk sewage sludge.

(j) Any person who applies bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) to the land shall provide written notice, prior to the initial application of bulk sewage sludge to a land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge will be applied and the permitting authority shall retain and provide access to the notice. The notice shall include:

(1) The location, by either street address or latitude and longitude, of the land application site.

(2) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) of the person who will apply the bulk sewage sludge.

**§ 503.13 Pollutant limits.**

(a) Sewage sludge. (1) Bulk sewage sludge or sewage sludge sold or given away in a bag or other container shall not be applied to the land if the concentration of any pollutant in the sewage sludge exceeds the ceiling concentration for the pollutant in Table 1 of § 503.13.

(2) If bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site, either:

(i) The cumulative loading rate for each pollutant shall not exceed the cumulative pollutant loading rate for the pollutant in Table 2 of § 503.13; or

(ii) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13.

(3) If bulk sewage sludge is applied to a lawn or a home garden, the concentration of each pollutant in the

sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13.

(4) If sewage sludge is sold or given away in a bag or other container for application to the land, either:

(i) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13; or

(ii) The product of the concentration of each pollutant in the sewage sludge and the annual whole sludge application rate for the sewage sludge shall not cause the annual pollutant loading rate for the pollutant in Table 4 of § 503.13 to be exceeded. The procedure used to determine the annual whole sludge application rate is presented in appendix A of this part.

(b) Poliutant concentrations and loading rates—sewage sludge.

(1) Ceiling concentrations.

TABLE 1 OF § 503.13.—CEILING CONCENTRATIONS

| Pollutant | Ceiling concentration (milligrams per kilogram)[1] |
|---|---|
| Arsenic | 75 |
| Cadmium | 85 |
| Chromium | 3000 |
| Copper | 4300 |
| Lead | 840 |
| Mercury | 57 |
| Molybdenum | 75 |
| Nickel | 420 |
| Selenium | 100 |
| Zinc | 7500 |

[1] Dry weight basis.

(2) Cumulative poll ·nt loading rates.

TABLE 2 OF § 503.13.—CUMULATIVE POLLUTANT LOADING RATES

| Pollutant | Cumulative pollutant loading rate (kilograms per hectare) |
|---|---|
| Arsenic | 41 |
| Cadmium | 39 |
| Chromium | 3000 |
| Copper | 1500 |
| Lead | 300 |
| Mercury | 17 |
| Molybdenum | 18 |
| Nickel | 420 |
| Selenium | 100 |
| Zinc | 2800 |

(3) Pollutant concentrations.

TABLE 3 OF § 503.13.—POLLUTANT CONCENTRATIONS

| Pollutant | Monthly average concentrations (milligrams per kilogram)[1] |
|---|---|
| Arsenic | 41 |
| Cadmium | 39 |
| Chromium | 1200 |
| Copper | 1500 |

TABLE 3 OF § 503.13.—POLLUTANT CONCENTRATIONS—Continued

| Pollutant | Monthly average concentrations (milligrams per kilogram)[1] |
|---|---|
| Lead | 300 |
| Mercury | 17 |
| Molybdenum | 18 |
| Nickel | 420 |
| Selenium | 36 |
| Zinc | 2800 |

[1] Dry weight basis.

(4) Annual pollutant loading rates.

TABLE 4 OF § 503.13.—ANNUAL POLLUTANT LOADING RATES

| Pollutant | Annual pollutant loading rate (kilograms per hectare per 365 day period) |
|---|---|
| Arsenic | 2.0 |
| Cadmium | 1.9 |
| Chromium | 150 |
| Copper | 75 |
| Lead | 15 |
| Mercury | 0.85 |
| Molybdenum | 0.90 |
| Nickel | 21 |
| Selenium | 5.0 |
| Zinc | 140 |

(c) Domestic septage.

The annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site shall not exceed the annual application rate calculated using equation (1).

$$AAR = \frac{N}{0.0026} \qquad \text{Eq. (1)}$$

Where:

AAR=Annual application rate in gallons per acre per 365 day period.

N=Amount of nitrogen in pounds per acre per 365 day period needed by the crop or vegetation grown on the land.

**§ 503.14 Management practices.**

(a) Bulk sewage sludge shall not be applied to the land if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) Bulk sewage sludge shall not be applied to agricultural land, forest, a public contact site, or a reclamation site that is flooded, frozen, or snow-covered so that the bulk sewage sludge enters a wetland or other waters of the United States, as defined in 40 CFR 122.2, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(c) Bulk sewage sludge shall not be applied to agricultural land, forest, or a reclamation site that is 10 meters or less from waters of the United States, as defined in 40 CFR 122.2, unless otherwise specified by the permitting authority.

(d) Bulk sewage sludge shall be applied to agricultural land, forest, a public contact site, or a reclamation site at a whole sludge application rate that is equal to or less than the agronomic rate for the bulk sewage sludge, unless, in the case of a reclamation site, otherwise specified by the permitting authority.

(e) Either a label shall be affixed to the bag or other container in which sewage sludge that is sold or given away for application to the land, or an information sheet shall be provided to the person who receives sewage sludge sold or given away in an other container for application to the land. The label or information sheet shall contain the following information:

(1) The name and address of the person who prepared the sewage sludge that is sold or given away in a bag or other container for application to the land.

(2) A statement that application of the sewage sludge to the land is prohibited except in accordance with the instructions on the label or information sheet.

(3) The annual whole sludge application rate for the sewage sludge that does not cause any of the annual pollutant loading rates in Table 4 of § 503.13 to be exceeded.

**§ 503.15 Operational standards—pathogens and vector attraction reduction.**

(a) *Pathogens—sewage sludge.*

(1) The Class A pathogen requirements in § 503.32(a) or the Class B pathogen requirements and site restrictions in § 503.32(b) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) The Class A pathogen requirements in § 503.32(a) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) The Class A pathogen requirements in § 503.32(a) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(b) *Pathogens—domestic septage.*

The requirements in either § 503.32 (c)(1) or (c)(2) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

(c) *Vector attraction reduction—sewage sludge.*

(1) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(10) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(d) *Vector attraction reduction—domestic septage.* The vector attraction reduction requirements in § 503.33(b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

**§ 503.16 Frequency of monitoring.**

(a) *Sewage sludge.* (1) The frequency of monitoring for the pollutants listed in Table 1, Table 2, Table 3 and Table 4 of § 503.13; the pathogen density requirements in § 503.32(a) and in § 503.32(b)(2) through (b)(4); and the vector attraction reduction requirements § 503.33 (b)(1) through § 503.33(b)(8) shall be the frequency in Table 1 of § 503.16.

TABLE. 1 OF § 503.16.—FREQUENCY OF MONITORING—LAND APPLICATION

| Amount of sewage sludge [1] (metric tons per 365 day period) | Frequency |
|---|---|
| Greater than zero but less than 290. | Once per year. |
| Equal to or greater than 290 but less than 1,500. | Once per quarter (four times per year). |
| Equal to or greater than 1,500 but less than 15,000. | Once per 60 days (six times per year). |
| Equal to or greater than 15,000. | Once per month (12 times per year). |

[1] Either the amount of bulk sewage sludge applied to the land or the amount of sewage sludge received by a person who prepares sewage sludge that is sold or given away in a bag or other container for application to the land (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of § 503.16, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in § 503.32 (a)(5)(ii) and (a)(5)(iii), but in no case shall the frequency of monitoring be less than once per year when sewage sludge is applied to the land.

(b) *Domestic septage.* If either the pathogen requirements in § 503.32(c)(2) or the vector attraction reduction requirements in § 503.33(b)(12) are met when domestic septage is applied to agricultural land, forest, or a reclamation site, each container of domestic septage applied to the land shall be monitored for compliance with those requirements.

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**§ 503.17 Recordkeeping.**

(a) *Sewage sludge.* (1) The person who prepares the sewage sludge in § 503.10(b)(1) or (e) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of § 503.13 in the sewage sludge.

(ii) The following certification statement:

"I certify, under penalty of law, that the Class A pathogen requirements in § 503.32(a) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33(b)(1) through § 503.33(b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iii) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met.

(2) The person who derives the material in § 503.10 (c)(1) or (f) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of § 503.13 in the material.

(ii) The following certification statement:

"I certify, under penalty of law, that the Class A pathogen requirements in § 503.32(a) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and the vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iii) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met.

(3) If the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and the vector attraction reduction requirements in either § 503.33 (b)(9) or (b)(10) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 3 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in § 503.32(a) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the pathogen requirements in § 503.32(a) are met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14 and the vector attraction reduction requirement in [insert either § 503.33 (b)(9) or (b)(10)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(B) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the vector attraction reduction requirements in either § 503.33(b)(9) or (b)(10) are met for each site on which bulk sewage sludge is applied.

(4) If the pollutant concentrations in § 503.13(b)(3) and the Class B pathogen requirements in § 503.32(b) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years:



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(A) The concentration of each pollutant listed in Table 3 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify under, penalty of law, that the Class B pathogen requirements in § 503.32(b) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) if one of those requirements is met] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements if applicable] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the Class B pathogen requirements in § 503.32(b) are met.

(D) When one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction reduction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14, the site restrictions in § 503.32(b)(5), and the vector attraction reduction requirements in [insert either § 503.33 (b)(9) or (b)(10), if one of those requirements is met] have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and site restrictions [and the vector attraction reduction requirements if applicable] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(B) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the site restrictions in § 503.32(b)(5) are met for each site on which bulk sewage sludge is applied.

(D) When the vector attraction reduction requirement in either § 503.33 (b)(9) or (b)(10) is met, a description of how the vector attraction reduction requirement is met.

(5) If the requirements in § 503.13(a)(2)(i) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 1 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert either § 503.32(a) or § 503.32(b)] and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) if one of those requirements is met] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the pathogen requirements in either § 503.32 (a) or (b) are met.

(D) When one of the vector attraction requirements in § 503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information, retain the information in § 503.17 (a)(5)(ii)(A) through (a)(5)(ii)(G) indefinitely, and retain the information in § 503.17 (a)(5)(ii)(H) through (a)(5)(ii)(M) for five years.

(A) The location, by either street address or latitude and longitude, of each site on which bulk sewage sludge is applied.

(B) The number of hectares in each site on which bulk sewage sludge is applied.

(C) The date and time bulk sewage sludge is applied to each site.

(D) The cumulative amount of each pollutant (i.e., kilograms) listed in Table 2 of § 503.13 in the bulk sewage sludge applied to each site, including the amount in § 503.12(e)(2)(iii).

(E) The amount of sewage sludge (i.e., metric tons) applied to each site.

(F) The following certification statement:

"I certify, under penalty of law, that the requirements to obtain information in § 503.12(e)(2) have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the requirements to obtain information have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(G) A description of how the requirements to obtain information in § 503.12(e)(2) are met.

(H) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14 have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(I) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(J) The following certification statement when the bulk sewage sludge meets the Class B pathogen requirements in § 503.32(b):

"I certify, under penalty of law, that the site restrictions in § 503.32(b)(5) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the site restrictions have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(K) A description of how the site restrictions in § 503.32(b)(5) are met for each site on which Class B bulk sewage sludge is applied.

(L) The following certification statement when the vector attraction reduction requirement in either § 503.33 (b)(9) or (b)(10) is met:

"I certify, under penalty of law, that the vector attraction reduction requirement in [insert either § 503.33(b)(9) or § 503.33(b)(10)] has been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the vector attraction reduction requirement has been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(M) If the vector attraction reduction requirements in either § 503.33 (b)(9) or (b)(10) are met, a description of how the requirements are met.

(6) If the requirements in § 503.13(a)(4)(ii) are met when sewage sludge is sold or given away in a bag or

other container for application to the land, the person who prepares the sewage sludge that is sold or given away in a bag or other container shall develop the following information and shall retain the information for five years:

(i) The annual whole sludge application rate for the sewage sludge that does not cause the annual pollutant loading rates in Table 4 of § 503.13 to be exceeded.

(ii) The concentration of each pollutant listed in Table 4 of § 503.13 in the sewage sludge.

(iii) The following certification statement:

"I certify, under penalty of law, that the management practice in § 503.14(e), the Class A pathogen requirement in § 503.32(a), and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practice, pathogen requirements, and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iv) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(v) A description of how one of the vector attraction requirements in § 503.33 (b)(1) through (b)(8) is met.

(b) *Domestic septage.* When domestic septage is applied to agricultural land, forest, or a reclamation site, the person who applies the domestic septage shall develop the following information and shall retain the information for five years:

(1) The location, by either street address or latitude and longitude, of each site on which domestic septage is applied.

(2) The number of acres in each site on which domestic septage is applied.

(3) The date and time domestic septage is applied to each site.

(4) The nitrogen requirement for the crop or vegetation grown on each site during a 365 day period.

(5) The rate, in gallons per acre per 365 day period, at which domestic septage is applied to each site.

(6) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert either § 503.32(c)(1) or § 503.32(c)(2)] and the vector attraction reduction requirements in [insert § 503.33(b)(9), § 503.33(b)(10), or § 503.33(b)(12)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(7) A description of how the pathogen requirements in either § 503.33 (c)(1) or (c)(2) are met.

(8) A description of how the vector attraction reduction requirements in § 503.33 (b)(9), (b)(10), or (b)(12) are met.

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**§ 503.18 Reporting.**

(a) Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more shall submit the following information to the permitting authority:

(1) The information in § 503.17(a), except the information in § 503.17 (a)(3)(ii), (a)(4)(ii) and in (a)(5)(ii), for the appropriate requirements on February 19 of each year.

(2) The information in § 503.17 (a)(5)(ii)(A) through (a)(5)(ii)(G) on [insert the month and day from the date of publication of this rule] of each year when 90 percent or more of any of the cumulative pollutant loading rates in Table 2 of § 503.13 is reached at a site.

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post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground-water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground-water monitoring, pollutant fate and transport, and corrective action.

(m) *Seismic impact zone* is an area that has a 10 percent or greater probability that the horizontal ground level acceleration of the rock in the area exceeds 0.10 gravity once in 250 years.

(n) *Sewage sludge unit* is land on which only sewage sludge is placed for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR 122.2.

(o) *Sewage sludge unit boundary* is the outermost perimeter of an active sewage sludge unit.

(p) *Surface disposal site* is an area of land that contains one or more active sewage sludge units.

(q) *Unstable area* is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

**§ 503.22 General requirements.**

(a) No person shall place sewage sludge on an active sewage sludge unit unless the requirements in this subpart are met.

(b) An active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time; located in an unstable area; or located in a wetland, except as provided in a permit issued pursuant to section 402 of the CWA, shall close by [insert date one year after the effective date of this Final rule], unless, in the case of an active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time, otherwise specified by the permitting authority.

(c) The owner/operator of an active sewage sludge unit shall submit a written closure and post closure plan to the permitting authority 180 days prior to the date that the active sewage sludge unit closes. The plan shall describe how the sewage sludge unit will be closed and, at a minimum, shall include:

(1) A discussion of how the leachate collection system will be operated and maintained for three years after the sewage sludge unit closes if the sewage sludge unit has a liner and leachate collection system.

(2) A description of the system used to monitor for methane gas in the air in any structures within the surface disposal site and in the air at the property line of the surface disposal site, as required in § 503.24(j)(2).

(3) A discussion of how public access to the surface disposal site will be restricted for three years after the last sewage sludge unit in the surface disposal site closes.

(d) The owner of a surface disposal site shall provide written notification to the subsequent owner of the site that sewage sludge was placed on the land.

**§ 503.23 Pollutant limits (other than domestic septage).**

(a) Active sewage sludge unit without a liner and leachate collection system.

(1) Except as provided in § 503.23 (a)(2) and (b), the concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit shall not exceed the concentration for the pollutant in Table 1 of § 503.23.

TABLE 1 OF § 503.23.—POLLUTANT CONCENTRATIONS—ACTIVE SEWAGE SLUDGE UNIT WITHOUT A LINER AND LEACHATE COLLECTION

| Pollutant | Concentration (milligrams per kilograms [1]) |
|---|---|
| Arsenic | 73 |
| Chromium | 600 |
| Nickel | 420 |

[1] Dry weight basis.

(2) Except as provided in § 503.23(b), the concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit whose boundary is less than 150 meters from the property line of the surface disposal site shall not exceed the concentration determined using the following procedure.

(i) The actual distance from the active sewage sludge unit boundary to the property line of the surface disposal site shall be determined.

(ii) The concentration of each pollutant listed in Table 2 of § 503.23 in the sewage sludge shall not exceed the concentration in Table 2 of § 503.23 that corresponds to the actual distance in § 503.23(a)(2)(i).

TABLE 2 OF § 503.23.—POLLUTANT CONCENTRATIONS—ACTIVE SEWAGE SLUDGE UNIT WITHOUT A LINER AND LEACHATE COLLECTION SYSTEM THAT HAS A UNIT BOUNDARY TO PROPERTY LINE DISTANCE LESS THAN 150 METERS

| Unit boundary to property line | Pollutant concentration [1] | | |
|---|---|---|---|
| Distance (meters) | Arsenic (mg/kg) | Chromium (mg/kg) | Nickel (mg/kg) |
| 0 to less than 25 | 30 | 200 | 210 |
| 25 to less than 50 | 34 | 220 | 240 |
| 50 to less than 75 | 39 | 260 | 270 |
| 75 to less than 100 | 46 | 300 | 320 |
| 100 to less than 125 | 53 | 360 | 390 |
| 125 to less than 150 | 62 | 450 | 420 |

[1] Dry weight basis.

(b) Active sewage sludge unit without a liner and leachate collection system—site-specific limits.

(1) At the time of permit application, the owner/operator of a surface disposal site may request site-specific pollutant limits in accordance with § 503.23(b)(2) for an active sewage sludge unit without a liner and leachate collection system when the existing values for site parameters specified by the permitting authority are different from the values for those parameters used to develop the pollutant limits in Table 1 of § 503.23 and when the permitting authority determines that site-specific pollutant limits are appropriate for the active sewage sludge unit.

(2) The concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit without a liner and leachate collection system shall not exceed either the concentration for the pollutant determined during a site-specific assessment, as specified by the permitting authority, or the existing concentration of the pollutant in the sewage sludge, whichever is lower.

**§ 503.24 Management practices.**

(a) Sewage sludge shall not be placed on an active sewage sludge unit if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) An active sewage sludge unit shall not restrict the flow of a base flood.

(c) When a surface disposal site is located in a seismic impact zone, an active sewage sludge unit shall be designed to withstand the maximum recorded horizontal ground level acceleration.

(d) An active sewage sludge unit shall be located 60 meters or more from a fault that has displacement in Holocene

time, unless otherwise specified by the permitting authority.

(e) An active sewage sludge unit shall not be located in an unstable area.

(f) An active sewage sludge unit shall not be located in a wetland, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(g)(1) Run-off from an active sewage sludge unit shall be collected and shall be disposed in accordance with National Pollutant Discharge Elimination System permit requirements and any other applicable requirements.

(2) The run-off collection system for an active sewage sludge unit shall have the capacity to handle run-off from a 24-hour, 25-year storm event.

(h) The leachate collection system for an active sewage sludge unit that has a liner and leachate collection system shall be operated and maintained during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(i) Leachate from an active sewage sludge unit that has a liner and leachate collection system shall be collected and shall be disposed in accordance with the applicable requirements during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(j)(1) When a cover is placed on an active sewage sludge unit, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas during the period that the sewage sludge unit is active and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas during the period that the sewage sludge unit is active.

(2) When a final cover is placed on a sewage sludge unit at closure, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas for three years after the sewage sludge unit closes and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas for three years after the sewage sludge unit closes, unless otherwise specified by the permitting authority.

(k) A food crop, a feed crop, or a fiber crop shall not be grown on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when crops are grown.

(l) Animals shall not be grazed on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when animals are grazed.

(m) Public access to a surface disposal site shall be restricted for the period that the surface disposal site contains an active sewage sludge unit and for three years after the last active sewage sludge unit in the surface disposal site closes.

(n)(1) Sewage sludge placed on an active sewage sludge unit shall not contaminate an aquifer.

(2) Results of a ground-water monitoring program developed by a qualified ground-water scientist or a certification by a qualified ground-water scientist shall be used to demonstrate that sewage sludge placed on an active sewage sludge unit does not contaminate an aquifer.

**§ 503.25 Operational standards—pathogens and vector attraction reduction.**

(a) *Pathogens—sewage sludge (other than domestic septage).* The Class A pathogens requirements in § 503.32(a) or one of the Class B pathogen requirements in § 503.32 (b)(2) through (b)(4) shall be met when sewage sludge is placed on an active sewage sludge unit, unless the vector attraction reduction requirement in § 503.33(b)(11) is met.

(b) *Vector attraction reduction—sewage sludge (other than domestic septage).* One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(11) shall be met when sewage sludge is placed on an active sewage sludge unit.

(c) *Vector attraction reduction—domestic septage.* One of the vector attraction reduction requirement in § 503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

**§ 503.26 Frequency of monitoring.**

(a) *Sewage sludge (other than domestic septage).*

(1) The frequency of monitoring for the pollutants in Tables 1 and 2 of § 503.23; the pathogen density requirements in § 503.32(a) and in § 503.32 (b)(2) through (b)(4); and the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) for sewage sludge placed on an active sewage sludge unit shall be the frequency in Table 1 of § 503.26.

TABLE 1 OF § 503.26.—FREQUENCY OF MONITORING—SURFACE DISPOSAL

| Amount of sewage sludge[1] (metric tons per 365 day period) | Frequency |
|---|---|
| Greater than zero but less than 290. | Once per year. |
| Equal to or greater than 290 but less than 1,500. | Once per quarter (four times per year). |
| Equal to or greater than 1,500 but less than 15,000. | Once per 60 days (six times per year). |
| Equal to or greater than 15,000. | Once per month (12 times per year). |

[1] Amount of sewage sludge placed on an active sewage sludge unit (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of § 503.26, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in § 503.32 (a)(5)(ii) and (a)(5)(iii), but in no case shall the frequency of monitoring be less than once per year when sewage sludge is placed on an active sewage sludge unit.

(b) *Domestic septage.* If the vector attraction reduction requirements in § 503.33(b)(12) are met when domestic septage is placed on an active sewage sludge unit, each container of domestic septage shall be monitored for compliance with those requirements.

(c) *Air.* Air in structures within a surface disposal site and at the property line of the surface disposal site shall be monitored continuously for methane gas during the period that the surface disposal site contains an active sewage sludge unit on which the sewage sludge is covered and for three years after a sewage sludge unit closes when a final cover is placed on the sewage sludge.

(Approved by the Office of Management and Budget under control number 2040–0157)

**§ 503.27 Recordkeeping.**

(a) When sewage sludge (other than domestic septage) is placed on an active sewage sludge unit:

(1) The person who prepares the sewage sludge shall develop the following information and shall retain the information for five years.

(i) The concentration of each pollutant listed in Table 1 of § 503.23 in the sewage sludge when the pollutant concentrations in Table 1 of § 503.23 are met.

(ii) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert § 503.32(a), § 503.32(b)(2), § 503.32(b)(3), or § 503.32(b)(4) when one of those requirements is met] and the vector attraction reduction requirements in [insert one of the vector attraction

applied to agricultural land, forest, or a reclamation site.

(d) This subpart contains alternative vector attraction reduction requirements for sewage sludge that is applied to the land or placed on a surface disposal site.

**§ 503.31 Special definitions.**

(a) *Aerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

(b) *Anaerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

(c) *Density of microorganisms* is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

(d) *Land with a high potential for public exposure* is land that the public uses frequently. This includes, but is not limited to, a public contact site and a reclamation site located in a populated area (e.g. a construction site located in a city).

(e) *Land with a low potential for public exposure* is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest, and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

(f) *Pathogenic organisms* are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

(g) *pH* means the logarithm of the reciprocal of the hydrogen ion concentration.

(h) *Specific oxygen uptake rate (SOUR)* is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in the sewage sludge.

(i) *Total solids* are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

(j) *Unstabilized solids* are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

(k) *Vector attraction* is the characteristic of sewage sludge that attracts rodents, flies, mosquitos, or other organisms capable of transporting infectious agents.

(l) *Volatile solids* is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

## Subpart D—Pathogens and Vector Attraction Reduction

**§ 503.30 Scope.**

(a) This subpart contains the requirements for a sewage sludge to be classified either Class A or Class B with respect to pathogens.

(b) This subpart contains the site restrictions for land on which a Class B sewage sludge is applied.

(c) This subpart contains the pathogen requirements for domestic septage

**§ 503.32 Pathogens.**

(a) *Sewage sludge—Class A.* (1) The requirement in § 503.32(a)(2) and the requirements in either § 503.32(a)(3), (a)(4), (a)(5), (a)(6), (a)(7), or (a)(8) shall be met for a sewage sludge to be classified Class A with respect to pathogens.

(2) The Class A pathogen requirements in § 503.32 (a)(3) through (a)(8) shall be met either prior to meeting or at the same time the vector attraction reduction requirements in § 503.33, except the vector attraction reduction requirements in § 503.33 (b)(6) through (b)(8), are met.

(3) *Class A—Alternative 1.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) The temperature of the sewage sludge that is used or disposed shall be maintained at a specific value for a period of time.

(A) When the percent solids of the sewage sludge is seven percent or higher, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 20 minutes or longer; and the temperature and time period shall be determined using equation (2), except when small particles of sewage sludge are heated by either warmed gases or an immiscible liquid.

$$D = \frac{131{,}700{,}000}{10^{0.1400t}} \quad \text{Eq. (2)}$$

Where,
D=time in days.
t=temperature in degrees Celsius.

(B) When the percent solids of the sewage sludge is seven percent or higher and small particles of sewage sludge are heated by either warmed gases or an immiscible liquid, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 15 seconds or longer; and the temperature and time period shall be determined using equation (2).

(C) When the percent solids of the sewage sludge is less than seven percent and the time period is at least 15 seconds, but less than 30 minutes, the temperature and time period shall be determined using equation (2).

(D) When the percent solids of the sewage sludge is less than seven percent; the temperature of the sewage sludge is 50 degrees Celsius or higher; and the time period is 30 minutes or longer, the temperature and time period shall be determined using equation (3).

$$D = \frac{50{,}070{,}000}{10^{0.1400t}} \quad \text{Eq. (3)}$$

Where,
D=time in days.
t=temperature in degrees Celsius.

(4) *Class A—Alternative 2.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) (A) The pH of the sewage sludge that is used or disposed shall be raised to above 12 and shall remain above 12 for 72 hours.

(B) The temperature of the sewage sludge shall be above 52 degrees Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12.

(C) At the end of the 72 hour period during which the pH of the sewage sludge is above 12, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50 percent.

(5) *Class A—Alternative 3.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) (A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains enteric viruses.

(B) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses until the next monitoring episode for the sewage sludge.

(C) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is equal to or greater than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses when the density of enteric viruses in the sewage sludge after pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the enteric virus density requirement are documented.

(D) After the enteric virus reduction in paragraph (a)(5)(ii)(C) of this section is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to enteric viruses when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(ii)(C) of this section.

(iii)(A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains viable helminth ova.

(B) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is less than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova until the next monitoring episode for the sewage sludge.

(C) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is equal to or greater than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova when the density of viable helminth ova in the sewage sludge after pathogen treatment is less than one per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the viable helminth ova density requirement are documented.

(D) After the viable helminth ova reduction in paragraph (a)(5)(iii)(C) of this section is demonstrated for the pathogen treatment process, the sewage

sludge continues to be Class A with respect to viable helminth ova when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(iii)(C) of this section.

(6) *Class A—Alternative 4.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) The density of enteric viruses in the sewage sludge shall be less than one Plaque-forming Unit per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f), unless otherwise specified by the permitting authority.

(iii) The density of viable helminth ova in the sewage sludge shall be less than one per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f), unless otherwise specified by the permitting authority.

(7) *Class A—Alternative 5.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella*, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in one of the Processes to Further Reduce Pathogens described in appendix B of this part.

(8) *Class A—Alternative 6.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella*, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Further Reduce Pathogens, as determined by the permitting authority.

(b) *Sewage sludge—Class B.* (1)(i) The requirements in either § 503.32(b)(2), (b)(3), or (b)(4) shall be met for a sewage sludge to be classified Class B with respect to pathogens.

(ii) The site restrictions in § 503.32(b)(5) shall be met when sewage sludge that meets the Class B pathogen requirements in § 503.32(b)(2), (b)(3), or (b)(4) is applied to the land.

(2) *Class B—Alternative 1.*

(i) Seven samples of the sewage sludge shall be collected at the time the sewage sludge is used or disposed.

(ii) The geometric mean of the density of fecal coliform in the samples collected in paragraph (b)(2)(i) of this section shall be less than either 2,000,000 Most Probable Number per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).

(3) *Class B—Alternative 2.* Sewage sludge that is used or disposed shall be treated in one of the Processes to Significantly Reduce Pathogens described in appendix B of this part.

(4) *Class B—Alternative 3.* Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Significantly Reduce Pathogens, as determined by the permitting authority.

(5) *Site Restrictions.* (i) Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

(ii) Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for four months or longer prior to incorporation into the soil.

(iii) Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than four months prior to incorporation into the soil.

(iv) Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of sewage sludge.

(v) Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

(vi) Turf grown on land where sewage sludge is applied shall not be harvested for one year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

(vii) Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge.

(viii) Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

(c) *Domestic septage.* (1) The site restrictions in § 503.32(b)(5) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site; or

(2) The pH of domestic septage applied to agricultural land, forest, or a reclamation site shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes and the site restrictions in § 503.32 (b)(5)(i) through (b)(5)(iv) shall be met.

**§ 503.33 Vector attraction reduction.**

(a)(1) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(10) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(4) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(11) shall be met when sewage sludge (other than domestic



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septage) is placed on an active sewage sludge unit.

(5) One of the vector attraction reduction requirements in § 503.33 (b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site and one of the vector attraction reduction requirements in § 503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

(b)(1) The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38 percent (see calculation procedures in "Environmental Regulations and Technology—Control of Pathogens and Vector Attraction in Sewage Sludge", EPA–625/R–92/013, 1992, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268).

(2) When the 38 percent volatile solids reduction requirement in § 503.33(b)(1) cannot be met for an anaerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30 and 37 degrees Celsius. When at the end of the 40 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 17 percent, vector attraction reduction is achieved.

(3) When the 38 percent volatile solids reduction requirement in § 503.33(b)(1) cannot be met for an aerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge that has a percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20 degrees Celsius. When at the end of the 30 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 15 percent, vector attraction reduction is achieved.

(4) The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process shall be equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20 degrees Celsius.

(5) Sewage sludge shall be treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge shall be higher than 40 degrees Celsius and the average temperature of the sewage sludge shall be higher then 45 degrees Celsius.

(6) The pH of sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for two hours and then at 11.5 or higher for an additional 22 hours.

(7) The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 75 percent based on the moisture content and total solids prior to mixing with other materials.

(8) The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 90 percent based on the moisture content and total solids prior to mixing with other materials.

(9)(i) Sewage sludge shall be injected below the surface of the land.

(ii) No significant amount of the sewage sludge shall be present on the land surface within one hour after the sewage sludge is injected.

(iii) When the sewage sludge that is injected below the surface of the land is Class A with respect to pathogens, the sewage sludge shall be injected below the land surface within eight hours after being discharged from the pathogen treatment process.

(10)(i) Sewage sludge applied to the land surface or placed on a surface disposal site shall be incorporated into the soil within six hours after application to or placement on the land.

(ii) When sewage sludge that is incorporated into the soil is Class A with respect to pathogens, the sewage sludge shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

(11) Sewage sludge placed on an active sewage sludge unit shall be covered with soil or other material at the end of each operating day.

(12) The pH of domestic septage shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes.

## APPENDIX B

## Justification for Deletion of Pollutants from the Final Standards for the Use or Disposal of Sewage Sludge

# JUSTIFICATION FOR THE DELETION OF POLLUTANTS FROM THE FINAL STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

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# JUSTIFICATION FOR THE DELETION OF POLLUTANTS FROM THE FINAL STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Office of Science and Technology
U.S. Environmental Protection Agency
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November 16, 1992

## SECTION ONE

## INTRODUCTION

On February 6, 1989, the U.S. Environmental Protection Agency (EPA) proposed Standards for the Use or Disposal of Sewage Sludge (**40 CFR Part 503**) in the Federal Register (54 FR 5746). Included in those standards were pollutant limits for different sewage sludge use or disposal practices.

Several commenters on the proposed Standards for the Use or Disposal of Sewage Sludge recommended that some of the organic pollutants for which pollutant limits were proposed be deleted from the final standards. The main reason for this recommendation was that the pollutants are either banned or restricted for use in the United States.

Because of the comments received on the proposal, EPA decided to evaluate all of the organic pollutants in the proposed Part 503 standards for land application of sewage sludge and for placement of sewage sludge on a surface disposal site to determine whether to delete any of those pollutants from the final Part 503 standards. This paper discusses the criteria the Agency used to evaluate each organic pollutant; presents the results of the evaluations; and provides the Agency's conclusion about deleting organic pollutants from the final Part 503 standards.

The Agency also evaluated the inorganic pollutants for surface disposal for deletion from the final Part 503 regulation. This paper presents the results of that evaluation and EPA's conclusions about deleting inorganic pollutants from the surface disposal subpart in the final Part 503 regulation.

## SECTION TWO

## ORGANIC POLLUTANTS - LAND APPLICATION AND SURFACE DISPOSAL

### 2.1 Criteria for the Deletion of An Organic Pollutant.

The Agency used three criteria to evaluate whether to delete an organic pollutant from the final Part 503 regulation. For an organic pollutant to be deleted from the regulation for a particular use or disposal practice, one of the following three criteria had to be satisfied.

1. The pollutant has been banned for use in the United States; has restricted use in the United States; or is not manufactured for use in the United States.

2. Based on the results of the National Sewage Sludge Survey (NSSS), the pollutant has a low percent detect in sewage sludge.

3. Based on data from the NSSS, the limit for an organic pollutant in the Part 503 exposure assessment by use or disposal practice is not expected to be exceeded in sewage sludge that is used or disposed.

The evaluation for each of the organic pollutants for which pollutant limits were published in the proposed Part 503 standards using the above three criteria is presented below.

### 2.2 Evaluation

#### 2.2.1 Introduction

The first step in the evaluation of organic pollutants is to identify the organic pollutants for which limits were proposed in the February 6, 1989, proposal (54 FR 5746) for land application of sewage sludge and for placement of sewage sludge on a surface disposal site. These pollutants are presented below in Table 1 by use or disposal practice.

Limits for organic pollutants also were proposed in Part 503 for distribution and marketing of sewage sludge and for sewage sludge placed on a monofill. The requirements for land application and distribution and marketing are combined in the final Part 503 regulation as are the requirements for placement of sewage sludge on a monofill and placement of sewage sludge on a surface disposal site. For this reason, the organic pollutants presented below for land application include the organic pollutants in the proposal for distribution and marketing and the organic pollutants for surface disposal include the organic pollutants in the proposal for a monofill.

**TABLE 1 - PART 503 ORGANIC POLLUTANTS BY USE OR DISPOSAL PRACTICE**

| Pollutant | Use or Disposal Practice LA | SD |
|---|---|---|
| Aldrin/dieldrin (total) | x | |
| Benzene | | x |
| Benzo(a)pyrene | x | x |
| Bis(2-ethylhexyl)phthalate | | x |
| Chlordane | x | x |
| DDT/DDE/DDD (total) | x | x |
| Heptachlor | x | |
| Hexachlorobenzene | x | |
| Hexachlorobutadiene | x | |
| Lindane | x | x |
| N-Nitrosodimethylamine | x | x |
| Polychlorinated biphenyls | x | x |
| Toxaphene | x | x |
| Trichloroethylene | x | x |

LA - land application
SD - surface disposal

The next step is to evaluate each of the organic pollutants using the above three criteria.

### 2.2.2 Criterion 1

The organic pollutants listed in Table 2 have been banned for use in the United States; have restricted uses in the United States; or are not manufactured for use in the United States.

**TABLE 3 - PERCENT DETECT FOR ORGANIC POLLUTANTS**

| Pollutant | Number of POTWs | Percent Detect* |
|---|---|---|
| Aldrin/dieldrin (total) | 177 | 8 |
| Benzene | 178 | 0 |
| Benzo(a)pyrene | 178 | 3 |
| Bis(2-ethylhexyl)phthalate | 178 | 63 |
| Chlordane | 177 | 0 |
| DDT/DDE/DDD (total) | 177 | 3 |
| Heptachlor | 177 | 0 |
| Hexachlorobenzene | 178 | 0 |
| Hexachlorobutadiene | 178 | 0 |
| Lindane | 177 | 0 |
| N-Nitrosodimethylamine | 178 | 0 |
| Polychlorinated biphenyls | 177 | 19 |
| Toxaphene | 177 | 0 |
| Trichloroethylene | 178 | 1 |

* Estimated percent detect in sewage sludge used or disposed at publicly owned treatment works nationwide. From "Statistical Support Documentation for the 40 CFR Part 503 Final Standards for the Use or Disposal of Sewage Sludge", Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11, 1992.

A review of the above information indicates that all of the pollutants, except aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and polychlorinated biphenyls (PCBs), satisfy Criteria 2 for the deletion of an organic pollutant from the final Part 503 standards because the pollutants have a low percentage of detection (i.e., five percent or less) nationwide. Aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and PCBs do not satisfy this criterion because they have a percent detect higher than five percent.

### 2.2.4 Criterion 3

For the Criterion 3 evaluation, the 99th percentile concentrations (see Table 7-11 in the report referenced in Table 4) from the NSSS were compared to the pollutant limits from the final Part 503 exposure assessment by use or disposal practice. For land application, the comparison was made by comparing annual pollutant loading rates. For surface disposal, pollutant concentrations from the final Part 503 exposure assessment were compared to the 99th percentile pollutant concentrations.

The 99th percentile concentrations from the NSSS were determined using the SM-ML procedure, except for bis(2-ethylhexyl)phthalate. For bis(2-ethylhexyl)phthalate, the MLE procedure was used to determine the 99th percentile concentration because the data for that pollutant appeared to be distributed log normally. The 99th percentile concentrations are presented in Table 4 and the comparisons using those concentrations

**TABLE 2 - ORGANIC POLLUTANTS THAT HAVE BEEN BANNED, HAVE RESTRICTED USE, OR ARE NOT MANUFACTURED**

| Pollutant | Reference |
|---|---|
| Aldrin/dieldrin (total) | * |
| Chlordane | * |
| DDT/DDE/DDD (total) | * |
| Heptachlor | * |
| Lindane | * |
| N-Nitrosodimethylamine | ** |
| Polychlorinated biphenyls | 40 CFR Part 761 |
| Toxaphene | * |

* See "Suspended, Cancelled, and Restricted Pesticides, 20T-1002, U.S. Environmental Protection Agency, February 1990.

** See "1992 Directory of Chemical Producers", SRI International, Menlo Par, California, 1992.

These eight pollutants satisfy the first criterion for deletion of an organic pollutant from the final Part 503 standards for land application of sewage sludge and for placement of sewage sludge on an active sewage sludge unit.

### 2.2.3 Criterion 2

The percent detect from the National Sewage Sludge Survey (NSSS) for each of the organic pollutants in the proposed Part 503 standards for land application of sewage sludge and for placement of sewage sludge on an active sewage sludge unit is presented in Table 3.

are presented below.

**TABLE 4 - 99TH PERCENTILE CONCENTRATIONS**

| Pollutant | Units | 99th Percentile Concentration* |
|---|---|---|
| Aldrin/dieldrin (total) | mg/kg | 0.074 |
| Benzene | mg/kg | 7.0 |
| Benzo(a)pyrene | mg/kg | 43 |
| Bis(2-ethylhexyl) phthalate | mg/kg | 1000 |
| Chlordane | mg/kg | 1.8 |
| DDT/DDE/DDD (total) | mg/kg | 0.14 |
| Heptachlor | mg/kg | 0.14 |
| Hexachlorobenzene | mg/kg | 43 |
| Hexachlorobutadiene | mg/kg | 43 |
| Lindane | mg/kg | 0.18 |
| N-Nitrosodimethylamine | mg/kg | 210 |
| Polychlorinated biphenyls | mg/kg | 9.1 |
| Toxaphene | mg/kg | 7.4 |
| Trichloroethylene | mg/kg | 7.0 |

* From "Statistical Support Documentation for the 40 CFR, Part 503 Standards for the Use or Disposal of Sewage", Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11, 1992. Values are on dry weight basis and are reported in two significant figures.

### 2.2.4.1 Land Application Comparison

For the purpose of comparing annual pollutant loading rates for land application, the annual whole sludge application rates in Table 5, which are from the NSSS (see Attachment A), were used in equation (1) below with the 99th percentile concentration from the NSSS to determine the calculated annual pollutant loading rates. The comparisons of the calculated annual pollutant loading rates to the annual pollutant loading rates from the Part 503 exposure assessment are presented Tables 6 through 9.

**TABLE 5 - ANNUAL WHOLE SLUDGE APPLICATION RATES**

| Type of Land | Annual Whole Sludge Application Rate* |
|---|---|
| Agricultural | 7 |
| Forest | 26 |
| Public contact site | 18 |
| Reclamation site | 74 |

* Metric tons per hectare per 365 day period (dry weight basis).

$$APLR = C \times AWSAR \times 0.001 \quad (1)$$

where,

APLR = Annual pollutant loading rate in kilograms per hectare per 365 day period.

C = pollutant concentration in milligrams per kilograms (dry weight basis).

AWSAR = Annual whole sludge application rate in metric tons per hectare per 365 day period (dry weight basis).

0.001 = A conversion factor.

Agricultural land:

**TABLE 6 - COMPARISON OF ANNUAL LOADS FOR AGRICULTURAL LAND**

| Pollutant | APLR (Exposure) kg/ha/365 | APLR (NSSS) kg/ha/365 |
|---|---|---|
| Aldrin/dieldrin (total) | 0.027 | 0.00051 |
| Benzo(a)pyrene | 0.15 | 0.30 |
| Chlordane | 0.86 | 0.012 |
| DDT/DDE/DDD (total) | 1.2 | 0.00098 |
| Heptachlor | 0.074 | 0.00098 |
| Hexachlorobenzene | 0.29 | 0.30 |
| Hexachlorobutadiene | 6.0 | 0.30 |
| Lindane | 0.84 | 0.0012 |
| N-Nitrosodimethylamine | 0.021 | 1.4 |
| Polychlorinated biphenyls | 0.046 | 0.063 |
| Toxaphene | 0.10 | 0.049 |
| Trichloroethylene | 100 | 0.05 |

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, and PCBs calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate of seven metric tons per hectare per 365 day period is greater than the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to agricultural land.

Forest:

TABLE 7 - COMPARISON OF ANNUAL LOADS FOR FORESTS

| Pollutant | APLR (Exposure) kg/ha/365 | APLR (NSSS) kg/ha/365 |
|---|---|---|
| Aldrin/dieldrin (total) | 0.027 | 0.0019 |
| Benzo(a)pyrene | 0.15 | 1.1 |
| Chlordane | 0.86 | 0.046 |
| DDT/DDE/DDD(total) | 1.2 | 0.0036 |
| Heptachlor | 0.074 | 0.0036 |
| Hexachlorobenzene | 0.29 | 1.1 |
| Hexachlorobutadiene | 6.0 | 1.1 |
| Lindane | 0.84 | 0.0046 |
| N-Nitrosodimethylamine | 0.021 | 5.4 |
| Polychlorinated biphenyls | 0.046 | 0.23 |
| Toxaphene | 0.10 | 0.19 |
| Trichloroethylene | 100 | 0.18 |

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration from the NSSS and an annual whole sludge application rate of 26 metric tons per hectare per 365 day period is greater than the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to forests.

Public contact site:

TABLE 8 - COMPARISON OF ANNUAL LOADS FOR PUBLIC CONTACT SITES

| Pollutant | APLR (exposure) kg/ha/365 | APLR (NSSS) kg/ha/365 |
|---|---|---|
| Aldrin/dieldrin (total) | 0.027 | 0.0013 |
| Benzo(a)pyrene | 0.15 | 0.77 |
| Chlordane | 0.86 | 0.032 |
| DDT/DDE/DDD(total) | 1.2 | 0.0025 |
| Heptachlor | 0.074 | 0.0025 |
| Hexachlorobenzene | 0.29 | 0.77 |
| Hexachlorobutadiene | 6.0 | 0.77 |
| Lindane | 0.84 | 0.0032 |
| N-Nitrosodimethylamine | 0.021 | 3.7 |
| Polychlorinated biphenyls | 0.046 | 0.16 |
| Toxaphene | 0.10 | 0.12 |
| Trichloroethylene | 100 | 0.13 |

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration from the NSSS and an annual whole sludge application rate of 18 metric tons per hectare per 365 day period exceeds the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to a public contact site.

Reclamation site:

**TABLE 9 - COMPARISON OF ANNUAL LOADS FOR RECLAMATION SITES**

| Pollutant | APLR (Exposure) kg/ha/365 | APLR (NSSS) kg/ha/365 |
|---|---|---|
| Aldrin/dieldrin (total) | 0.027 | 0.0054 |
| Benzo(a)pyrene | 0.15 | 3.1 |
| Chlordane | 0.86 | 0.13 |
| DDT/DDE/DDD(total) | 1.2 | 0.010 |
| Heptachlor | 0.074 | 0.010 |
| Hexachlorobenzene | 0.29 | 3.1 |
| Hexachlorobutadiene | 6.0 | 3.1 |
| Lindane | 0.84 | 0.013 |
| N-Nitrosodimethylamine | 0.021 | 15 |
| Polychlorinated biphenyls | 0.046 | 0.67 |
| Toxaphene | 0.10 | 0.54 |
| Trichloroethylene | 100 | 0.51 |

The annual pollutant loading rates for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate of 74 metric tons per hectare per 365 day period exceed the annual pollutant loading rates for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to a reclamation site.

Annual pollutant loading rates for organic pollutants are included in the final Part 503 exposure assessment only for land application of sewage sludge. Those rates are the same for all types of land on which sewage sludge is applied. For this reason, results of the above evaluation were combined to determine which pollutants satisfy Criterion 3 for land application of sewage sludge. When this is done, the pollutants that do not satisfy Criterion 3 for land application of sewage sludge are benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene.

Sewage sludge sold or given-away in a bag or other container for application to the land (formerly distribution and marketing):

The Part 503 exposure assessment contains limits for organic pollutants for sewage sludge sold or given-away in a bag or other container for application to the land. These limits are annual pollutant loading rates.

Sewage sludge sold or given-away in a bag or other container for application to the land may be applied to all types of land. For this reason, the annual whole sludge application rates used to calculate the annual pollutant loading rates for the above land application comparison also were used to calculate the annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land.

For the purpose of comparing annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land, the highest annual whole sludge application rate (i.e., 74 metric tons per hectare per 365 day period) from the land application comparison was used in equation (2) below along with the 99th percentile concentrations from the NSSS to calculate annual pollutant loading rates. Results of the comparison of the calculated annual pollutant loading rates to the annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land from the Part 503 exposure assessment are presented in Table 10.

$$APLR = C \times AWSAR \times 0.001 \qquad (2)$$

where,

APLR = annual pollutant loading rate in kilograms per hectare per 365 day period.

C = pollutant concentration in milligrams per kilogram of sewage sludge (dry weight basis).

AWSAR = annual whole sludge application rate in metric tons per hectare per 365 day period (dry weight basis).

0.001 = a conversion factor.

**TABLE 10 - COMPARISON OF ANNUAL LOADS FOR SEWAGE SLUDGE SOLD OR GIVEN AWAY IN A BAG OR OTHER CONTAINER FOR APPLICATION TO THE LAND**

| Pollutant | APLR (Exposure) kg/hectare/365 | APLR (NSSS) kg/hectare/365 |
|---|---|---|
| Aldrin/dieldrin (total) | 0.027 | 0.0054 |
| Benzo(a)pyrene | 0.15 | 3.1 |
| Chlordane | 0.86 | 0.13 |
| DDT/DDE/DDD (total) | 1.2 | 0.010 |
| Heptachlor | 0.074 | 0.010 |
| Hexachlorobenzene | 0.29 | 3.1 |
| Hexachlorobutadiene | 6.0 | 3.1 |
| Lindane | 0.84 | 0.013 |
| Polychlorinated biphenyls | 0.046 | 0.67 |
| Toxaphene | 0.10 | 0.54 |

The annual pollutant loading rate calculated using the 99th percentile concentration for benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene from the NSSS and an annual whole application rate of 74 metric tons per hectare per 365 day period exceeds the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for sewage sludge sold or given away in a bag or other container for application to the land.

### 2.2.4.2 Surface Disposal

For this disposal practice, the 99th percentile concentrations from the NSSS were compared to the Part 503 pollutant concentrations from the exposure assessment for an active sewage sludge unit without a liner and leachate collection system. This comparison is presented in Table 11.

**TABLE 11 - COMPARISON OF ORGANIC POLLUTANT CONCENTRATIONS FOR SURFACE DISPOSAL**

| Pollutant | Concentration* Exposure - mg/kg | Concentration NSSS - mg/kg |
|---|---|---|
| Benzene | 140 | 7.0 |
| Benzo(a)pyrene | >100,000 | 43 |
| Bis(2-ethylhexyl)phthalate | >100,000 | 1000 |
| Chlordane | >100,000 | 1.8 |
| DDT/DDE/DDD (total) | >100,000 | 0.14 |
| Lindane | 28,000 | 0.18 |
| N-Nitrosodimethylamine | 0.088 | 210 |
| Polychlorinated biphenyls | 110 | 9.1 |
| Toxaphene | 26,000 | 7.4 |
| Trichloroethylene | 9,500 | 7.0 |

* Active sewage sludge unit without a liner and leachate collection system.

N-Nitrosodimethylamine does not satisfy Criterion 3 for placement of sewage sludge on an active sewage sludge unit because the 99th percentile concentration for that pollutant from the NSSS exceeds the concentration for that pollutant from the Part 503 exposure assessment. All of the other organic pollutants for this practice satisfy Criterion 3.

## 2.3 Evaluation results

Following are the results of the evaluation of the organic pollutants for which pollutant limits were published in the proposed Part 503 standards to determine which of those pollutants, if any, to delete from the final Part 503 standards:

- Eight of the organic pollutants for which pollutant limits were published in the proposed Part 503 regulation for land application of sewage sludge and placement of sewage sludge on a surface disposal site have been banned for use in the United States; have been restricted for use in the United States; or are not manufactured in the United States. They are: aldrin/dieldrin (total), chlordane, DDT/DDE/DDD (total), heptachlor, lindane, N-Nitrosodimethylamine, polychlorinated biphenyls, and toxaphene. These pollutants satisfy Criterion 1.

- The percent detect from the NSSS for the organic pollutants for which limits were proposed for land application of sewage sludge and placement of sewage sludge on a surface disposal site are low (i.e., five percent or less), except for aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and polychlorinated biphenyls. All of the other organic pollutants for which limits were proposed satisfy Criterion 2.

o With the exception of benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene, the annual pollutant loading rate for the organic pollutants calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole application rate from the NSSS is below the Part 503 exposure assessment annual pollutant loading rate for each organic pollutant for sewage sludge applied to agricultural land, forest, a public contact site, or a reclamation site. For land application of sewage sludge, benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene do not satisfy Criterion 3.

o With the exception of benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene, the annual pollutant loading rate for the organic pollutants calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate from the NSSS is below the final Part 503 exposure assessment annual pollutant loading rate for each organic pollutant for sewage sludge sold or given-away in a bag or other container for application to the land (formerly distribution and marketing). For sewage sludge sold or given away in a bag or other container, benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene do not satisfy Criterion 3.

o With the exception of N-Nitrosodimethylamine, the 99th percentile pollutant concentration from the NSSS is below the Part 503 exposure assessment concentration for each organic pollutant in sewage sludge placed on an active sewage sludge unit without a liner and leachate collection system. For this practic N-Nitrosodimethylamine does not satisfy Criterion 3.

## 2.4 Conclusions

Based on the results of the above evaluations, the Agency is deleting organic pollutants from the final Part 503 regulation, as indicated below, for the appropriate use or disposal practice. EPA concluded that because those organic pollutants satisfy one of the three criteria discussed above, public health and the environment are protected from the reasonably anticipated adverse effects of the organic pollutants in sewage sludge without establishing limits for the pollutants in the final Part 503 regulation.

2.4.1 Application to agricultural land, forest, a public contact site, or a reclamation site - pollutants deleted:

| Pollutant | Criteria Met |
|---|---|
| Aldrin/dieldrin (total) | 1 and 3 |
| Benzo(a)pyrene | 2 |
| Chlordane | 1, 2, and 3 |
| DDT/DDE/DDD(total) | 1, 2, and 3 |
| Heptachlor | 1, 2, and 3 |
| Hexachlorobenzene | 2 |
| Hexachlorobutadiene | 2 and 3 |
| Lindane | 1, 2, and 3 |
| N-Nitrosodimethylamine | 1 and 2 |
| Polychlorinated biphenyls | 1 |
| Toxaphene | 1 and 2 |
| Trichloroethylene | 2 and 3 |

Organic pollutant remaining: none.

Sewage sludge sold or given-away in a bag or other container for application to the land (formerly distribution and marketing) - pollutants deleted:

| Pollutant | Criteria Met |
|---|---|
| Aldrin/dieldrin (total) | 1 and 3 |
| Benzo(a)pyrene | 2 |
| Chlordane | 1, 2, and 3 |
| DDT/DDE/DDE (total) | 1, 2, and 3 |
| Heptachlor | 1, 2, and 3 |
| Hexachlorobenzene | 2 |
| Hexchlorobutadiene | 2 and 3 |
| Lindane | 1, 2, and 3 |
| Polychlorinated biphenyls | 1 |
| Toxaphene | 1 and 2 |

Organic pollutants remaining: none

As indicated above, PCBs were deleted from the final Part 503 regulation for land application because Criterion 1 is satisfied. PCBs are restricted for use in the United States. They can be used only in closed systems and the disposal of PCBs is closely regulated under the Toxic Substances Control Act (**40 CFR Part 761**).

Based on the results of the National Sewage Sludge Survey (NSSS), PCBs did not satisfy Criterion 2. PCBs are estimated to be detected in sewage sludge that is used or disposed at 19 percent of the publicly owned treatment works nationwide. To satisfy Criterion 2, the percent detect had to be five percent or less.

PCBs also did not satisfy Criterion 3. If PCBs had been

regulated, the pollutant limit for PCBs based on results of the exposure assessment would be 0.046 kilograms per hectare per 365 day period. The annual pollutant loading rate (APLR) delivered to each hectare of land assuming a concentration of PCBs in the sewage sludge equal to the 99th percentile concentration from the NSSS (i.e., 9.1 milligrams per kilogram) and an annual whole sludge application rate of 7, 18, 26, and 74 metric tons per hectare for agricultural land, forest, a public contact site, and a reclamation site, respectively, would be 0.063, 0.16, 0.23, and 0.67 kilograms per hectare, respectively.

For application to agricultural land, which is by far the most widely used land for application of sewage sludge, the above APLR calculated using the 99th percentile PCB concentration is higher than the pollutant limit for PCBs that would have been in the final Part 503 regulation by only 37 percent. The APLRs for the other types of land are higher than the potential Part 503 APLR by larger factors. However, this is mitigated by the fact that sewage sludge only is applied to forest, a public contact site, or a reclamation site at most every three to five years. In the case of a reclamation site, sewage sludge is applied to the site at most three times during the period that the land is a reclamation site.

Another factor that mitigates the calculated APLRs is the use of the 99th percentile concentration for PCBs from the NSSS to calculate the APLRs. This concentration represents, to a large extent, outlier values for PCBs and, therefore, is conservative. If the more reasonable worst case 90th percentile concentration for PCBs (i.e., 1.9 milligrams per kilogram) is used to calculate the APLRs, the annual amounts delivered to a hectare of land are 0.013, 0.034, 0.049, and 0.14 kilograms for agricultural land, forest, a public contact site, and reclamation site, respectively. In this case,the calculated APLRs for agricultural land and forest satisfy Criterion 3, the APLR for a public contact site is only slightly higher than the exposure assessment value for PCBs (i.e., 0.046 kilograms per hectare per 365 day period), and the APLR for a reclamation site does not satisfy Criterion 3.

EPA is committed to re-evaluate the decision not to regulate PCBs in the final Part 503 regulation during the next review of the regulation (i.e., Round II). EPA expects the concentration of PCBs in sewage sludge to continue to decrease. In addition, EPA will re-evaluate the toxicity of PCB congeners through use of a toxicity equivalent factor system. Both of these factors will be considered in Round II.

## 2.4.2 Surface disposal - pollutant deleted:

| Pollutant | Criteria Met |
|---|---|
| Benzene | 2 and 3 |
| Benzo(a)pyrene | 2 and 3 |
| Bis(2-ethylhexyl)phthalate | 3 |
| Chlordane | 1, 2, and 3 |
| DDT/DDE/DDD (total) | 1, 2, and 3 |
| Lindane | 1, 2, and 3 |
| N-Nitrosodimethylamine | 1 and 2 |
| Polychlorinated biphenyls | 1 and 3 |
| Toxaphene | 1, 2, and 3 |
| Trichloroethylene | 2 and 3 |

Organic pollutants remaining: none

## SECTION THREE

## INORGANIC POLLUTANTS - SURFACE DISPOSAL

### 3.1 Introduction

After reviewing results of the exposure assessment for surface disposal, the Agency decided to evaluate the inorganic pollutants to determine whether to include limits in the final Part 503 regulation for all of the inorganic pollutants for which limits were included in the proposed Part 503 regulation. This evaluation was done for both sewage sludge and domestic septage. Results the evaluations and the Agency's conclusions based on those results are presented below.

### 3.2 Evaluation - Sewage Sludge

The evaluation to determine whether to include limits for inorganic pollutants in sewage sludge placed on an active sewage sludge unit in the final Part 503 regulation consisted of comparing the limits from the Part 503 exposure assessment to the 99th percentile concentration for a pollutant from the NSSS. Results of this comparison are present in Table 12.

**TABLE 12 - COMPARISON OF INORGANIC POLLUTANT CONCENTRATIONS FOR SEWAGE SLUDGE**

| Pollutant | Concentration (mg/kg)[1] | Concentration (mg/kg)[2] | Concentration (mg/kg)[3] |
|---|---|---|---|
| Arsenic | 75 | 73 | >100,000 |
| Cadmium | 85 | >100,000 | >100,000 |
| Chromium | 1200 | 600 | >100,000 |
| Copper | 4300 | 46,000 | >100,000 |
| Lead | 840 | >100,000 | >100,000 |
| Mercury | 58 | >100,000 | >100,000 |
| Nickel | 420 | 690 | >100,000 |

1 - From "Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge, Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11,1992. Pollutant concentrations are dry weight 99th percentile concentrations.

2 - From Part 503 exposure assessment for an active sewage sludge unit without a liner and leachate collection system (dry weight basis) - see technical support document for the Part 503 surface disposal requirements.

3 - From Part 503 exposure assessment for an active sewage sludge unit with a liner and leachate collection system (dry weight basis) - see technical support document for the Part 503 surface disposal requirements.

Results of the above comparison indicate that the 99th percentile pollutant concentrations are much lower than the Part 503 exposure assessment concentrations for an active sewage sludge unit without a liner and leachate collection system, except for arsenic, chromium, and nickel. In the case of arsenic, chromium, and nickel, the 99th percentile concentration is either higher than or very close to the exposure assessment concentrations for those pollutants.

The above results also indicate that the 99th percentile pollutant concentrations are much lower than the Part 503 exposure assessment concentrations for an active sewage sludge unit with a liner and leachate collection system. In this case, all of the 99th percentile concentrations are at least an order of magnitude lower than the exposure assessment concentrations.

### 3.3 Evaluation - Domestic Septage

The evaluation to determine whether to include limits in the final Part 503 regulation for inorganic pollutants in domestic septage placed on an active sewage sludge unit consisted of comparing the limit from the Part 503 exposure assessment for sewage sludge placed on an active sewage sludge unit to the 98th percentile concentration for a pollutant in domestic septage (see

Attachment B). Results of this comparison are presented in Table 13.

**TABLE 13 - COMPARISON OF INORGANIC POLLUTANT CONCENTRATIONS FOR DOMESTIC SEPTAGE**

| Pollutant | Concentration (mg/kg)[1] | Concentration (mg/kg)[2] | Concentration (mg/kg)[3] |
|---|---|---|---|
| Arsenic | 30[4] | 73 | >100,000 |
| Cadmium | 25 | >100,000 | >100,000 |
| Chromium | 110 | 600 | >100,000 |
| Copper | 2600 | 46,000 | >100,000 |
| Lead | 100 | >100,000 | >100,000 |
| Mercury | 0.91 | >100,000 | >100,000 |
| Nickel | 50 | 690 | >100,000 |

1 - Concentration on a dry weight basis (see page 26 in Attachment B).

2 - From Part 503 exposure assessment for an active sewage sludge unit without a liner and leachate collection system (dry weight basis) - see the technical support document for the Part 503 surface disposal requirements.

3 - From Part 503 exposure assessment for an active sewage sludge unit with a liner and leachate collection system (dry weight basis) - see the technical support document for the Part 503 surface disposal requirements.

4 - Concentration is the minimum level value (i.e., highest detection limit value) because arsenic was not detected in any of the collected domestic septage samples.

Results of the above comparison indicate that the 98th percentile pollutant concentrations are lower than the Part 503 exposure assessment concentrations for sewage sludge placed on an active sewage sludge unit both with and without a liner and leachate collection system. The 98th percentile concentration that is the closest to the Part 503 concentration is the value for arsenic when compared to the Part 503 exposure assessment concentration for an active sewage sludge unit without a liner and leachate collection system. As indicated in a footnote above, arsenic was not detected in any of the domestic septage samples collected and analyzed. The concentration for arsenic in the table is the minimum level value (i.e., the highest detection limit) for arsenic in the domestic septage samples collected and analyzed.

## 3.4 Conclusions

### 3.4.1 Sewage Sludge

After comparing the 99th percentile concentrations to the Part 503 exposure assessment concentrations for an active sewage sludge unit without a liner and leachate collection system, the Agency concluded that limits only should be included in the final Part 503 regulation for arsenic, chromium, and nickel. Limits are not needed in the final regulation to protect public health and the environment from cadmium, copper, lead, and mercury in the sewage sludge because the 99th percentile concentration is much lower than the exposure assessment concentration for each of those pollutants. In this case, the concentration of cadmium, copper, lead, and mercury in the sewage sludge is not expected to exceed the exposure assessment concentration for those pollutants. Consequently, there are no pollutant limits for cadmium, copper, lead, and mercury in the final Part 503 regulation for an active sewage sludge without a liner and leachate collection system.

The Agency also concluded that no limits are needed in the final Part 503 regulation for inorganic pollutants in sewage sludge placed on an active sewage sludge unit with a liner and leachate collection system to protect public health and the environment because the 99th percentile concentrations are much lower than the exposure assessment concentrations for the inorganic pollutants. The concentration of each of the inorganic pollutants in sewage sludge is not expected to exceed the exposure assessment concentration for the pollutant. Consequently, there are no pollutant limits in the final Part 503 regulation for sewage sludge placed on an active sewage sludge unit with a liner and leachate collection system.

### 3.4.2 Domestic Septage

After comparing the 98th percentile domestic septage concentrations to the Part 503 exposure assessment concentrations for an active sewage sludge unit both with and without a liner and leachate collection, the Agency concluded that limits are not needed in the final Part 503 regulation to protect public health and the environment from the reasonably anticipated of arsenic, cadmium, chromium, copper, lead, mercury, and nickel in domestic septage placed on an active sewage sludge unit because the 98th percentile concentrations are lower than the Part 503 exposure assessment concentrations for those pollutants. In this case, the concentration of each of those pollutants is not expected to exceed the exposure assessment concentration for each pollutant. Consequently, there are no limits for inorganic pollutants in the final Part 503 regulation for domestic septage placed on either an active sewage sludge without a liner and leachate collection system or an active sewage sludge unit with a liner and leachate collection system.

# MEMORANDUM

Date: November 10, 1992

To: Bob Southworth, EPA

From: Anne Jones and Matt Murphy, ERG

Re: Revised Mean Application Rates for Land Application

==========

We have calculated weighted mean application rates for agricultural land application, land application to forest sites and public contact sites, and land reclamation. The following methodology was used to derive these numbers.

First, we used the analytical survey rather than the larger questionnaire survey for the following reason. A question on numbers of applications was critical to the calculation of application rates. However, respondents frequently, and fairly consistently, misinterpreted this question. We made corrections (based on call backs) to the question on number of applications, as well as to other questions that affected application rates, to many of the analytical survey observations. Thus a larger proportion of the analytical survey had application rates based on corrected data than the questionnaire survey. Because we had more confidence in a greater proportion of data in the analytical questionnaire, we preferred to use this questionnaire.

Second, because of some remaining problems with the question on number of applications we limited the number of applications to 10, that is, we allowed this number to range up to 10, but where any number exceeded 10, it was set to 10. This was felt to be a very conservatively high estimate of numbers of applications. We feel that, if anything, this assumption would tend to somewhat overstate actual application rates in most cases.

Finally, we deleted one observation, which was a POTW practicing land reclamation. This POTW was applying sewage sludge at over 1,600 dmt/ha. The sewage sludge fails ceiling concentrations, but even if it passed, it is highly unlikely that this application rate would be allowed under Subpart B. The mean application rate shown in the following tables reflects the deletion of this observation.

We then ran the Univariate Procedure in SAS to obtain the weighted means discussed below and presented in the attached tables.

The results of this analysis are as follows: agricultural rates average about 7 dmt/ha; rates at forest sites average 26 dmt/ha; rates at public contact sites average 19 dmt/ha; and rates at reclamation sites average 74 dmt/ha, as shown in the attached tables.

NEWUSE=AG

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

| | | | |
|---|---|---|---|
| N | 87 | Sum Wgts | 3691 |
| Mean | 6.768121 | Sum | 24981.14 |
| Std Dev | 104.9951 | Variance | 11023.97 |
| Skewness | . | Kurtosis | . |
| USS | 1117136 | CSS | 948061.1 |
| CV | 1551.318 | Std Mean | 11.25665 |
| T:Mean=0 | 0.601255 | Pr>\|T\| | 0.5493 |
| Num ^= 0 | 87 | Num > 0 | 87 |
| M(Sign) | 43.5 | Pr>=\|M\| | 0.0001 |
| Sgn Rank | 1914 | Pr>=\|S\| | 0.0001 |

Quantiles(Def=5)

| | | | |
|---|---|---|---|
| 100% Max | 290 | 99% | 290 |
| 75% Q3 | 16.3666 | 95% | 53.4717 |
| 50% Med | 7.53312 | 90% | 43.719 |
| 25% Q1 | 1.61424 | 10% | 0.13452 |
| 0% Min | 0.026904 | 5% | 0.035872 |
| | | 1% | 0.026904 |
| Range | 289.9731 | | |
| Q3-Q1 | 14.75236 | | |
| Mode | 0.026904 | | |

Extremes

| Lowest | Obs | Highest | Obs |
|---|---|---|---|
| 0.026904 | 40 | 53.4717 | 19 |
| 0.026904 | 39 | 58.5162 | 51 |
| 0.026904 | 73 | 61.2066 | 9 |
| 0.035872 | 72 | 75.3312 | 50 |
| 0.035872 | 71 | 290 | 25 |

| | |
|---|---|
| Missing Value | . |
| Count | 2 |
| % Count/Nobs | 2.25 |



NEWUSE=FOR

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

| | | | |
|---|---|---|---|
| N | 2 | Sum Wgts | 12 |
| Mean | 26.06325 | Sum | 312.759 |
| Std Dev | 26.21199 | Variance | 687.0685 |
| Skewness | . | Kurtosis | . |
| USS | 8838.584 | CSS | 687.0685 |
| CV | 100.5707 | Std Mean | 18.53468 |
| T:Mean=0 | 1.406189 | Pr>\|T\| | 0.3935 |
| Num ^= 0 | 2 | Num > 0 | 2 |
| M(Sign) | 1 | Pr>=\|M\| | 0.5000 |
| Sgn Rank | 1.5 | Pr>=\|S\| | 0.5000 |

Quantiles(Def=5)

| | | | |
|---|---|---|---|
| 100% Max | 33.63 | 99% | 33.63 |
| 75% Q3 | 33.63 | 95% | 33.63 |
| 50% Med | 26.06325 | 90% | 33.63 |
| 25% Q1 | 18.4965 | 10% | 18.4965 |
| 0% Min | 18.4965 | 5% | 18.4965 |
| | | 1% | 18.4965 |
| Range | 15.1335 | | |
| Q3-Q1 | 15.1335 | | |
| Mode | 18.4965 | | |

Extremes

| Lowest | Obs | Highest | Obs |
|---|---|---|---|
| 18.4965 | 2 | . | |
| 33.63 | 1 | . | |
| . | | . | |
| . | | 18.4965 | 2 |
| . | | 33.63 | 1 |

NEWUSE=PUBC

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

| | | | |
|---|---|---|---|
| N | 11 | Sum Wgts | 74 |
| Mean | 18.67404 | Sum | 1381.879 |
| Std Dev | 121.8776 | Variance | 14854.16 |
| Skewness | . | Kurtosis | . |
| USS | 174346.9 | CSS | 148541.6 |
| CV | 652.6581 | Std Mean | 36.74749 |
| T:Mean=0 | 0.508172 | Pr>\|T\| | 0.6224 |
| Num ^= 0 | 11 | Num > 0 | 11 |
| M(Sign) | 5.5 | Pr>=\|M\| | 0.0010 |
| Sgn Rank | 33 | Pr>=\|S\| | 0.0010 |

Quantiles(Def=5)

| | | | |
|---|---|---|---|
| 100% Max | 6.194 | 99% | 246.194 |
| 75% Q3 | 1..4.6552 | 95% | 246.194 |
| 50% Med | 55.1532 | 90% | 230.2534 |
| 25% Q1 | 44.7279 | 10% | 4.0356 |
| 0% Min | 0.38114 | 5% | 0.38114 |
| | | 1% | 0.38114 |
| Range | 245.8129 | | |
| Q3-Q1 | 79.9273 | | |
| Mode | 55.1532 | | |

Extremes

| Lowest | Obs | Highest | Obs |
|---|---|---|---|
| 0.38114( | 11) | 1C2.011( | 7) |
| 4.0356( | 10) | 116.584( | 6) |
| 44.7279( | 9) | 124.6552( | 2) |
| 51.0055( | 8) | 230.2534( | 5) |
| 55.1532( | 4) | 246.194( | 1) |

Missing Value .
Count 2
% Count/Nobs 15.38



NEWUSE=RECL

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

| | | | |
|---|---|---|---|
| N | 7 | Sum Wgts | 17 |
| Mean | 74.07916 | Sum | 1259.346 |
| Std Dev | 147.885 | Variance | 21869.97 |
| Skewness | . | Kurtosis | . |
| USS | 224511.1 | CSS | 131219.8 |
| CV | 199.631 | Std Mean | 55.89527 |
| T:Mean=0 | 1.325321 | Pr>\|T\| | 0.2333 |
| Num ^= 0 | 7 | Num > 0 | 7 |
| M(Sign) | 3.5 | Pr>=\|M\| | 0.0156 |
| Sgn Rank | 14 | Pr>=\|S\| | 0.0156 |

Quantiles(Def=5)

| | | | |
|---|---|---|---|
| 100% Max | 420.7113 | 99% | 420.7113 |
| 75% Q3 | 100.89 | 95% | 420.7113 |
| 50% Med | 65.9148 | 90% | 420.7113 |
| 25% Q1 | 45 | 10% | 45 |
| 0% Min | 45 | 5% | 45 |
| | | 1% | 45 |
| Range | 375.7113 | | |
| Q3-Q1 | 55.89 | | |
| Mode | 65.9148 | | |

Extremes

| Lowest | Obs | Highest | Obs |
|---|---|---|---|
| 45( | 7) | 65.9148( | 3) |
| 45( | 6) | 65.9148( | 4) |
| 65.9148( | 5) | 65.9148( | 5) |
| 65.9148( | 4) | 100.89( | 2) |
| 65.9148( | 3) | 420.7113( | 1) |

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 6 1992

OFFICE OF WATER

MEMORANDUM

**Subject:** Summary Statistics for EPA's Study on the Quality of Domestic Septage

**From:** Charles E. White, Statistician
Statistical Analysis Section

**To:** Alan Rubin, Chief
Sludge Risk Assessment Branch

**Through:** Henry D. Kahn, Chief
Statistical Analysis Section

At your request, I will present and document summary statistics based on EPA's Study on the Quality of Domestic Septage. These summary statistics will include basic statistics on pollutants of concern, other requested pollutants, and the estimated relationship between Total Kjeldahl Nitrogen and Ammonia. EPA's Study on the Quality of Domestic Septage (1991) was conducted in order to support the development of hydraulic loading rates for the land application of domestic septage under the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal. This loading rate is intended to be a protective and affordable method for regulating the beneficial reuse of septage. Development of the loading rate itself will not be discussed in this memo.

**Results**

There are two basic results from these analyses. First, truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. Second, Total Kjeldahl Nitrogen is found to be approximately 43% Ammonia in wet domestic septage.

**Data**

Nine trucks delivering domestic septage to the Madison Metropolitan Sewerage District (MMSD) in Madison, Wisconsin were each sampled once. As septage was being discharged, a grab sample was collected and delivered to the MMSD lab for splitting, labeling, icing, and shipping to appropriate labs under contract to the EPA. Each

independent sample was physically analyzed for 324 pollutants. Only data regarding pollutants of concern and some data for pollutants that are also micro-nutrients will be considered in this report.

**Physical Analytical Procedures**

Physical analytical methods used here are the same as those used for the National Sewage Sludge Survey (NSSS), though some pollutants are reported differently. Individual PCB aroclors were reported in the NSSS; total PCB aroclors are reported here. Aldrin and Dieldrin were reported separately in the NSSS; the totals for Aldrin and Dieldrin are reported here. Total Chlordane is reported in the NSSS; the alpha and gamma portions of chlordane are reported here. DDT, DDS, and DDD are reported separately in the NSSS; totals for DDT, DDS, and DDD are reported here. Lindane is reported in the NSSS; Lindane (Gamma-BHC) is reported here.

Some pollutant concentrations were not measured above the Minimum Level for the particular pollutant. Minimum Levels are a form of "detection limit" used in physical analytical methods developed for the Office of Science and Technology. Under contract, each contractor lab must demonstrate that it is able to achieve the Minimum Levels stated for the particular EPA method to be used. In general, a Minimum Level is defined as the lowest concentration at which the physical analytical process can be reliably calibrated. Pollutant concentrations not measured above the Minimum Level for a particular pollutant are not reported; the Minimum Level is reported instead.

**Statistical Methods for Basic Summary Statistics**

Statistical analysis methods were primarily selected to estimate a concentration level for each pollutant such that, under certain assumptions, "most" septage concentrations for a particular pollutant will be below it's respective level, i.e., we are primarily estimating percentiles. These methods will also be used to characterize both wet and dry weight pollutant concentration measurements, mixed with "detection limits." Substitution and Maximum Likelihood Methods will be used to estimate summary statistics. One overall assumption of this study is that residential septage samples across the country follow approximately the same probability distributions for pollutant concentrations as those distributions found in the area around Madison, Wisconsin. Additional statistical assumptions are discussed in the section on the Substitution Method, in the section on the Maximum Likelihood Method for estimating summary statistics in the presence of censored, or "non-detect," data and in the section on estimating the relationship between Ammonia and Total Kjeldahl Nitrogen.

Dry Weight Conversion

Physical analyses were conducted on liquid septage samples. However, both because pollutants are assumed to be concentrated in the solid phase of the septage sample and

because pollutants were reported this way in the NSSS, a dry weight conversion is also used in presentation of these data. More detailed discussion of the reasons for dry weight conversion and analyses in support of this practice are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.* Conversion of a concentration reported in ug/l is illustrated below:

Let: Pollutant Concentration for Sample $i = x_i$ µg/l
Solids Concentration for Sample $i = y_i$ mg/l

$$\text{Dry Weight Pollutant Concentration in } \mu g/kg = \frac{x_i \mu g/l}{y_i mg/l}\left(\frac{1{,}000{,}000 \text{ mg}}{\text{kg}}\right)$$
$$= \left(\frac{1{,}000{,}000 x_i}{y_i}\right) \mu g/kg$$

Substitution Methods

The substitution methods used here make no assumptions about the probability distributions of the pollutant concentration data, but they do make assumptions about the concentration of pollutants in samples where pollutants could not be measured above their "detection limit." The first of two substitution methods used assumes that pollutant concentrations, in samples where pollutants could not be measured, are at the "detection limit." The second substitution method assumes that pollutant concentrations, in samples where pollutants could not be measured, are zero. Together, these two substitution methods give a kind of upper and lower bound on non-parametric summary statistics for pollutant concentrations in septage. More detailed discussion of these methods and the reasons for their selection are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.*

Tables of wet weight summary statistics developed using these substitution methods are presented on pages 13 through 23 and tables of dry weight summary statistics developed using these substitution methods are presented on pages 27 through 36.

Maximum Likelihood Estimation

The maximum likelihood estimation (MLE) procedure used here assumes pollutant concentrations are approximately lognormal in probability distribution. When this assumption is true, estimates produced using this procedure will be more efficient than those produced without assumptions about probability distributions. The procedure uses sample

size, measured pollutant concentrations, and the range of possible values for "detection limit" data in order to pick optimum estimates for the log mean and log variance of a two parameter lognormal distribution. If the assumption of a lognormal distribution is not closely approximated, this procedure is expected to produce good estimates for upper percentiles while the mean and variance estimates may not be optimal.

The two parameter lognormal distribution is fully described by the log mean and log variance, or the mean and standard deviation. Any desired summary statistic can be calculated using an appropriate pair of sufficient statistics. More detailed discussion of this method and the reasons why it was selected are presented in *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal* (1992).

In order to assess the quality of the MLEs, cumulative probability distributions were plotted for both the wet and dry weight distributions. Each plot shows the estimated cumulative distribution for all three estimation methods. The substitution methods are illustrated with points for each observation. The probability plotting position for each point is determined by a ranking procedure developed by Blom. The line indicating the estimated lognormal distribution is a plot of the 10th through 90th percentiles. These plots do not indicate any obvious deviations from the assumption that the pollutant concentration data are approximately lognormal in distribution. These plots are presented in the appendix.

Tables for wet weight summary statistics are presented on pages 10 through 12 and tables for dry weight summary statistics are presented on pages 24 through 26. Pollutants measured above their sample specific Minimum Level, or "detection limit," one time or less are not included in these tables as it is not possible to obtain MLEs under those conditions.

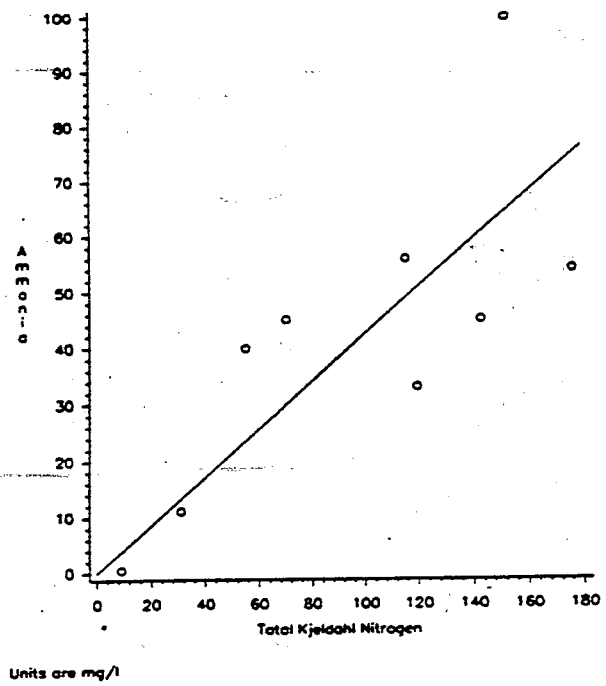
Note that truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. This statement is based on the previously mentioned distributional assumptions of the MLE estimation procedure and the additional assumption that domestic septage trucks across the country have approximately the same probability distribution for pollutant concentrations as domestic septage in trucks found in the area around Madison, Wisconsin. This result is found by comparing the 98th percentile estimates from the National Sewage Sludge Survey, presented in *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge* (1992), to 98th percentile estimates developed here for dry weight concentrations of septage.

**Statistical Methods for Estimating the Relationship Between Ammonia & TKN**

Ammonia is the constituent of Total Kjeldahl Nitrogen (TKN) that is immediately available for plant uptake. Over time, Total Kjeldahl Nitrogen is expected to completely break down into Ammonia. The purpose of this analysis is to assist in determining an

appropriate hydraulic loading rate for domestic septage that allows sufficient nitrogen for crop growth while not allowing for so much nitrogen that crop growth would be adversely affected. The loading rate itself will be estimated in another document.

Relation of Total Kjeldahl Nitrogen to Ammonia:




* Units are mg/l

The observed relationship between the Ammonia and the Total Kjeldahl Nitrogen data indicates, as expected, that both pollutants increase together. A statistical model was fit to these data that assumes the concentration of Ammonia is zero when the concentration of TKN is zero, that the Ammonia concentration will increase in a linear fashion as TKN increases, that the Ammonia concentrations about that line are approximately normal in distribution, and that the deviations from that line are independent and identically distributed. Under these assumptions, Total Kjeldahl Nitrogen is approximately 43% Ammonia in wet domestic septage.

Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Prob>F |
|---|---|---|---|---|---|
| Model | 1 | 3785.12042 | 3785.12042 | 9.806 | 0.0166 |
| Error | 7 | 2702.12438 | 386.01777 | | |
| C Total | 8 | 6487.24480 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 19.64733 | R-square | 0.5835 |
| Dep Mean | 42.72000 | Adj R-sq | 0.5240 |
| C.V. | 45.99095 | | |

Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > \|T\| |
|---|---|---|---|---|---|
| INTERCEP | 1 | 6.292426 | 13.34986889 | 0.471 | 0.6517 |
| TKN | 1 | 0.377705 | 0.12061931 | 3.131 | 0.0166 |

| Variable | DF | Variable Label |
|---|---|---|
| INTERCEP | 1 | Intercept |
| TKN | 1 | Total Kjeldahl Nitrogen |

## Evaluation of Assumptions

For the assumption that the concentration of Ammonia is zero when the concentration of TKN is zero, a model was fit that estimated a non-zero constant when TKN is zero and a hypothesis test was conducted that failed to reject the hypothesis that the constant was statistically different than zero. The

Analysis of Variance table for this model indicates that the intercept term is not statistically significant at the 0.05 level. The significance test used is robust to many departures from assumptions.

Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Prob>F |
|---|---|---|---|---|---|
| Model | 1 | 20124.34510 | 20124.34510 | 57.748 | 0.0001 |
| Error | 8 | 2787.88530 | 348.48566 | | |
| U Total | 9 | 22912.23040 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 18.66777 | R-square | 0.8783 |
| Dep Mean | 42.72000 | Adj R-sq | 0.8631 |
| C.V. | 43.69797 | | |

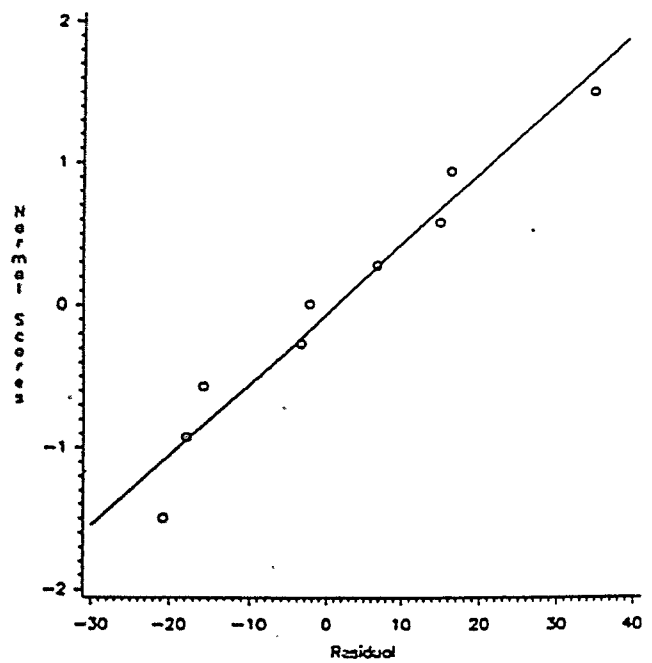
Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > \|T\| |
|---|---|---|---|---|---|
| TKN | 1 | 0.427247 | 0.05622261 | 7.599 | 0.0001 |

| Variable | DF | Variable Label |
|---|---|---|
| TKN | 1 | Total Kjeldahl Nitrogen |

For the assumption of linearity, both the Analysis of Variance table for the model with an intercept term and for the model without an intercept term indicate that a statistically significant linear relationship exists between Ammonia and TKN. Again, the significance test used is robust to many departures from assumptions.

Relation of Total Kjeldahl Nitrogen to Ammonia:
Normal Scores Plot of Residuals from Regression



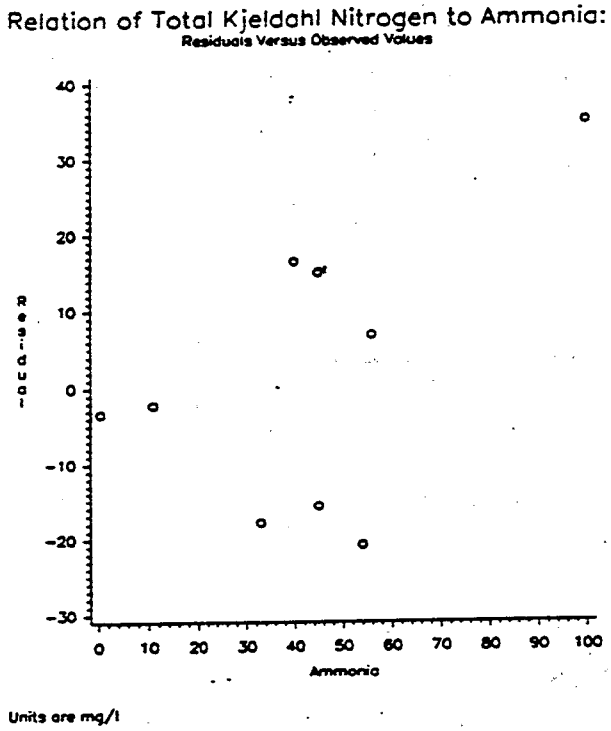

Units are mg/l

For the assumption that Ammonia concentrations about that line are approximately normal in distribution, the Shapiro-Wilk test for the normal distribution fails to reject the hypothesis that the residuals from the fitted line come from a normal distribution. Residuals are the arithmetic difference between the observed concentration of Ammonia at a particular TKN concentration and the Ammonia concentration predicted by the statistical model. Further evidence is that the plot of the residuals versus their expected position in a normal distribution, a normal scores plot, is approximately linear.

For the assumption that deviations from the line are

independent, the physical process of sampling from different truck loads of septage would tend to make the sample results independent.

For the assumption that deviations from the line are identically distributed, the plot of residuals versus observed Ammonia values does not appear to indicate strong deviation from this assumption.



# References

Blom, G. (1958), *Statistical Estimates and Transformed Beta Variables*, New York: John Wiley & Sons, Inc.

USEPA (1992), *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge*

# Appendix A

## Summary Statistics

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Sample Size | Non-Detect | Log Mean | Log Variance |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 9 | 7 | -4.872 | 15.2471 |
| AMMONIA (AS N) | MG/L | 9 | 0 | 3.231 | 2.5560 |
| CADMIUM | UG/L | 9 | 6 | 1.207 | 1.1385 |
| CHROMIUM | UG/L | 9 | 1 | 3.494 | 0.8888 |
| COPPER | UG/L | 9 | 0 | 5.373 | 1.8551 |
| DDT,DDE,DDD(TOTAL) | UG/L | 9 | 7 | -2.783 | 6.1436 |
| LEAD | UG/L | 9 | 6 | 3.642 | 0.5873 |
| LINDANE(GAMMA-BHC) | UG/L | 9 | 7 | -2.360 | 0.2981 |
| MERCURY | UG/L | 9 | 4 | -1.348 | 2.7855 |
| NICKEL | UG/L | 9 | 4 | 3.747 | 0.3319 |
| NITRATE+NITRITE (AS N) | MG/L | 9 | 2 | -1.345 | 1.0699 |
| PERCENT SOLIDS | % | 9 | 0 | -0.488 | 2.8024 |
| SELENIUM | UG/L | 9 | 7 | 0.442 | 5.4810 |
| TOTAL KJELDAHL NITROGEN | MG/L | 9 | 0 | 4.284 | 0.9236 |
| TOTAL PHOSPHOROUS | MG/L | 9 | 0 | 2.960 | 1.2521 |
| ZINC | UG/L | 9 | 0 | 7.806 | 2.1128 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 15.7000 | 10700.000 | 32100.000 | 2050.0000 |
| AMMONIA (AS N) | MG/L | 90.8000 | 104.0000 | 313.0000 | 3.4500 |
| CADMIUM | UG/L | 5.9100 | 2.8700 | 8.6100 | 1.4600 |
| CHROMIUM | UG/L | 51.3000 | 20.5000 | 61.4000 | 1.2000 |
| COPPER | UG/L | 545.0000 | 422.0000 | 1270.0000 | 2.3200 |
| DDT,DDE,DDD(TOTAL) | UG/L | 1.3300 | 9.5900 | 28.8000 | 21.6000 |
| LEAD | UG/L | 51.2000 | 15.3000 | 45.8000 | 0.8940 |
| LINDANE(GAMMA-BHC) | UG/L | 0.1100 | 0.0215 | 0.0646 | 0.5890 |
| MERCURY | UG/L | 1.0500 | 1.3600 | 4.0800 | 3.9000 |
| NICKEL | UG/L | 50.0000 | 10.5000 | 31.4000 | 0.6270 |
| NITRATE+NITRITE (AS N) | MG/L | 0.4450 | 0.2050 | 0.6160 | 1.3800 |
| PERCENT SOLIDS | % | 2.4900 | 3.2700 | 9.8100 | 3.9300 |
| SELENIUM | UG/L | 24.1000 | 124.0000 | 373.0000 | 15.5000 |
| TOTAL KJELDAHL NITROGEN | MG/L | 115.0000 | 47.3000 | 142.0000 | 1.2300 |
| TOTAL PHOSPHOROUS | MG/L | 36.1000 | 19.0000 | 57.0000 | 1.5800 |
| ZINC | UG/L | 7060.0000 | 6350.0000 | 19000.000 | 2.7000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Median | 90th Percentile | 95th Percentile | 98th Percentile |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 0.0077 | 1.1600 | 4.7200 | 23.4000 |
| AMMONIA (AS N) | MG/L | 25.3000 | 197.0000 | 351.0000 | 676.0000 |
| CADMIUM | UG/L | 3.400 | 13.2000 | 19.3000 | 30.0000 |
| CHROMIUM | UG/L | 32.9000 | 111.0000 | 155.0000 | 228.0000 |
| COPPER | UG/L | 216.0000 | 1240.0000 | 2030.0000 | 3540.0000 |
| DDT,DDE,DDD(TOTAL) | UG/L | 0.0619 | 1.4900 | 3.6500 | 10.1000 |
| LEAD | UG/L | 38.2000 | 102.0000 | 135.0000 | 184.0000 |
| LINDANE(GAMMA-BHC) | UG/L | 0.0944 | 0.1900 | 0.2320 | 0.2900 |
| MERCURY | UG/L | 0.2600 | 2.2200 | 4.0400 | 8.0200 |
| NICKEL | UG/L | 42.4000 | 88.9000 | 109.0000 | 138.0000 |
| NITRATE+NITRITE (AS N) | MG/L | 0.2610 | 0.9840 | 1.4300 | 2.1800 |
| PERCENT SOLIDS | % | 0.6140 | 5.2800 | 9.6400 | 19.1000 |
| SELENIUM | UG/L | 1.5600 | 31.5000 | 73.2000 | 191.0000 |
| TOTAL KJELDAHL NITROGEN | MG/L | 72.5000 | 249.0000 | 352.0000 | 523.0000 |
| TOTAL PHOSPHOROUS | MG/L | 19.3000 | 81.3000 | 122.0000 | 192.0000 |
| ZINC | UG/L | 2460.0000 | 15900.000 | 26800.000 | 48700.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.4480 | 0.2660 | 0.7980 | 178.0 | 0.1000 | 0.1000 | 2.500 |
| SM-0 | 0.3610 | 0.2800 | 0.8400 | 232.0 | 0.0000 | 0.0000 | 2.500 |

---------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1090 | 0.0093 | 0.0280 | 25.6 | 0.1000 | 0.1000 | 0.184 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 42.7000 | 9.4900 | 28.5000 | 66.7 | 0.4800 | 45.0000 | 100.000 |
| SM-0 | 42.7000 | 9.4900 | 28.5000 | 66.7 | 0.4800 | 45.0000 | 100.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

### Pollutant=ARSENIC -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 20.0000 | 0.0000 | 0.0000 | 0.0 | 20.0000 | 20.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=BENZENE -- Sample Size=7 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.4000 | 1.4300 | 3.7800 | 33.1 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

### Pollutant=BERYLLIUM -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 5.0000 | 0.0000 | 0.0000 | 0.0 | 5.0000 | 5.0000 | 5.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=CADMIUM -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 7.1300 | 1.4900 | 4.4700 | 62.7 | 5.0000 | 5.0000 | 18.400 |
| SM-0 | 3.8000 | 2.1700 | 6.5000 | 171.0 | 0.0000 | 0.0000 | 18.400 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=CHROMIUM -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 46.7000 | 12.7000 | 38.1000 | 81.6 | 10.0000 | 33.5000 | 128.000 |
| SM-0 | 45.6000 | 13.1000 | 39.4000 | 86.5 | 0.0000 | 33.5000 | 128.000 |

**Pollutant=COPPER -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 503.0000 | 223.0000 | 669.0000 | 133.0 | 62.0000 | 115.0000 | 1850.000 |
| SM-0 | 503.0000 | 223.0000 | 669.0000 | 133.0 | 62.0000 | 115.0000 | 1850.000 |

**Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.6850 | 0.2810 | 0.8440 | 123.0 | 0.3380 | 0.3380 | 2.880 |
| SM-0 | 0.4220 | 0.3230 | 0.9690 | 230.0 | 0.0000 | 0.0000 | 2.880 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1230 | 0.0104 | 0.0313 | 25.4 | 0.1130 | 0.1130 | 0.207 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

**Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.0896 | 0.0209 | 0.0626 | 69.9 | 0.0630 | 0.0630 | 0.250 |
| SM-0 | 0.0278 | 0.0278 | 0.0833 | 300.0 | 0.0000 | 0.0000 | 0.250 |

**Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=LEAD -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 63.4000 | 8.0800 | 24.2000 | 38.2 | 50.0000 | 50.0000 | 121.000 |
| SM-0 | 30.1000 | 15.7000 | 47.1000 | 157.0 | 0.0000 | 0.0000 | 121.000 |

---------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1620 | 0.0170 | 0.0511 | 31.6 | 0.1250 | 0.1380 | 0.253 |
| SM-0 | 0.0417 | 0.0295 | 0.0884 | 212.0 | 0.0000 | 0.0000 | 0.250 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=MERCURY -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.8220 | 0.4200 | 1.2600 | 153.0 | 0.2000 | 0.3000 | 4.050 |
| SM-0 | 0.7330 | 0.4380 | 1.3100 | 179.0 | 0.0000 | 0.3000 | 4.050 |

---------- Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 10.5000 | 0.4890 | 1.4700 | 14.0 | 10.0000 | 10.0000 | 14.400 |
| SM-0 | 1.6000 | 1.6000 | 4.8000 | 300.0 | 0.0000 | 0.0000 | 14.400 |

---------- Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 55.6000 | 5.5600 | 16.7000 | 30.0 | 50.0000 | 50.0000 | 100.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=NICKEL -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 54.5000 | 7.8300 | 23.5000 | 43.1 | 40.0000 | 41.6000 | 105.000 |
| SM-0 | 36.7000 | 13.2000 | 39.7000 | 108.0 | 0.0000 | 41.6000 | 105.000 |

---------- Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.3890 | 0.0964 | 0.2890 | 74.4 | 0.1000 | 0.2000 | 0.900 |
| SM-0 | 0.3670 | 0.1050 | 0.3160 | 86.2 | 0.0000 | 0.2000 | 0.900 |

---------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1.9100 | 0.1630 | 0.4890 | 25.6 | 1.7500 | 1.7500 | 3.220 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=PERCENT SOLIDS -- Sample Size=9 -- Units=' %'**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.2100 | 1.5100 | 4.5400 | 205.0 | 0.0653 | 0.6580 | 14.200 |
| SM-0 | 2.2100 | 1.5100 | 4.5400 | 205.0 | 0.0653 | 0.6580 | 14.200 |

**Pollutant=SELENIUM -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 20.8000 | 6.6400 | 19.9000 | 95.6 | 5.0000 | 5.0000 | 50.000 |
| SM-0 | 6.9400 | 4.6000 | 13.8000 | 199.0 | 0.0000 | 0.0000 | 32.000 |

**Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 96.4000 | 19.2000 | 57.6000 | 59.7 | 9.0000 | 115.0000 | 175.000 |
| SM-0 | 96.4000 | 19.2000 | 57.6000 | 59.7 | 9.0000 | 115.0000 | 175.000 |

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 27.6000 | 5.7400 | 17.2000 | 62.3 | 1.7000 | 32.0000 | 48.000 |
| SM-0 | 27.6000 | 5.7400 | 17.2000 | 62.3 | 1.7000 | 32.0000 | 48.000 |

---------- Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.3000 | 1.6700 | 5.0100 | 44.3 | 0.9100 | 11.4000 | 20.900 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.4000 | 1.4300 | 3.7800 | 33.1 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=ZINC -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 5300.0000 | 2420.0000 | 7270.0000 | 137.0 | 182.0000 | 3190.0000 | 23800.000 |
| SM-0 | 5300.0000 | 2420.0000 | 7270.0000 | 137.0 | 182.0000 | 3190.0000 | 23800.000 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Sample Size | Non-Detect | Log Mean | Log Variance |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 9 | 7 | 0.741 | 8.92238 |
| AMMONIA (AS N) | MG/KG | 9 | 0 | 8.325 | 3.90825 |
| CADMIUM | MG/K' | 9 | 6 | -1.766 | 5.86238 |
| CHROMIUM | MG/KG | 9 | 1 | 1.542 | 2.39400 |
| COPPER | MG/KG | 9 | 0 | 3.559 | 4.39988 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 9 | 7 | 1.665 | 7.27425 |
| LEAD | MG/KG | 9 | 6 | 0.561 | 3.87225 |
| LINDANE(GAMMA-BHC) | UG/KG | 9 | 7 | 0.967 | 2.14650 |
| MERCURY | MG/KG | 9 | 4 | -3.571 | 2.86875 |
| NICKEL | MG/KG | 9 | 4 | 1.330 | 1.57612 |
| NITRATE+NITRITE (AS N) | MG/KG | 9 | 2 | 3.522 | 0.82463 |
| PERCENT SOLIDS | % | 9 | 0 | -0.488 | 2.80237 |
| SELENIUM | MG/KG | 9 | 7 | -2.098 | 6.97725 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 9 | 0 | 9.378 | 2.81813 |
| TOTAL PHOSPHOROUS | MG/KG | 9 | 0 | 8.054 | 1.42312 |
| ZINC | MG/KG | 9 | 0 | 5.992 | 1.05525 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 182.0000 | 5240.0000 | 15700.000 | 86.6000 |
| AMMONIA (AS N) | MG/KG | 29100.000 | 67800.000 | 203000.00 | 6.9900 |
| CADMIUM | MG/KG | 3.2100 | 20.0000 | 60.0000 | 18.7000 |
| CHROMIUM | MG/KG | 15.5000 | 16.3000 | 48.8000 | 3.1600 |
| COPPER | MG/KG | 317.0000 | 948.0000 | 2840.0000 | 8.9700 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 201.0000 | 2540.0000 | 7620.0000 | 38.0000 |
| LEAD | MG/KG | 12.1000 | 27.8000 | 83.3000 | 6.8600 |
| LINDANE(GAMMA-BHC) | UG/KG | 7.6900 | 7.0500 | 21.1000 | 2.7500 |
| MERCURY | MG/KG | 0.1180 | 0.1600 | 0.4810 | 4.0800 |
| NICKEL | MG/KG | 8.3200 | 5.4300 | 16.3000 | 1.9600 |
| NITRATE+NITRITE (AS N) | MG/KG | 51.1000 | 19.3000 | 57.9000 | 1.1300 |
| PERCENT SOLIDS | % | 2.4900 | 3.2700 | 9.8100 | 3.9300 |
| SELENIUM | MG/KG | 4.0200 | 43.8000 | 131.0000 | 32.7000 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 48400.000 | 64000.000 | 192000.00 | 3.9700 |
| TOTAL PHOSPHOROUS | MG/KG | 6410.0000 | 3790.0000 | 11400.000 | 1.7700 |
| ZINC | MG/KG | 678.0000 | 309.0000 | 928.0000 | 1.3700 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Median | 90th Percentile | 95th Percentile | 98th Percentile |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 2.1000 | 97.4000 | 286.0000 | 972.0000 |
| AMMONIA (AS N) | MG/KG | 4130.0000 | 52300.000 | 107000.00 | 240000.00 |
| CADMIUM | MG/KG | 0.1710 | 3.8400 | 9.1800 | 24.8000 |
| CHROMIUM | MG/KG | 4.6700 | 34.1000 | 59.6000 | 112.0000 |
| COPPER | MG/KG | 35.1000 | 520.0000 | 1110.0000 | 2620.0000 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 5.2900 | 169.0000 | 447.0000 | 1350.0000 |
| LEAD | MG/KG | 1.7500 | 22.0000 | 44.6000 | 100.0000 |
| LINDANE(GAMMA-BHC) | UG/KG | 2.6300 | 17.3000 | 29.3000 | 53.4000 |
| MERCURY | MG/KG | 0.0281 | 0.2480 | 0.4560 | 0.9140 |
| NICKEL | MG/KG | 3.7800 | 19.0000 | 29.8000 | 49.9000 |
| NITRATE+NITRITE (AS N) | MG/KG | 33.9000 | 109.0000 | 151.0000 | 219.0000 |
| PERCENT SOLIDS | % | 0.6140 | 5.2800 | 9.6400 | 19.1000 |
| SELENIUM | MG/KG | 0.1230 | 3.6600 | 9.4600 | 27.9000 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 11800.000 | 102000.00 | 187000.00 | 372000.00 |
| TOTAL PHOSPHOROUS | MG/KG | 3150.0000 | 14600.000 | 22400.000 | 36500.000 |
| ZINC | MG/KG | 400.0000 | 1500.0000 | 2170.0000 | 3300.0000 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 77.200 | 36.300 | 109.000 | 141.0 | 8.55000 | 17.6000 | 325.00 |
| SM-0 | 38.000 | 35.900 | 108.000 | 283.0 | 0.00000 | 0.0000 | 325.00 |

---------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 44.100 | 19.500 | 58.500 | 133.0 | 0.70400 | 15.2000 | 153.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 12700.000 | 6390.000 | 19200.000 | 151.0 | 77.50000 | 8210.0000 | 61300.00 |
| SM-0 | 12700.000 | 6390.000 | 19200.000 | 151.0 | 77.50000 | 8210.0000 | 61300.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=ARSENIC -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 8.710 | 3.920 | 11.800 | 135.0 | 0.14100 | 3.0400 | 30.60 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=BENZENE -- Sample Size=7 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1540.000 | 519.000 | 1370.000 | 89.1 | 70.40000 | 1080.0000 | 4330.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=BERYLLIUM -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.180 | 0.981 | 2.940 | 135.0 | 0.03520 | 0.7600 | 7.66 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=CADMIUM -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.430 | 0.954 | 2.860 | 118.0 | 0.03520 | 0.9950 | 7.66 |
| SM-0 | 0.632 | 0.349 | 1.050 | 166.0 | 0.00000 | 0.0000 | 2.77 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 10.900 | 3.640 | 10.900 | 100.0 | 0.22600 | 7.6300 | 35.30 |
| SM-0 | 9.360 | 3.800 | 11.400 | 122.0 | 0.00000 | 6.9200 | 35.30 |

---------- Pollutant=COPPER -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 113.000 | 40.900 | 123.000 | 108.0 | 0.81000 | 105.0000 | 328.00 |
| SM-0 | 113.000 | 40.900 | 123.000 | 108.0 | 0.81000 | 105.0000 | 328.00 |

---------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 176.000 | 64.500 | 194.000 | 110.0 | 2.38000 | 69.3000 | 518.00 |
| SM-0 | 33.800 | 28.100 | 84.400 | 250.0 | 0.00000 | 0.0000 | 254.00 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 49.800 | 22.000 | 66.100 | 133.0 | 0.79600 | 17.2000 | 173.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

**Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 32.000 | 12.400 | 37.100 | 116.0 | 0.44400 | 9.5700 | 96.50 |
| SM-0 | 5.690 | 5.690 | 17.100 | 300.0 | 0.00000 | 0.0000 | 51.20 |

**Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=LEAD -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 23.800 | 9.600 | 28.800 | 121.0 | 0.35200 | 7.6000 | 76.60 |
| SM-0 | 3.960 | 2.730 | 8.200 | 207.0 | 0.00000 | 0.0000 | 24.80 |

---------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 61.900 | 26.700 | 80.000 | 129.0 | 0.88000 | 22.1000 | 211.00 |
| SM-0 | 2.560 | 2.450 | 7.340 | 287.0 | 0.00000 | 0.0000 | 22.10 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=MERCURY -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.138 | 0.044 | 0.132 | 95.4 | 0.00211 | 0.0760 | 0.35 |
| SM-0 | 0.059 | 0.037 | 0.112 | 189.0 | 0.00000 | 0.0021 | 0.35 |

---------- Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4.460 | 1.950 | 5.850 | 131.0 | 0.07040 | 1.5200 | 15.30 |
| SM-0 | 0.328 | 0.328 | 0.984 | 300.0 | 0.00000 | 0.0000 | 2.95 |

---------- Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 22100.000 | 9740.000 | 29200.000 | 132.0 | 352.00000 | 7600.0000 | 76600.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=NICKEL -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 18.900 | 7.800 | 23.400 | 124.0 | 0.56200 | 6.0800 | 61.30 |
| SM-0 | 4.470 | 2.870 | 8.620 | 193.0 | 0.00000 | 0.5620 | 26.80 |

---------- Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 68.600 | 17.200 | 51.700 | 75.4 | 6.34000 | 53.1000 | 153.00 |
| SM-0 | 36.400 | 11.600 | 34.900 | 95.9 | 0.00000 | 32.4000 | 91.20 |

---------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 771.000 | 341.000 | 1020.000 | 133.0 | 12.30000 | 266.0000 | 2680.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=SELENIUM -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4.370 | 1.240 | 3.720 | 85.2 | 0.03520 | 2.7400 | 10.20 |
| SM-0 | 0.487 | 0.335 | 1.000 | 206.0 | 0.00000 | 0.0000 | 2.74 |

**Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 23600.000 | 8350.000 | 25100.000 | 106.0 | 218.00000 | 13000.0000 | 84200.00 |
| SM-0 | 23600.000 | 8350.000 | 25100.000 | 106.0 | 218.00000 | 13000.0000 | 84200.00 |

**Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4580.000 | 1050.000 | 3150.000 | 68.7 | 176.00000 | 3500.0000 | 10700.00 |
| SM-0 | 4580.000 | 1050.000 | 3150.000 | 68.7 | 176.00000 | 3500.0000 | 10700.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 3240.000 | 1600.000 | 4800.000 | 148.0 | 80.10000 | 1390.0000 | 15500.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1540.000 | 519.000 | 1370.000 | 89.1 | 70.40000 | 1080.0000 | 4330.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

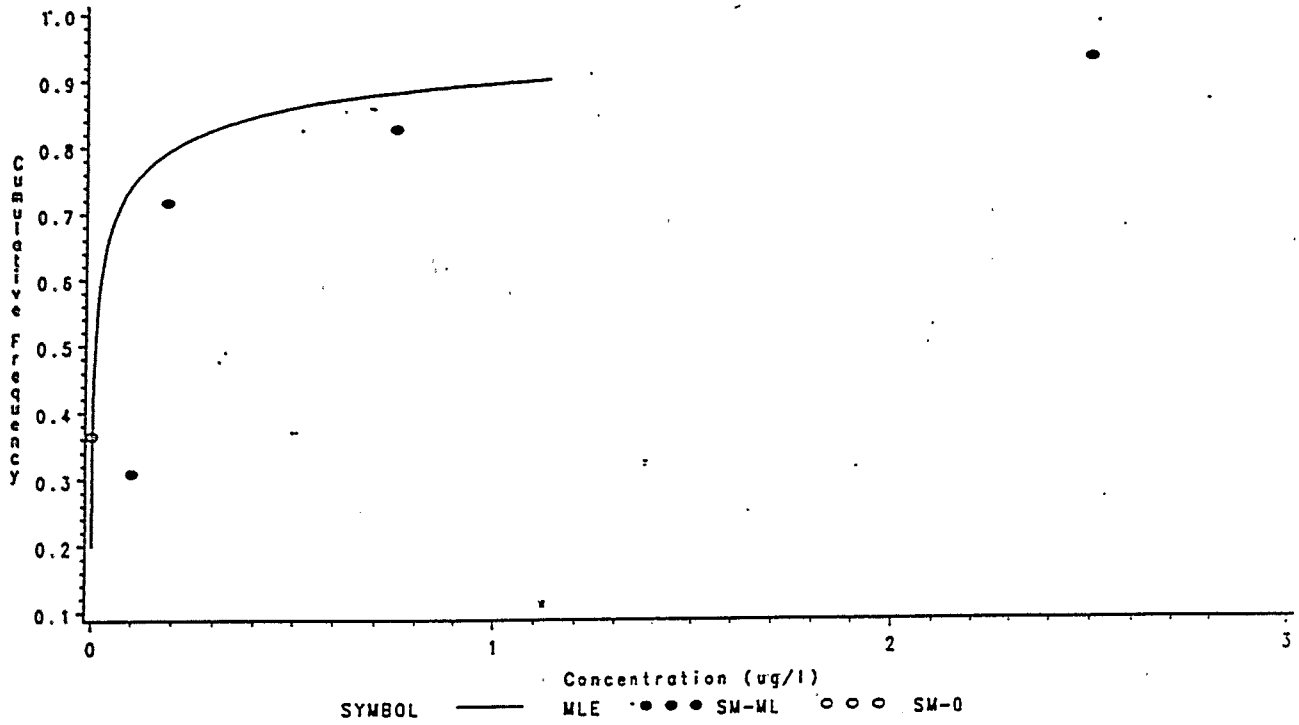
---------- Pollutant=ZINC -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 570.000 | 146.000 | 439.000 | 77.1 | 43.70000 | 433.0000 | 1290.00 |
| SM-0 | 570.000 | 146.000 | 439.000 | 77.1 | 43.70000 | 433.0000 | 1290.00 |

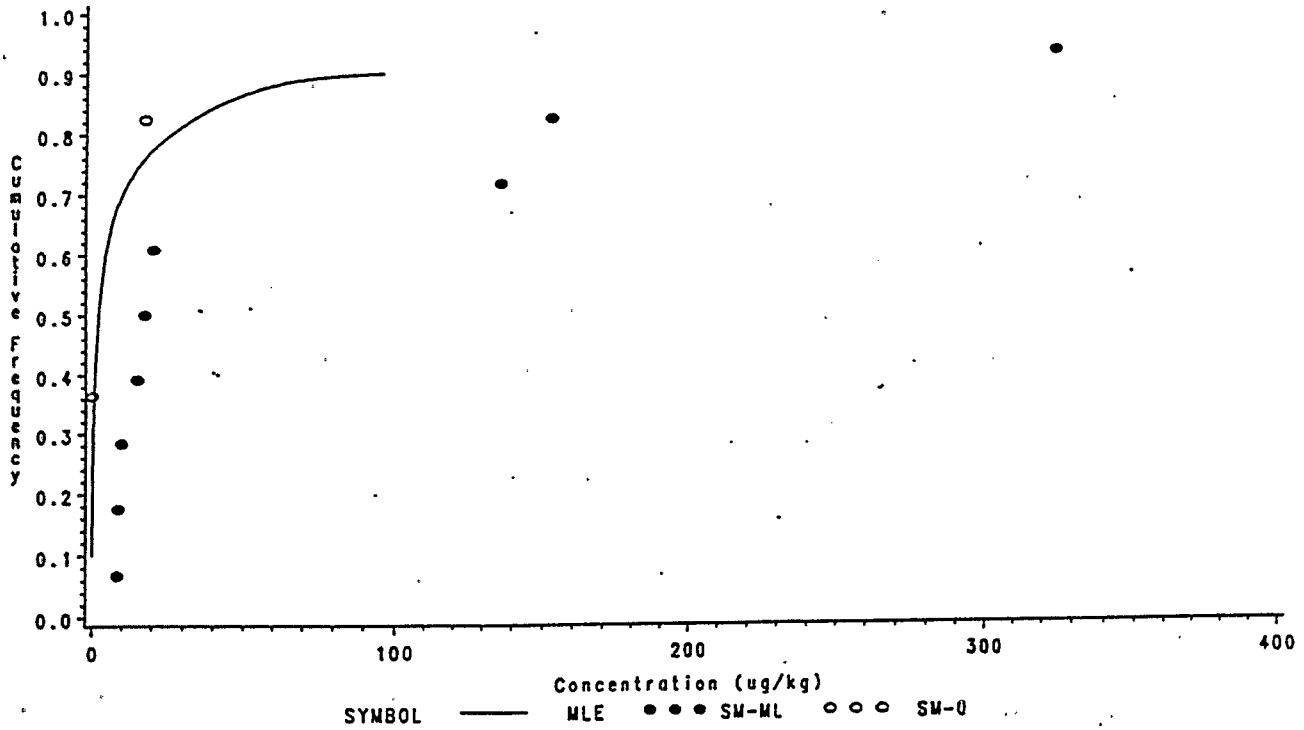
# Appendix B

## Graphics

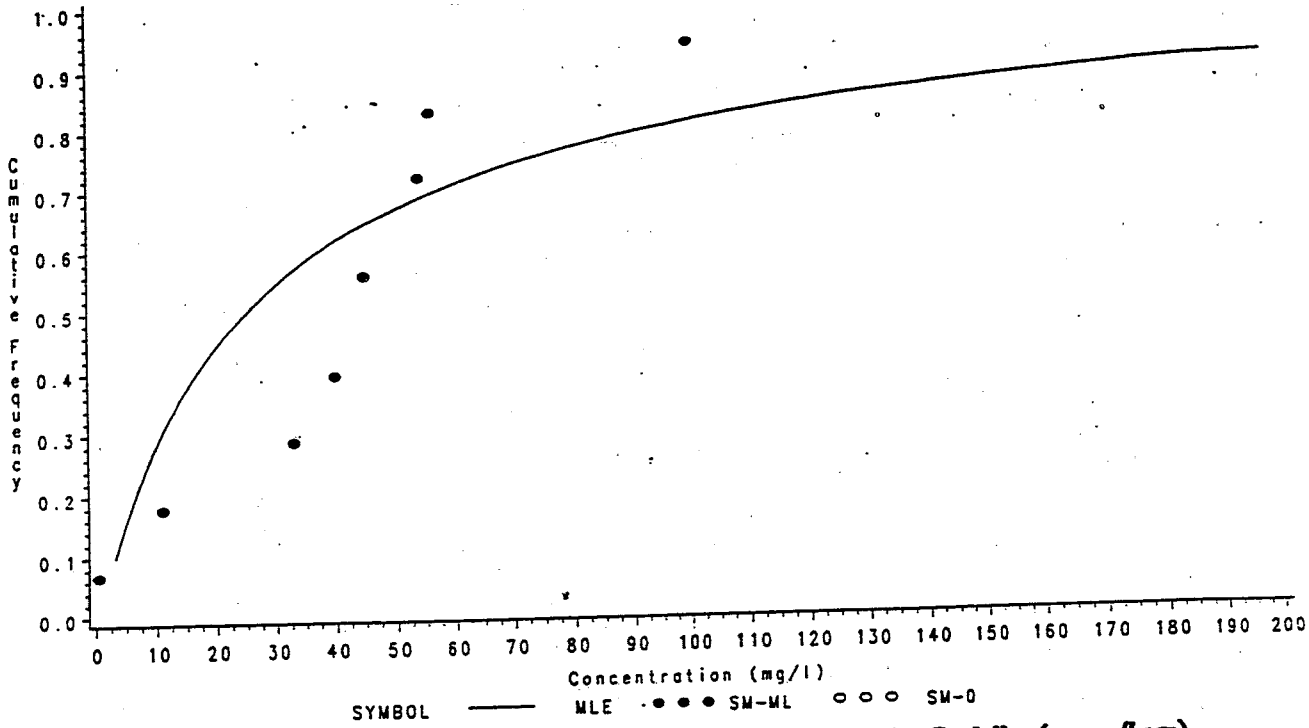
## Cumulative Frequency for Total Aldrin/Dieldrin (ug/l)



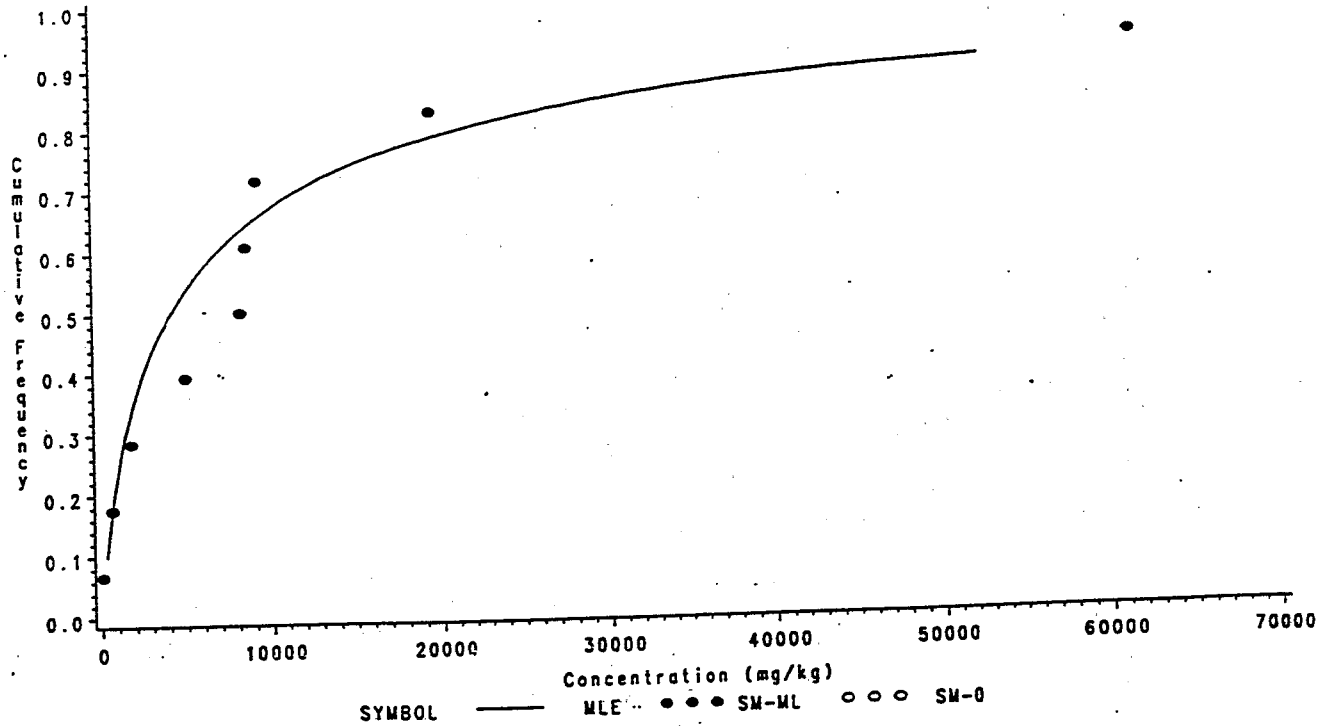

## Cumulative Frequency for Total Aldrin/Dieldrin (ug/kg)



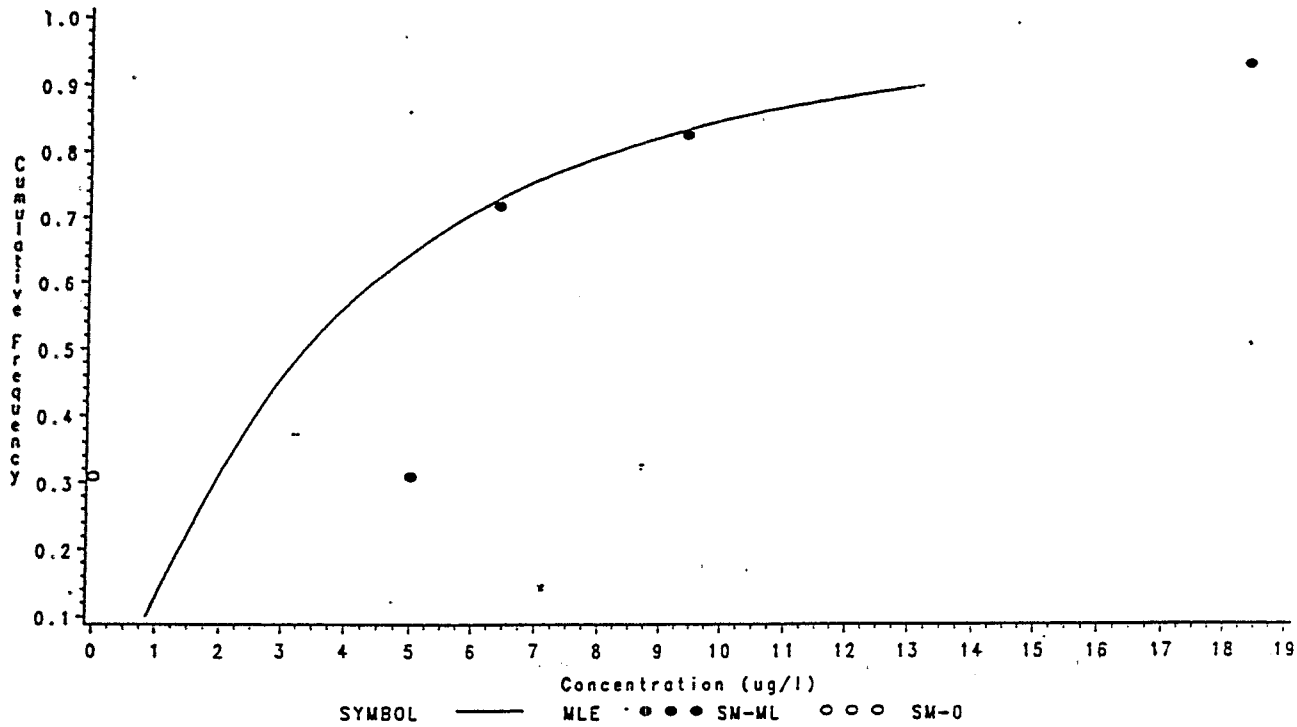
## Cumulative Frequency for Ammonia (AS N) (mg/l)



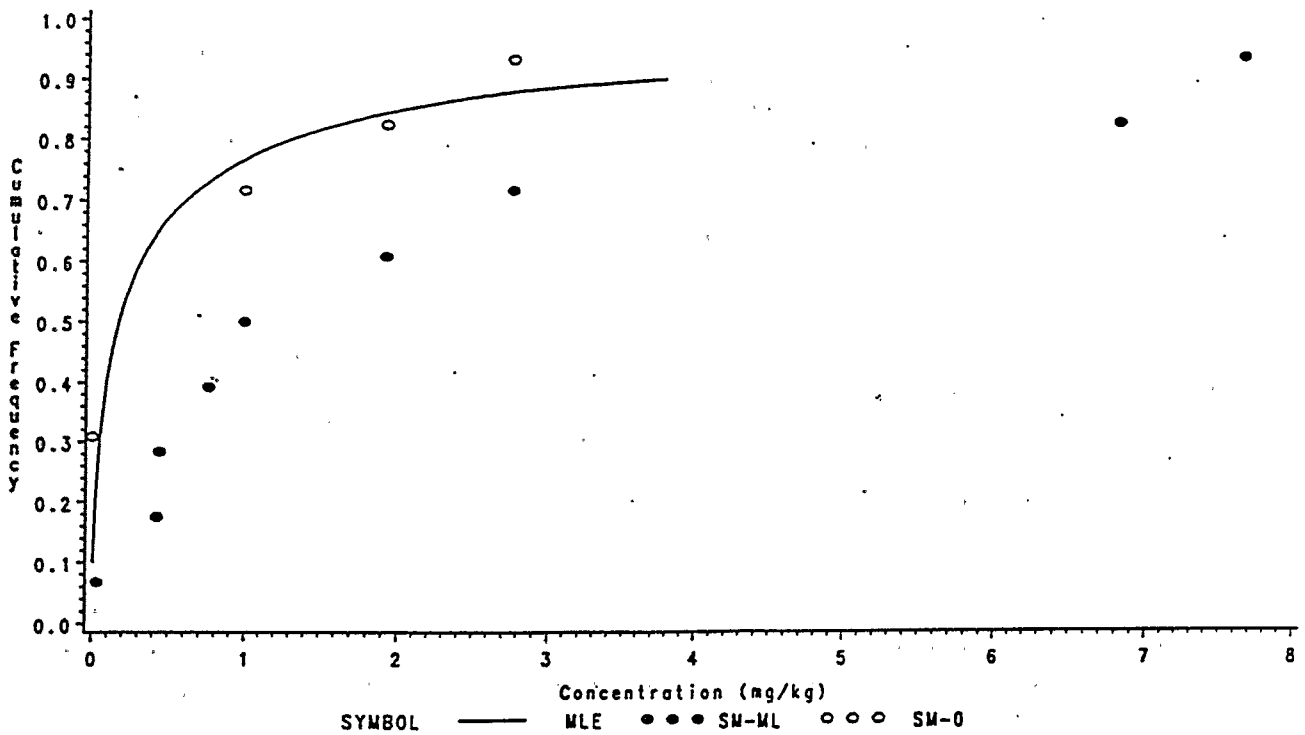

## Cumulative Frequency for Ammonia (AS N) (mg/kg)



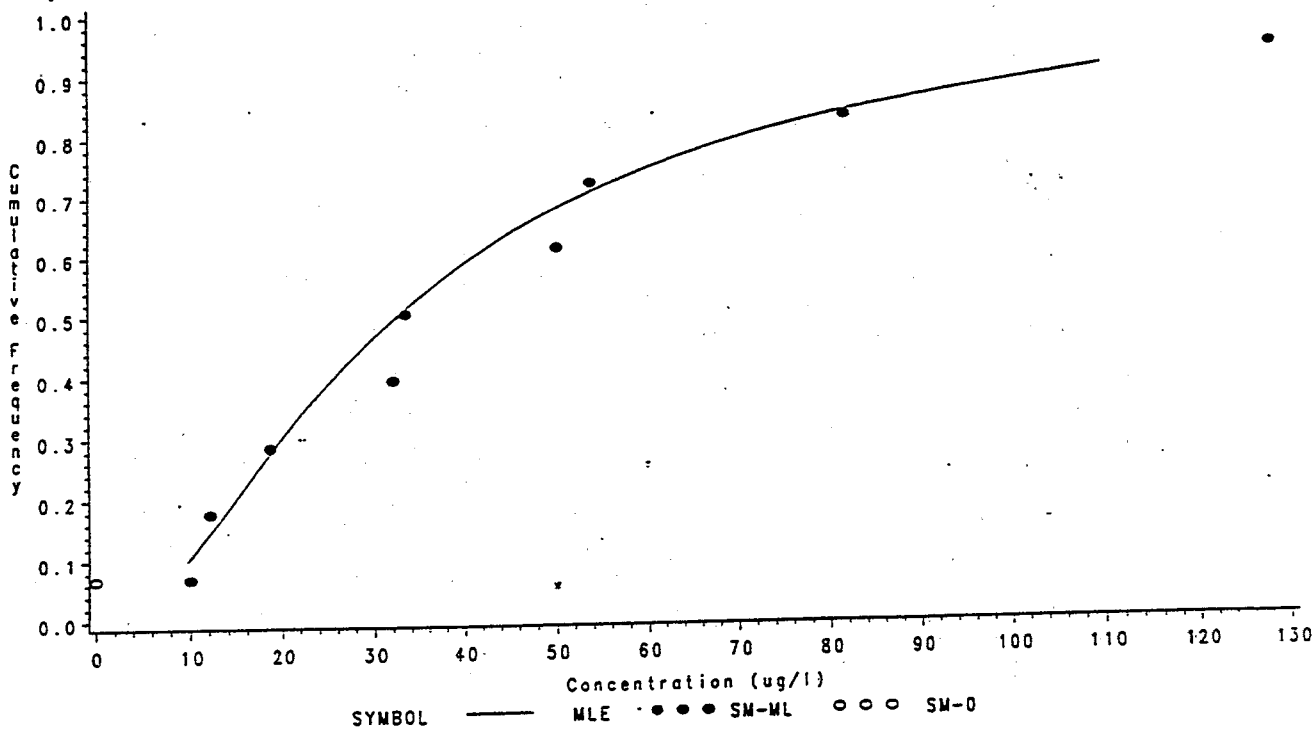
## Cumulative Frequency for Cadmium (ug/l)



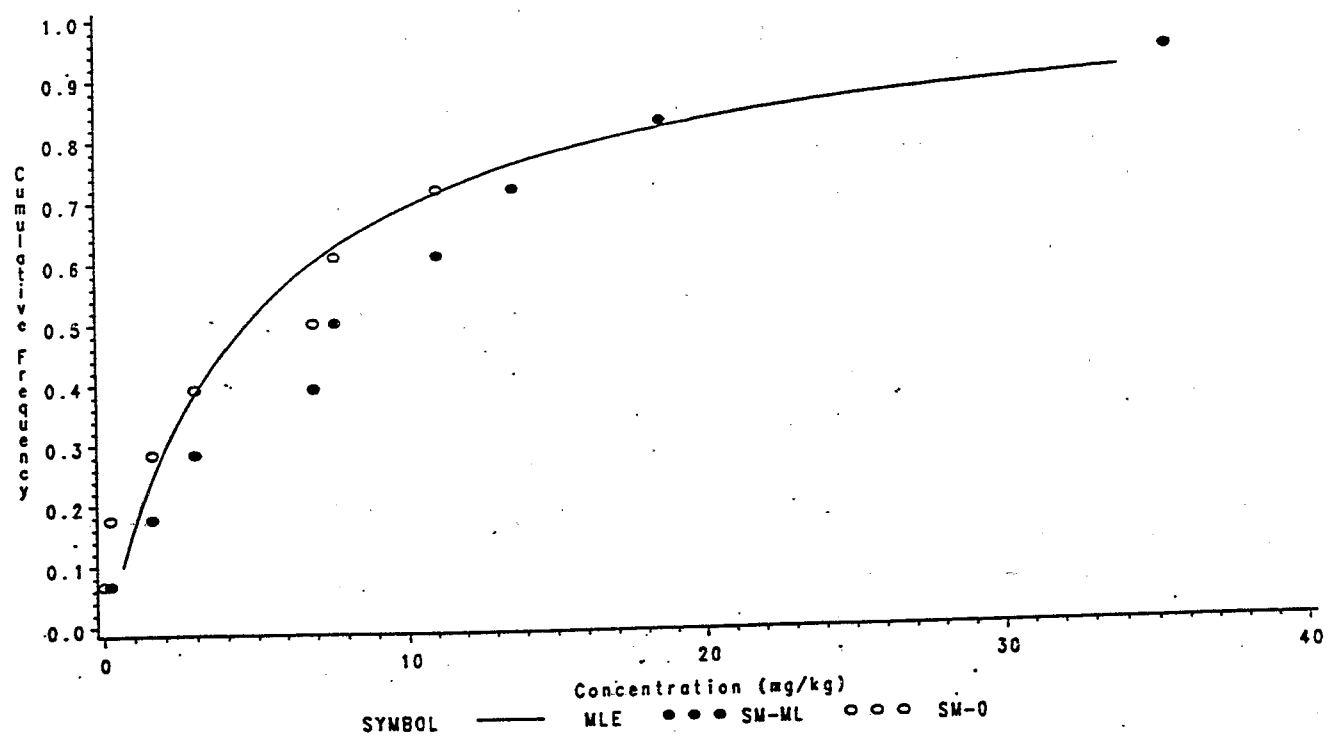

## Cumulative Frequency for Cadmium (mg/kg)



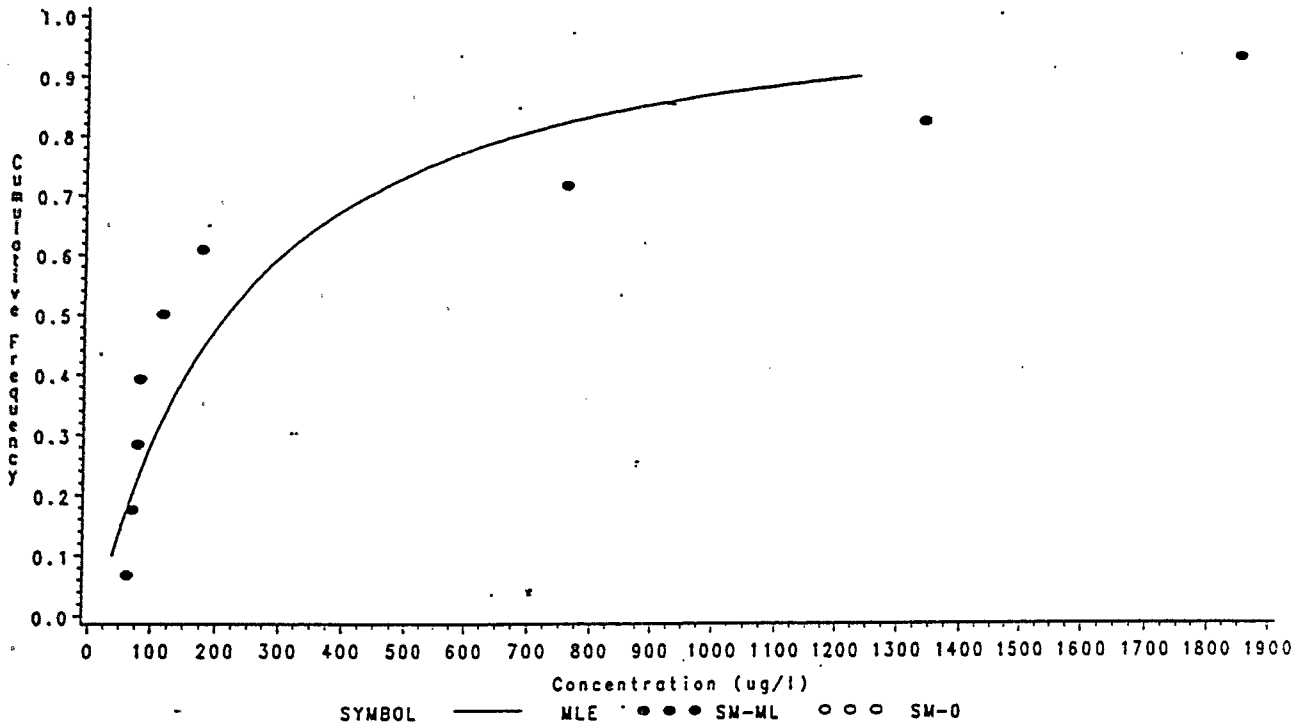
## Cumulative Frequency for Chromium (ug/l)



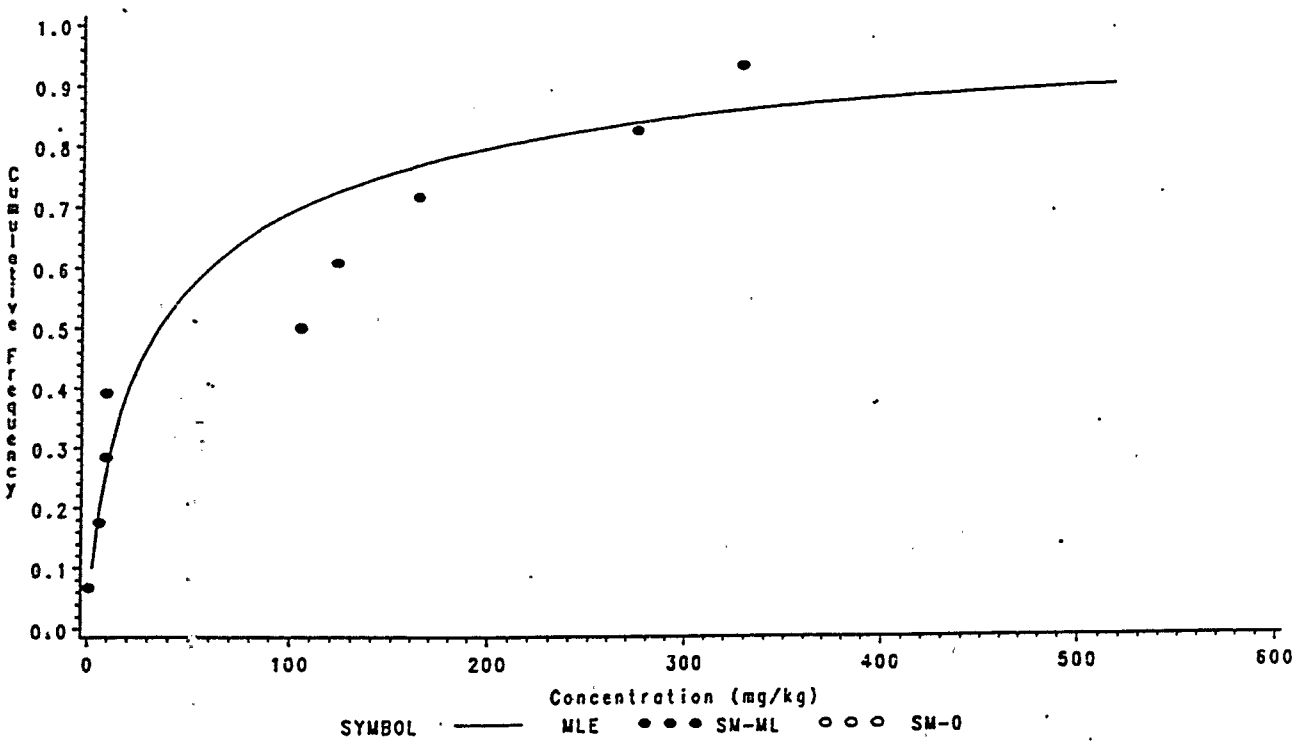

## Cumulative Frequency for Chromium (mg/kg)



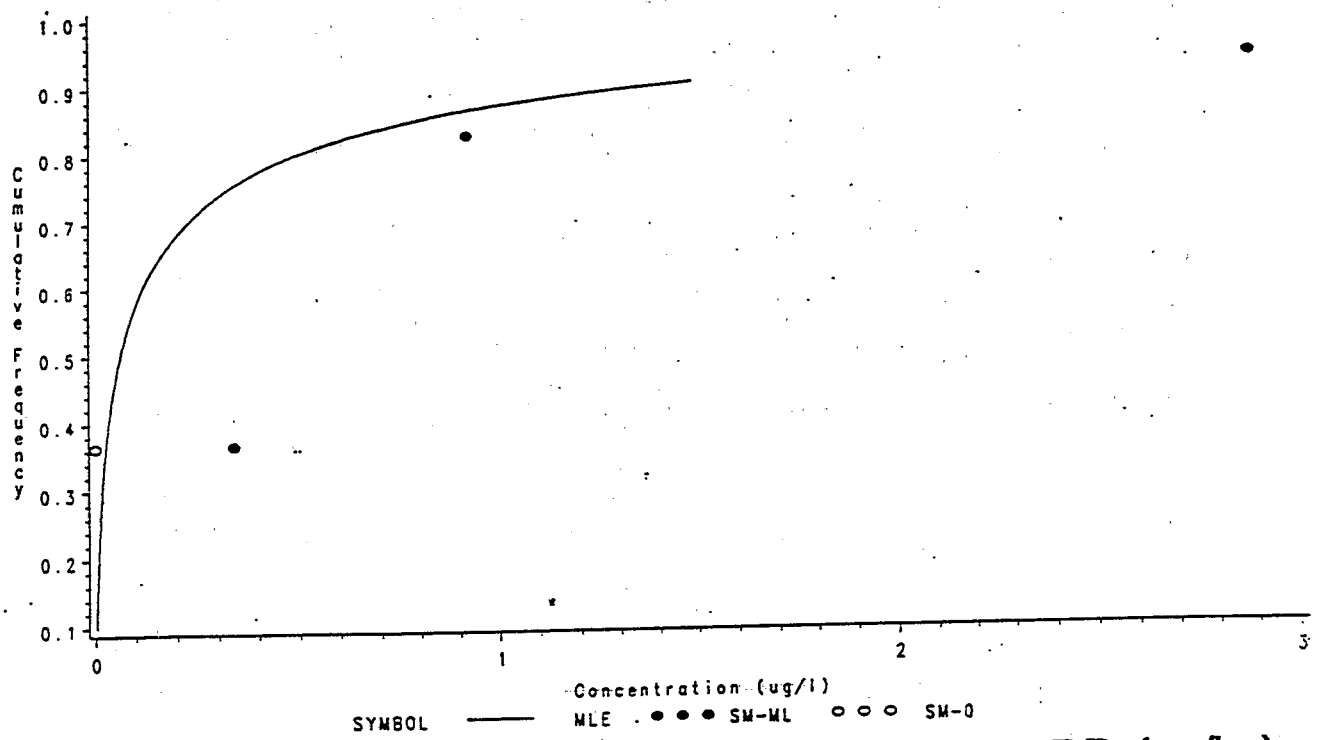
## Cumulative Frequency for Copper (ug/l)



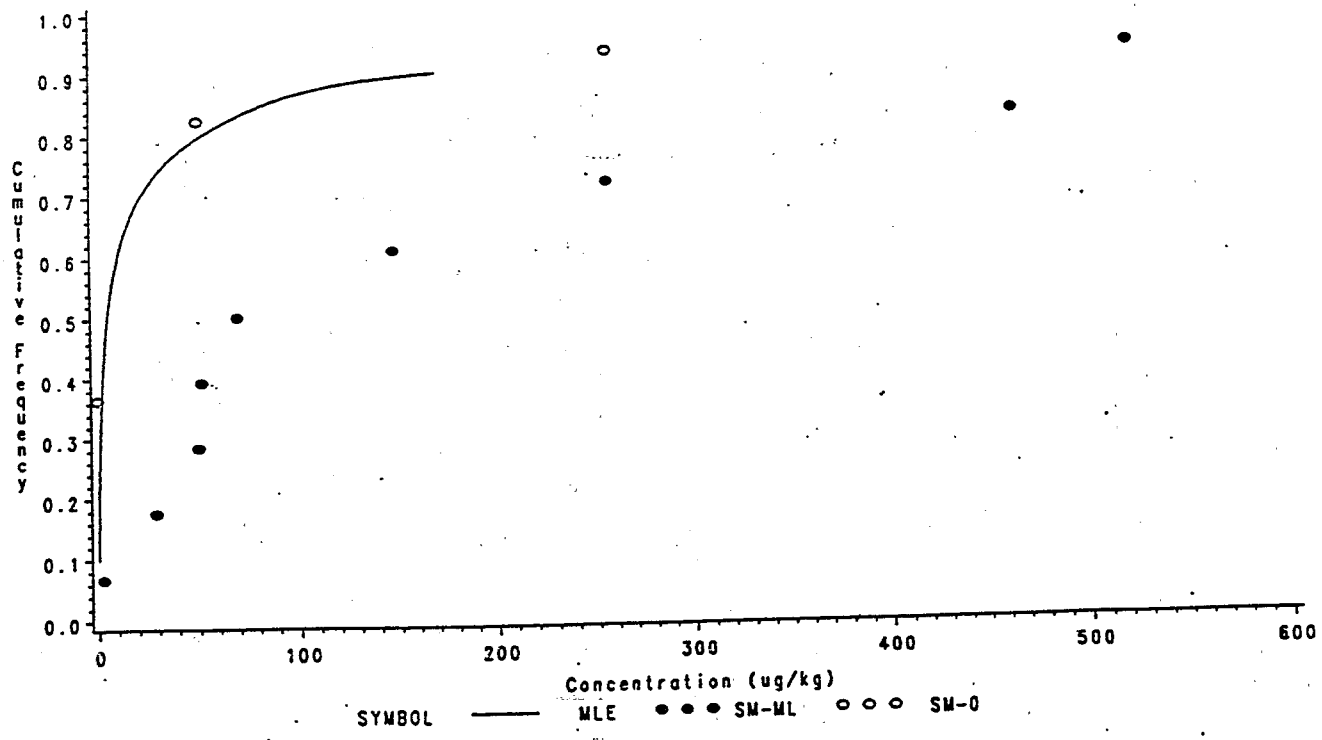

## Cumulative Frequency for Copper (mg/kg)



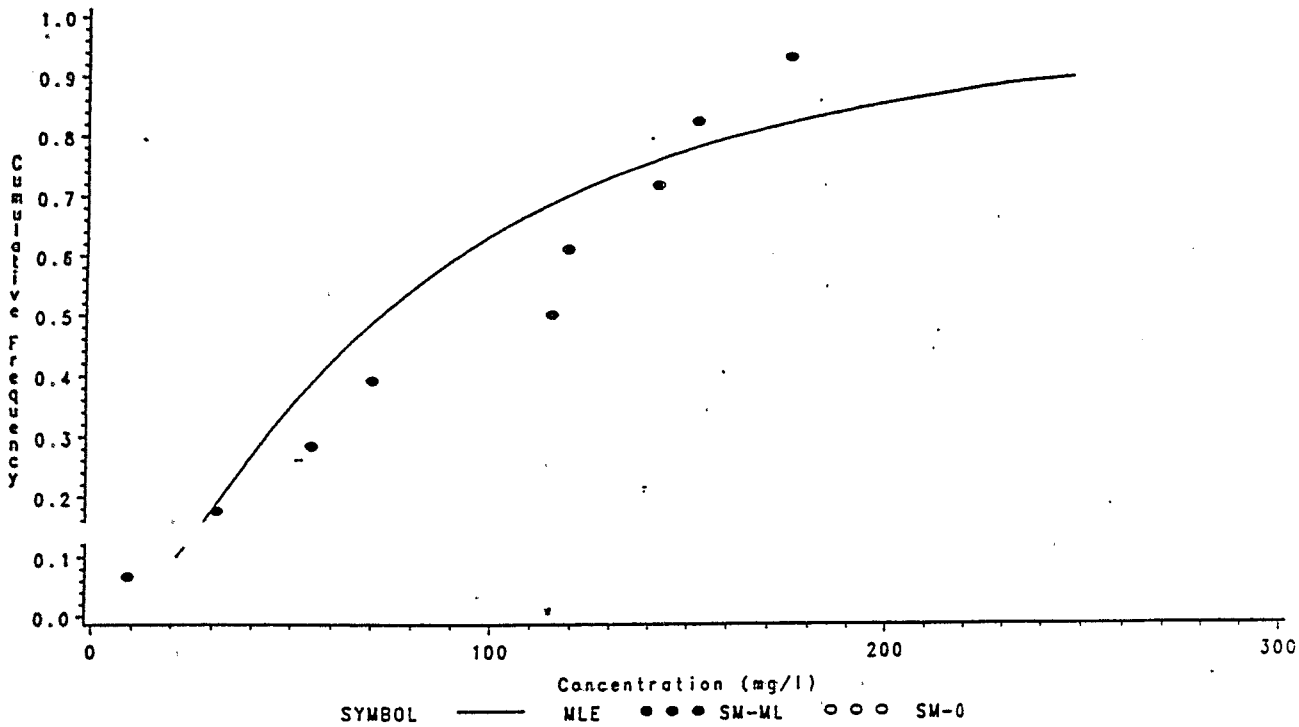
## Cumulative Frequency for Total DDT, DDE, and DDD (ug/l)



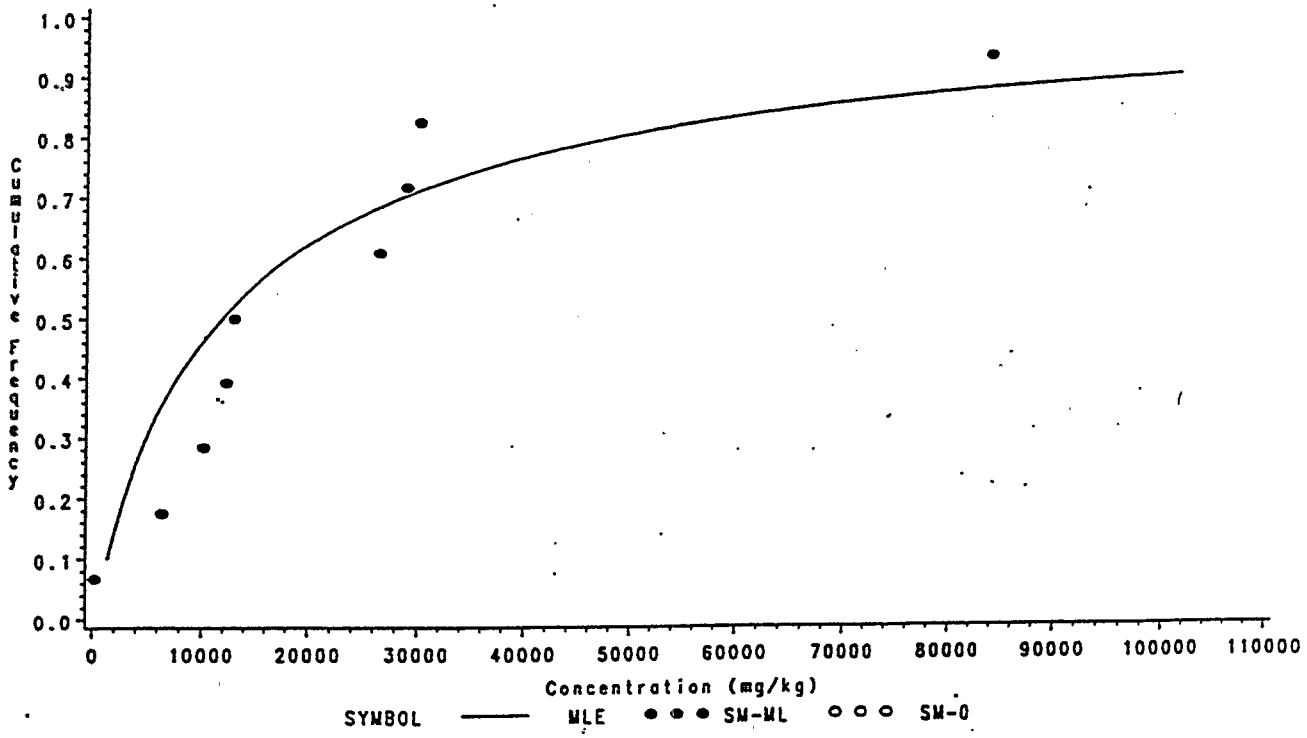

## Cumulative Frequency for Total DDT, DDE, and DDD (ug/kg)



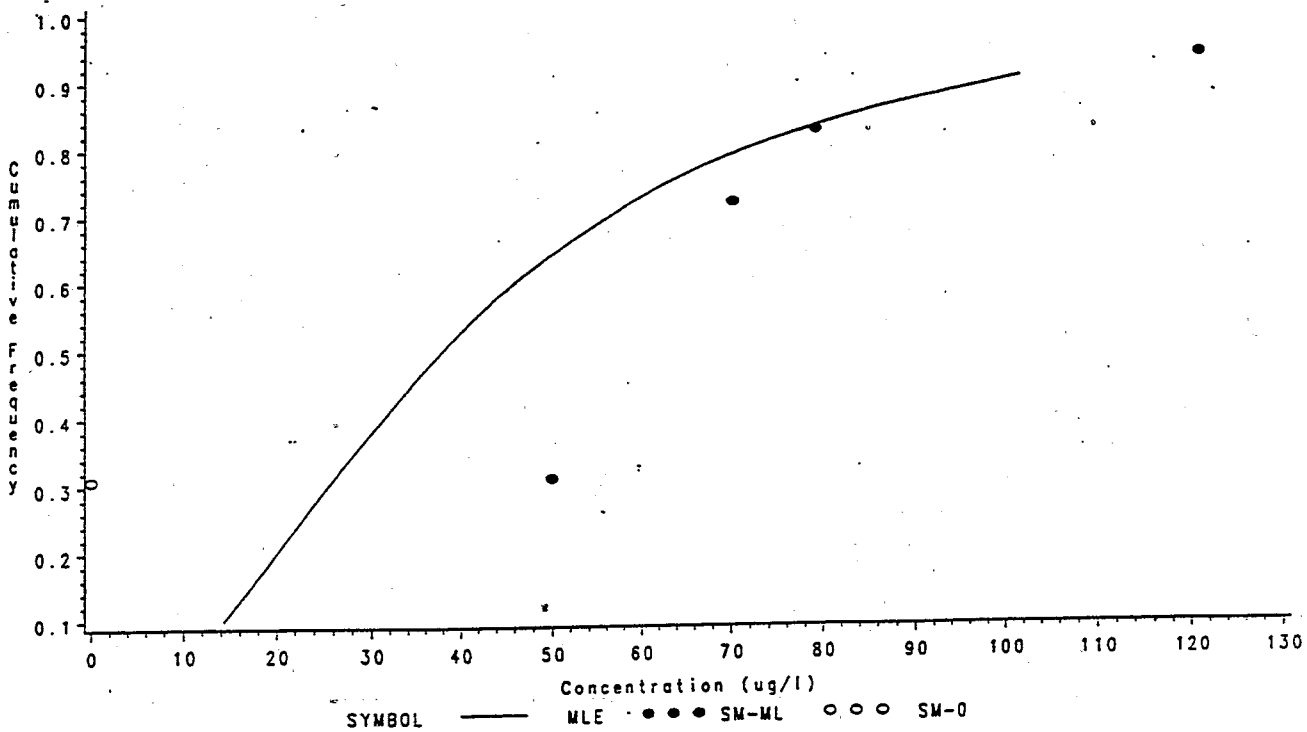
## Cumulative Frequency for Total Kjeldahl Nitrogen (mg/l)



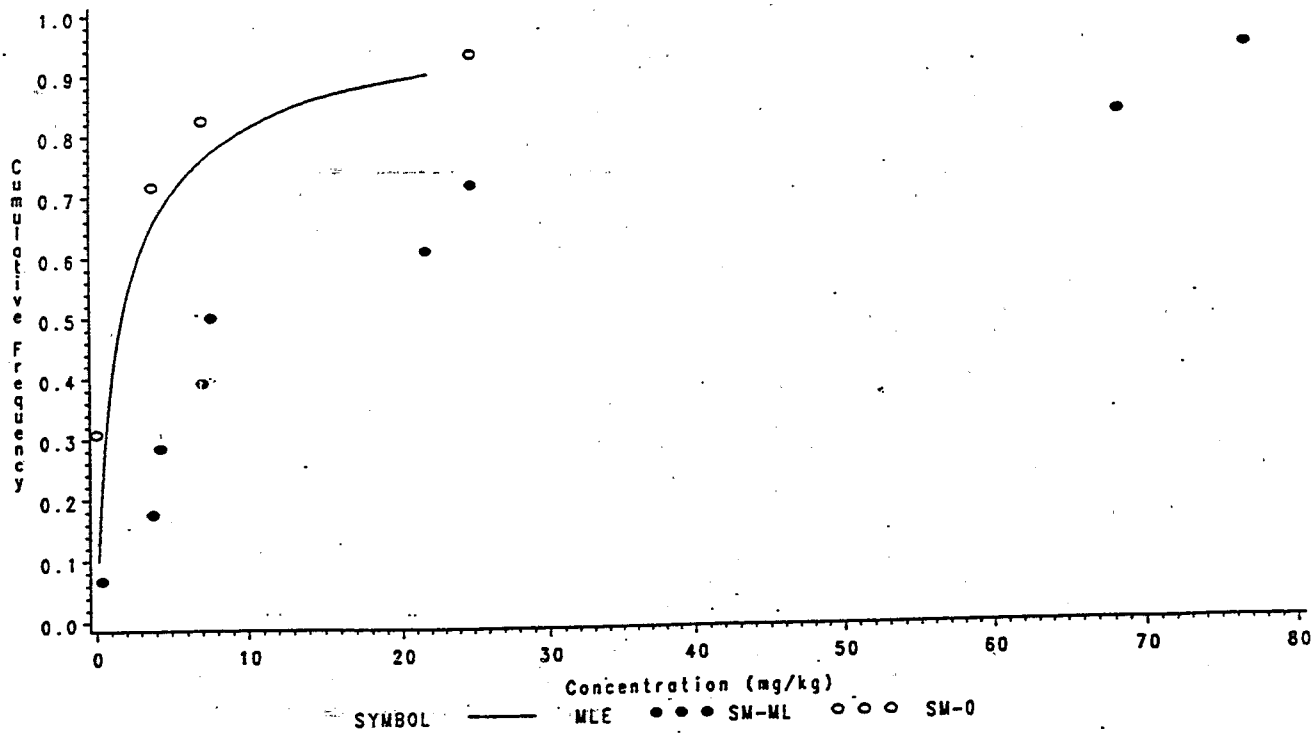

## Cumulative Frequency for Total Kjeldahl Nitrogen (mg/kg)



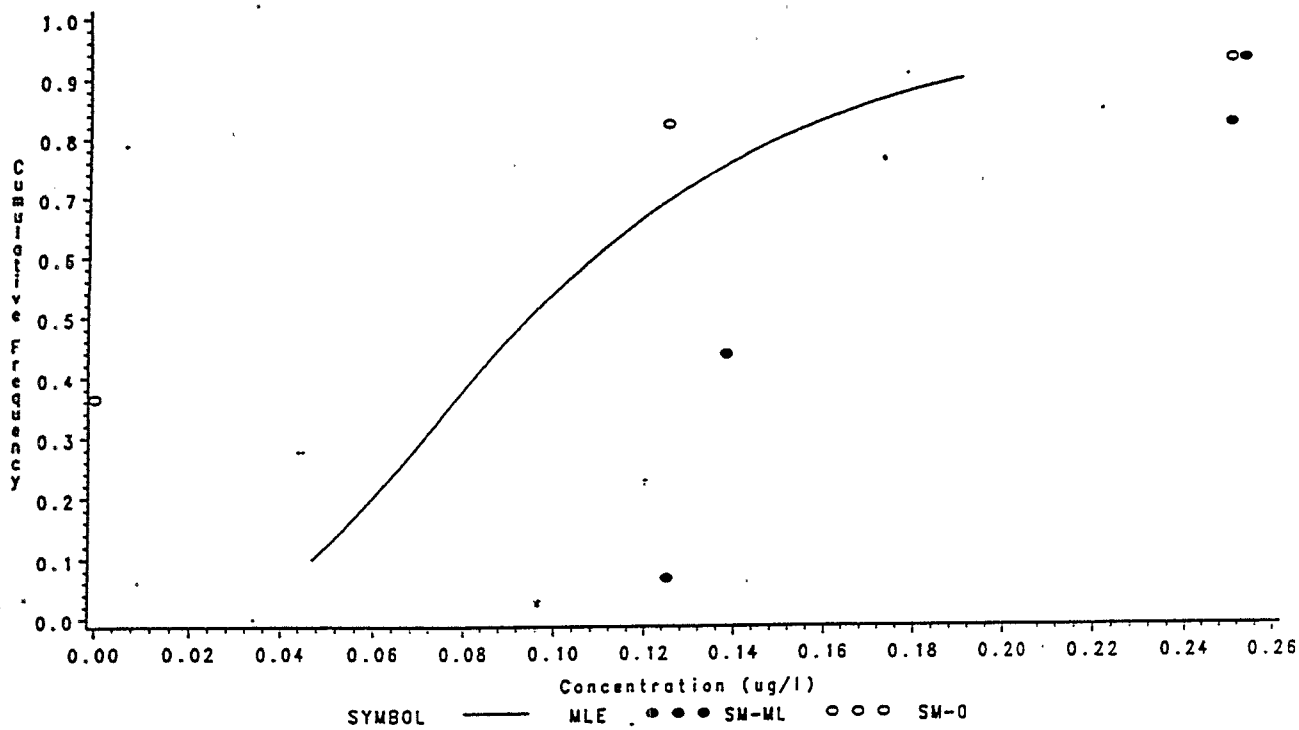
## Cumulative Frequency for Lead (ug/l)



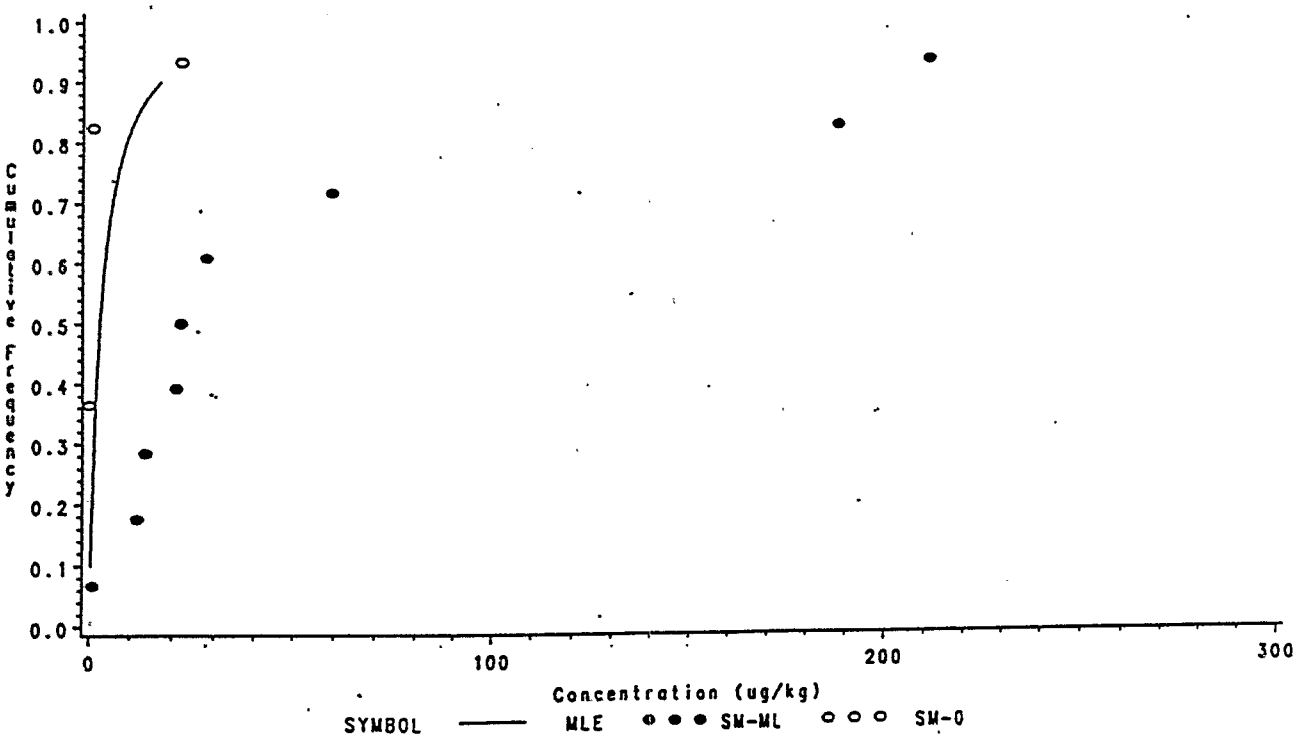

## Cumulative Frequency for Lead (mg/kg)



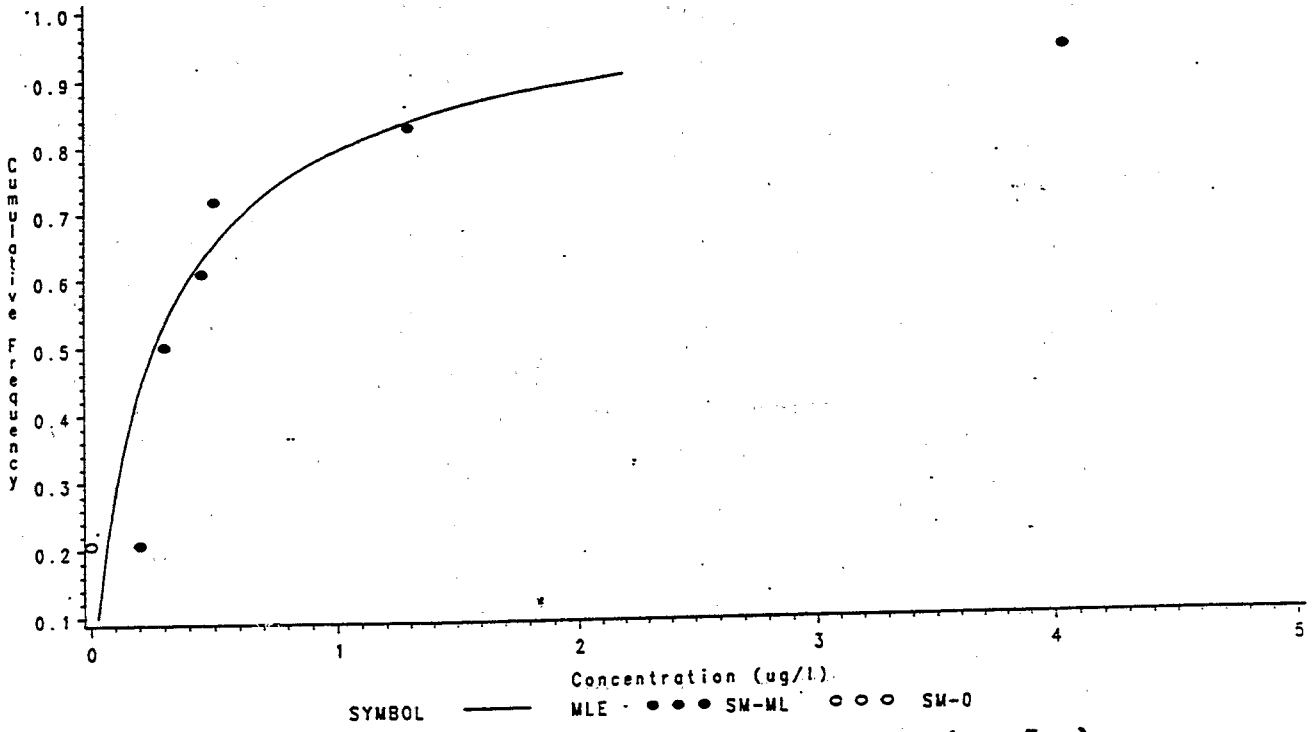
## Cumulative Frequency for Lindane (Gamma-BHC) (ug/l)



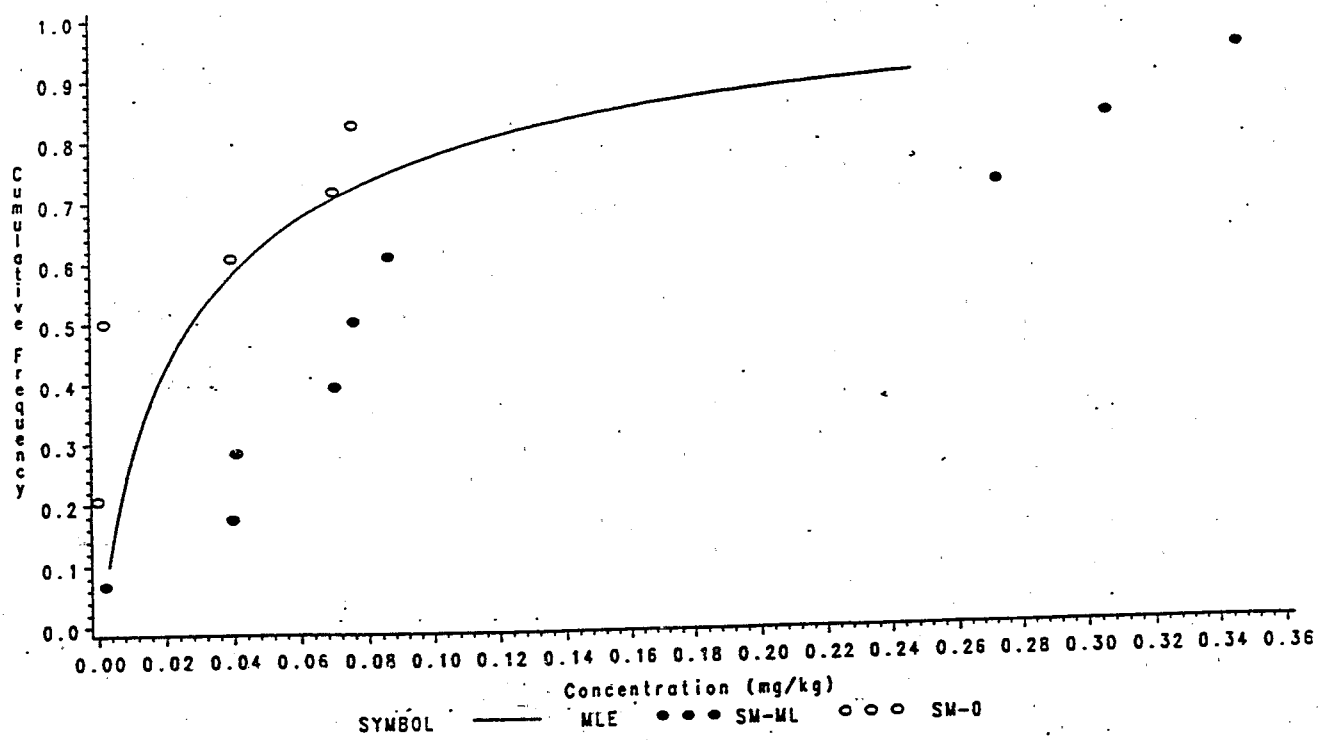

## Cumulative Frequency for Lindane (Gamma-BHC) (ug/kg)



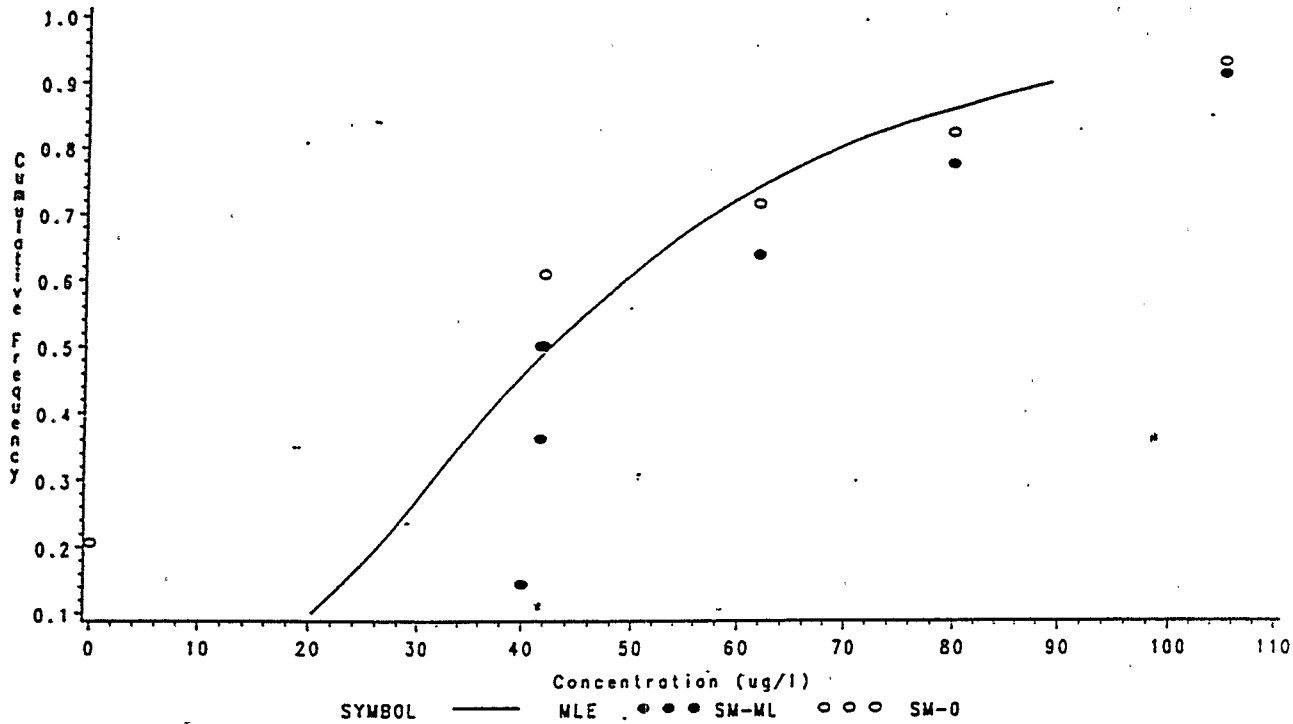
## Cumulative Frequency for Mercury (ug/l)



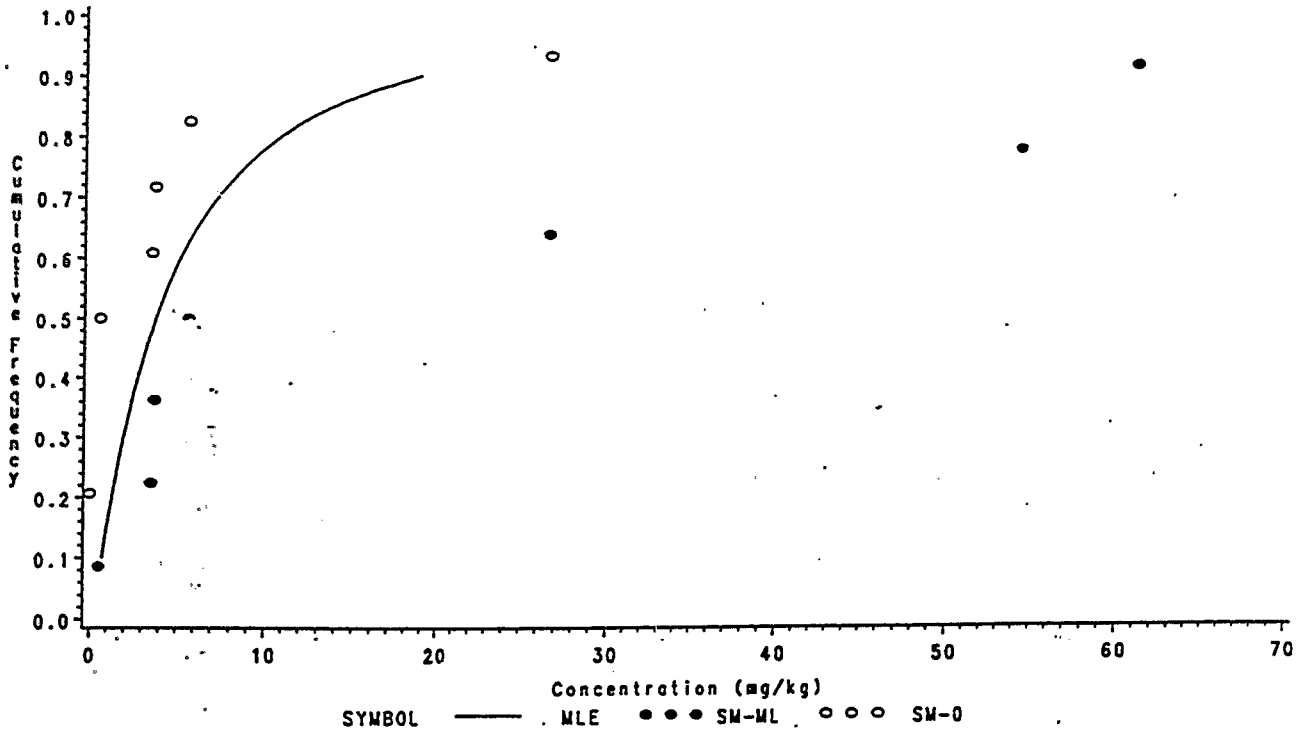

## Cumulative Frequency for Mercury (mg/kg)



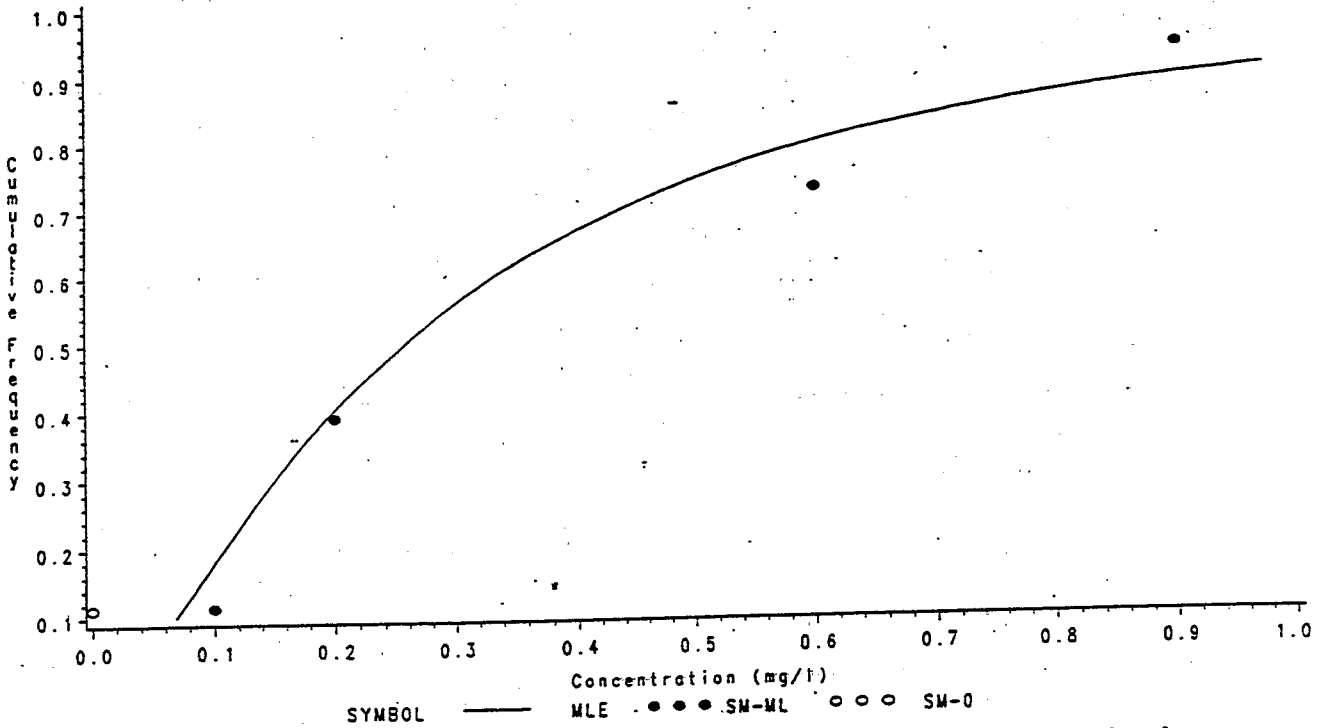
## Cumulaltive Frequency for Nickel (ug/l)



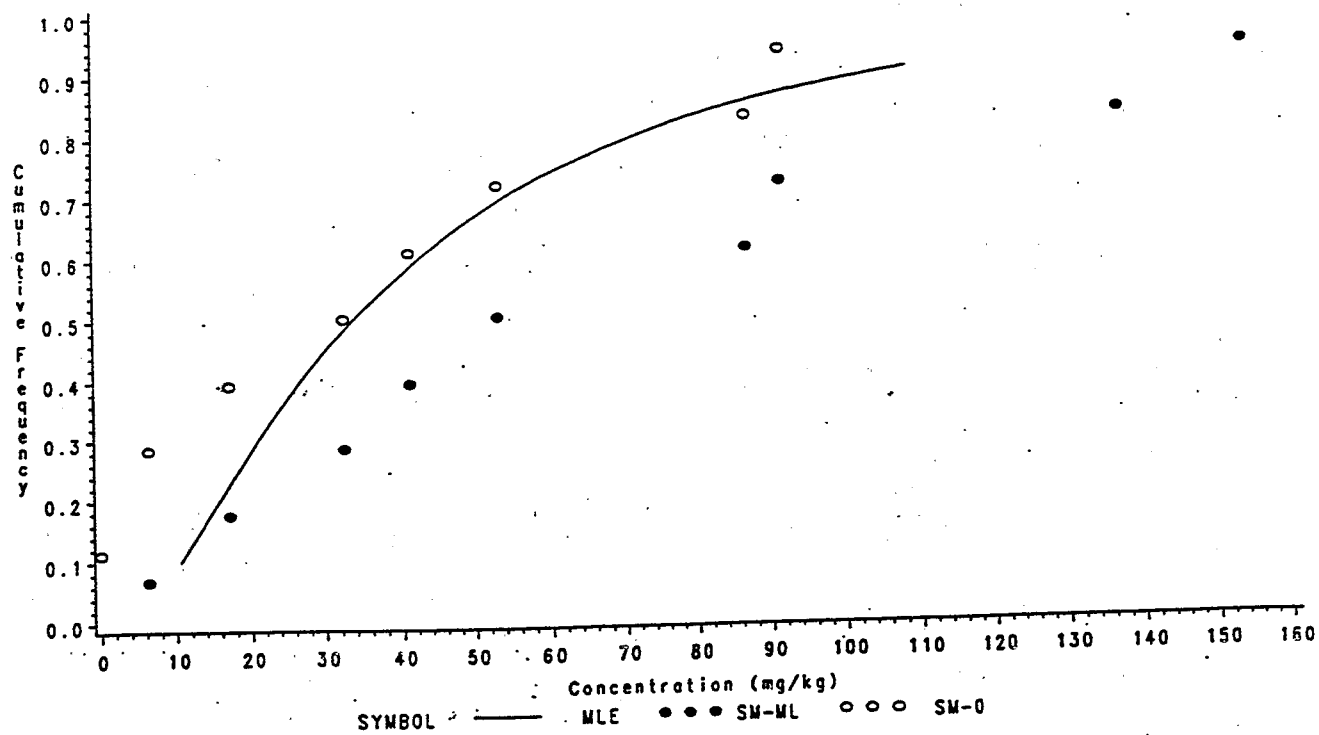

## Cumulative Frequency for Nickel (mg/kg)



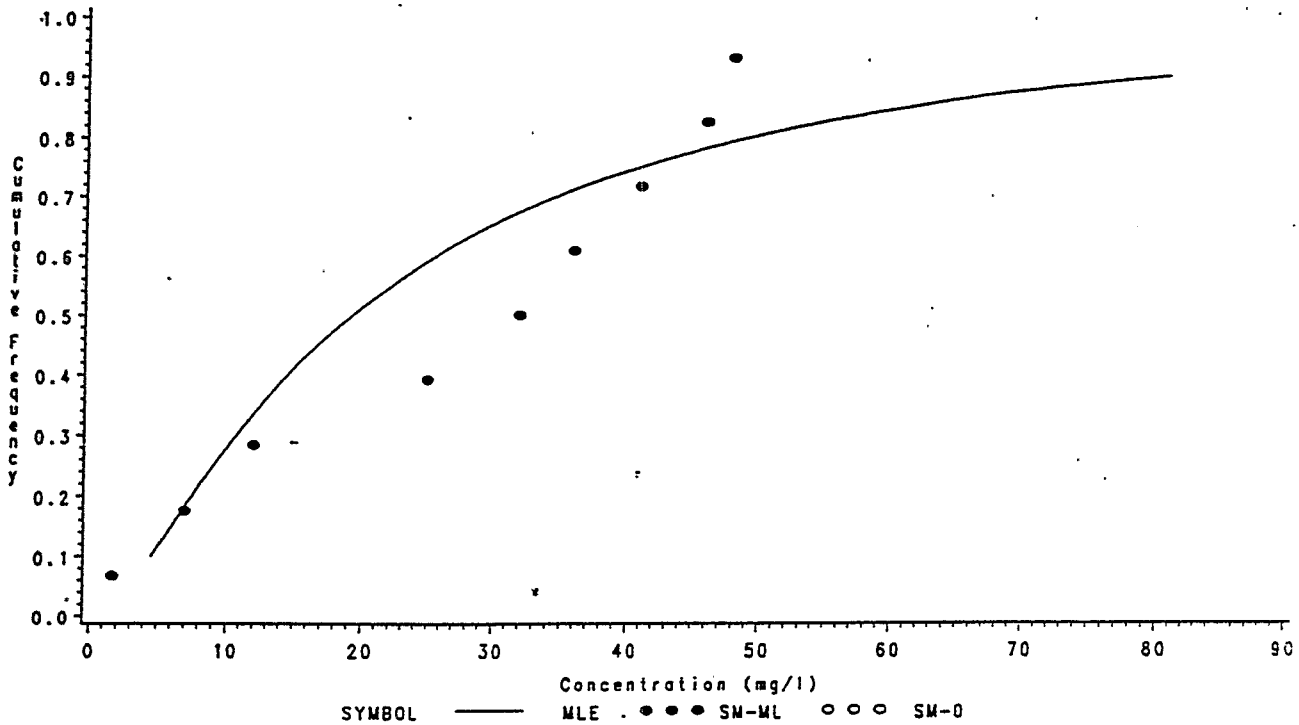
## Cumulative Frequency for Nitrate + Nitrite (mg/l)



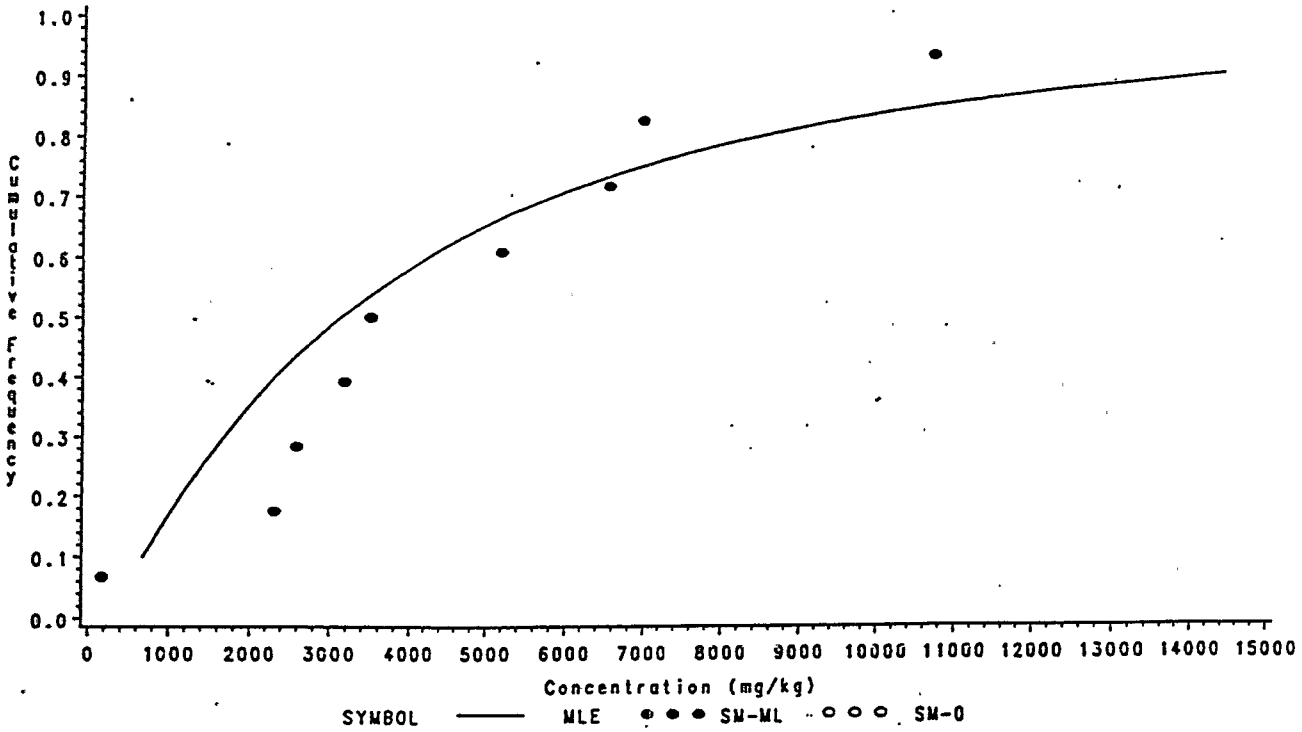

## Cumulative Frequency for Nitrate + Nitrite (mg/kg)



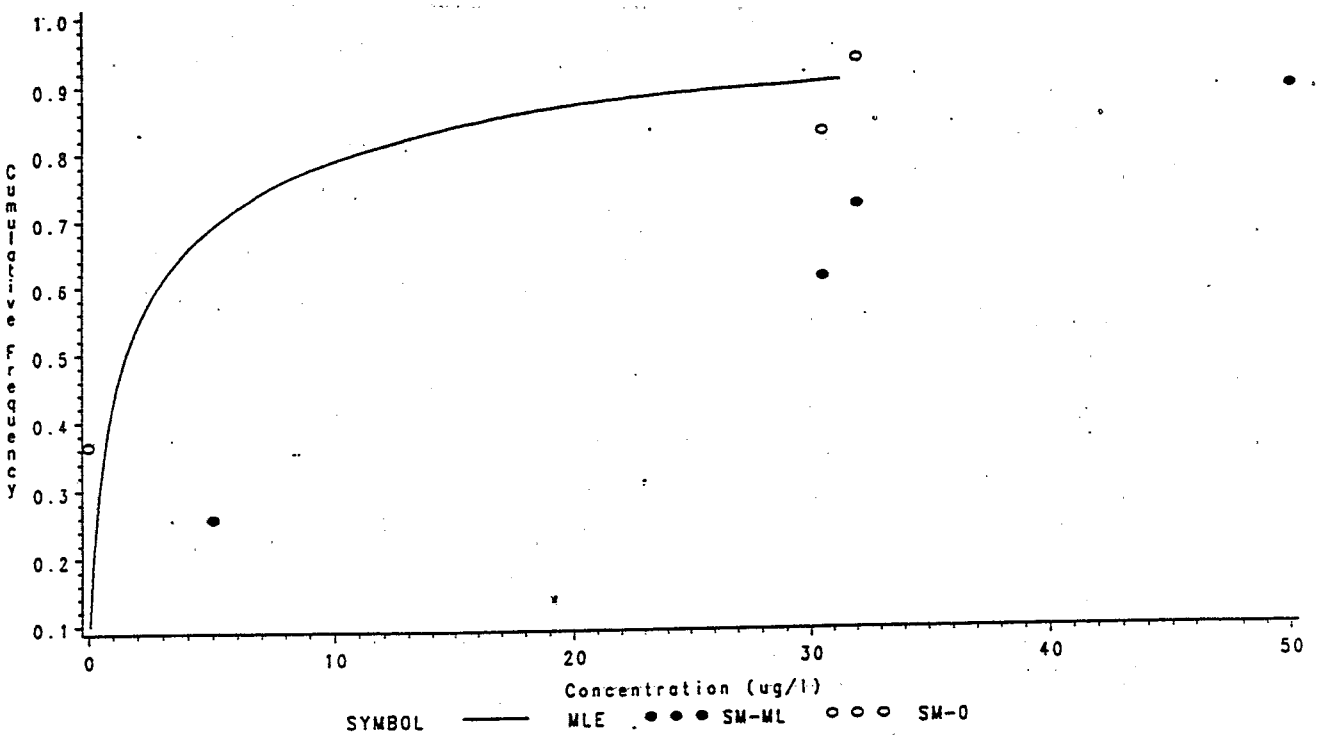
## Cumulative Frequency for Total Phosphorous (mg/l)



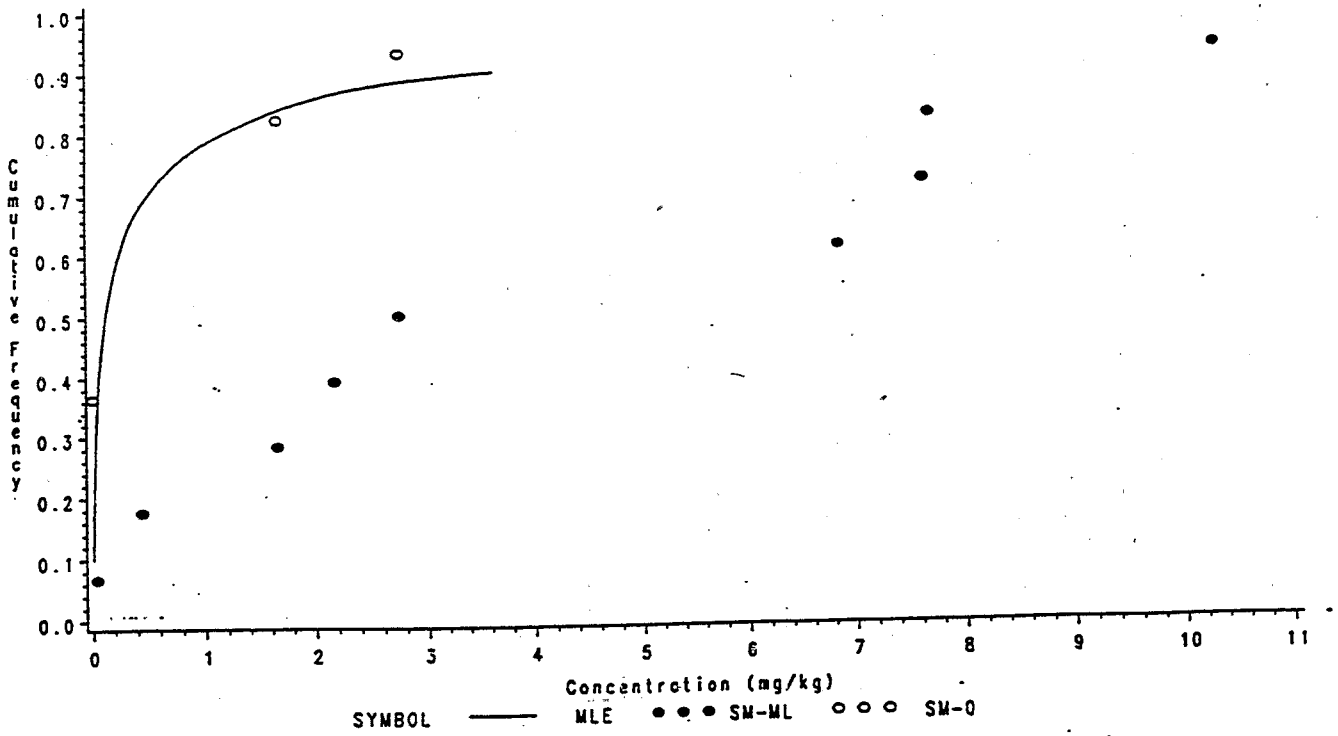

## Cumulative Frequency for Total Phosphorous (mg/kg)



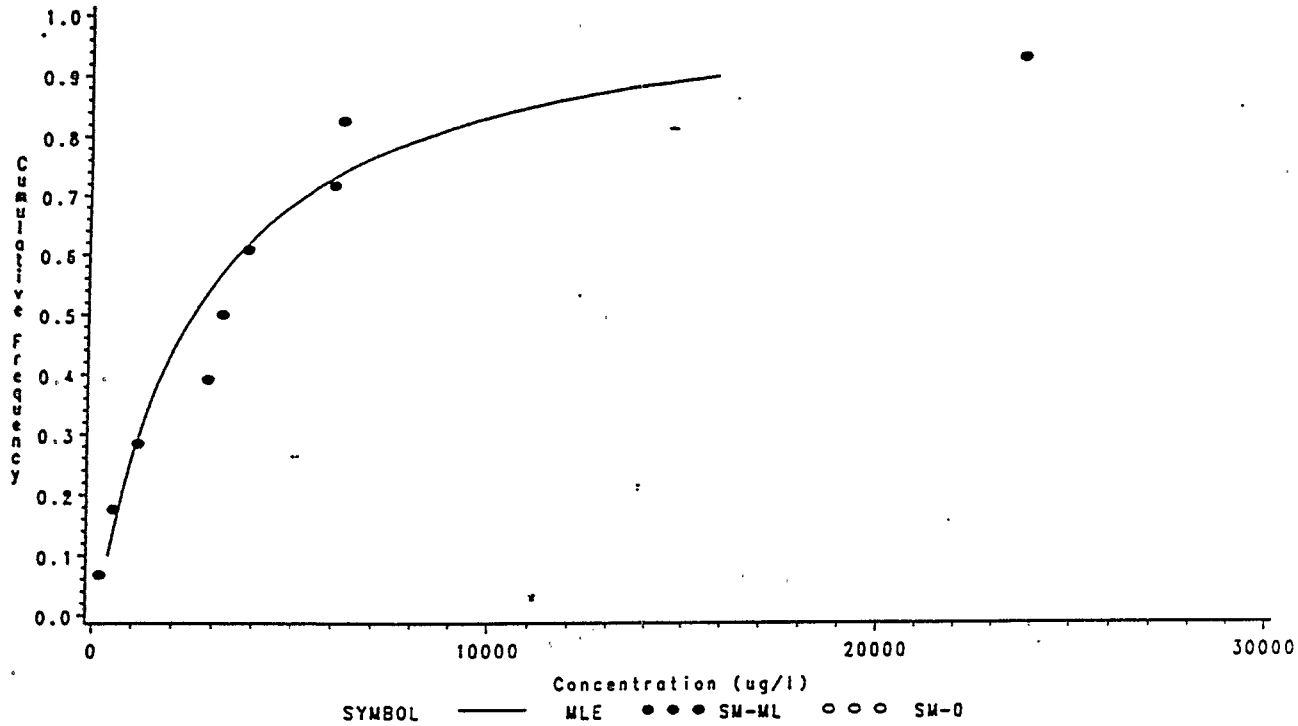
## Cumulative Frequency for Selenium (ug/l)



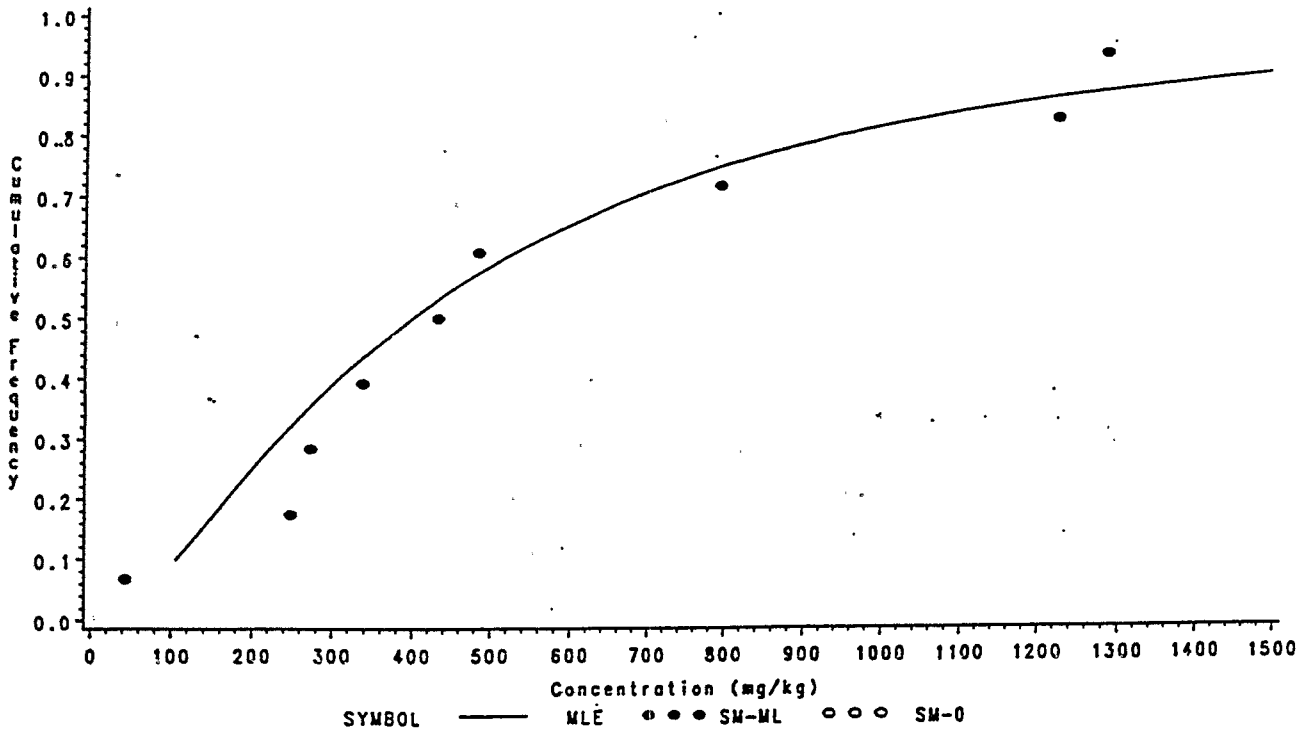

## Cumulative Frequency for Selenium (mg/kg)



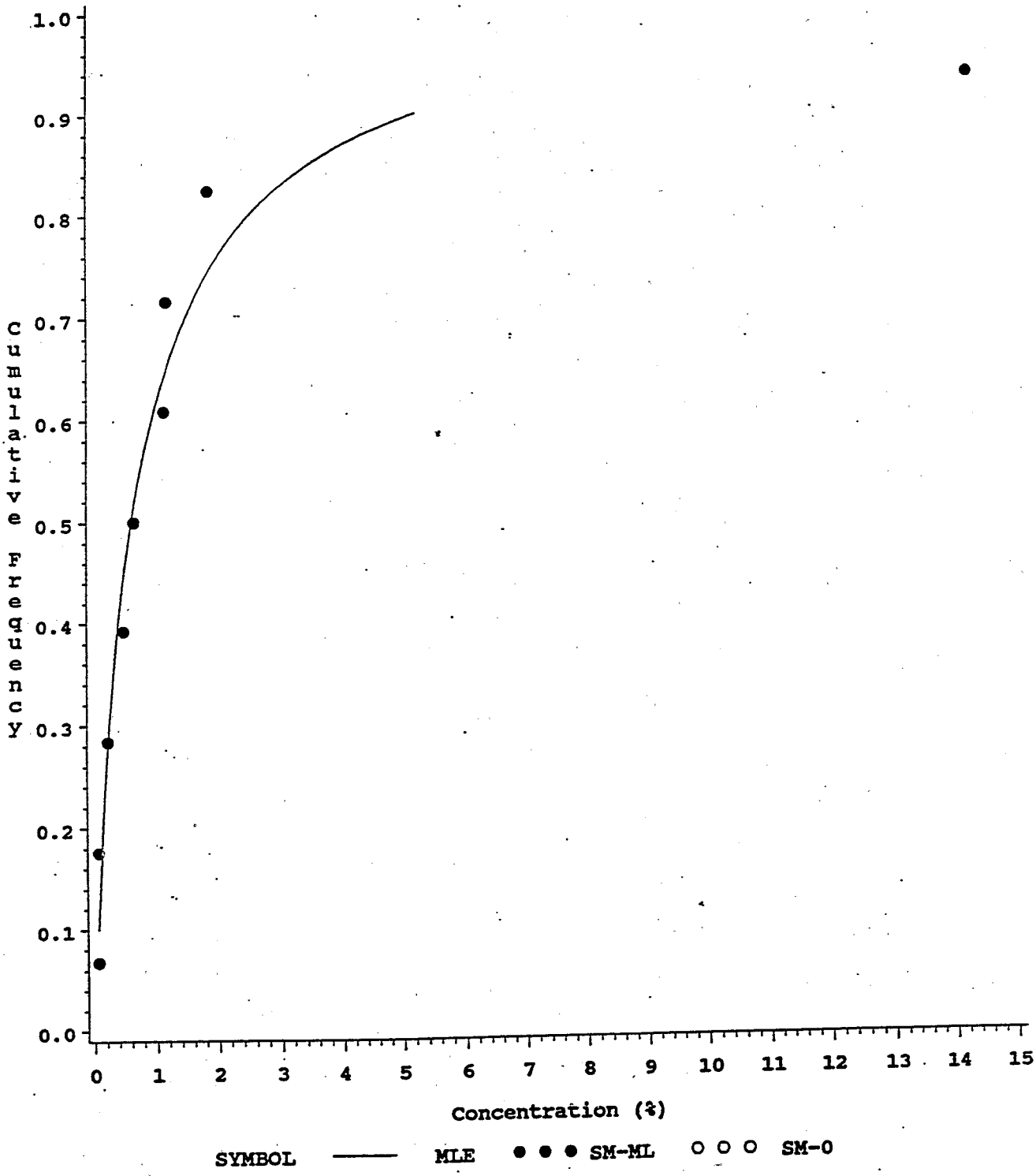
## Cumulative Frequency for Zinc (ug/l)




## Cumulative Frequency for Zinc (mg/kg)



# Cumulative Frequency for Percent Solids (%)



# Appendix C

## Data Listing

## Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=ALDRIN/DIELDRIN(TOTAL) ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.100 | UG/L |
| 19975 | . | 0.100 | UG/L |
| 19976 | . | 0.100 | UG/L |
| 19977 | 2.50 | . | UG/L |
| 19978 | 0.75 | . | UG/L |
| 19979 | . | 0.184 | UG/L |
| 19980 | . | 0.100 | UG/L |
| 19981 | . | 0.100 | UG/L |
| 19982 | . | 0.100 | UG/L |

---------- Pollutant=ALPHA-CHLORDANE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.100 | UG/L |
| 19975 | . | 0.100 | UG/L |
| 19976 | . | 0.100 | UG/L |
| 19977 | . | 0.100 | UG/L |
| 19978 | . | 0.100 | UG/L |
| 19979 | . | 0.184 | UG/L |
| 19980 | . | 0.100 | UG/L |
| 19981 | . | 0.100 | UG/L |
| 19982 | . | 0.100 | UG/L |

---------- Pollutant=AMMONIA (AS N) ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 45.00 | . | MG/L |
| 19975 | 0.48 | . | MG/L |
| 19976 | 40.00 | . | MG/L |
| 19977 | 11.00 | . | MG/L |
| 19978 | 45.00 | . | MG/L |
| 19979 | 33.00 | . | MG/L |
| 19980 | 56.00 | . | MG/L |
| 19981 | 54.00 | . | MG/L |
| 19982 | 100.00 | . | MG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=ARSENIC

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 20.000 | UG/L |
| 19975 | . | 20.000 | UG/L |
| 19976 | . | 20.000 | UG/L |
| 19977 | . | 20.000 | UG/L |
| 19978 | . | 20.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 20.000 | UG/L |
| 19981 | . | 20.000 | UG/L |
| 19982 | . | 20.000 | UG/L |

### Pollutant=BENZENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=BENZO(A)PYRENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=BERYLLIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 5.000 | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | . | 5.000 | UG/L |
| 19979 | . | 5.000 | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 5.000 | UG/L |
| 19982 | . | 5.000 | UG/L |

### Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=CADMIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 9.40 | . | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | 6.40 | . | UG/L |
| 19979 | 18.40 | . | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 5.000 | UG/L |
| 19982 | . | 5.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=CHROMIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 53.90 | . | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | 12.10 | . | UG/L |
| 19977 | 32.10 | . | UG/L |
| 19978 | 81.60 | . | UG/L |
| 19979 | 128.00 | . | UG/L |
| 19980 | 33.50 | . | UG/L |
| 19981 | 50.20 | . | UG/L |
| 19982 | 18.70 | . | UG/L |

### Pollutant=COPPER

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 1340.00 | . | UG/L |
| 19975 | 77.10 | . | UG/L |
| 19976 | 80.30 | . | UG/L |
| 19977 | 115.00 | . | UG/L |
| 19978 | 758.00 | . | UG/L |
| 19979 | 174.00 | . | UG/L |
| 19980 | 1850.00 | . | UG/L |
| 19981 | 62.00 | . | UG/L |
| 19982 | 69.60 | . | UG/L |

### Pollutant=DDT,DDE,DDD(TOTAL)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.338 | UG/L |
| 19975 | . | 0.338 | UG/L |
| 19976 | . | 0.338 | UG/L |
| 19977 | . | 0.338 | UG/L |
| 19978 | . | 0.338 | UG/L |
| 19979 | 0.92 | . | UG/L |
| 19980 | 2.88 | . | UG/L |
| 19981 | . | 0.338 | UG/L |
| 19982 | . | 0.338 | UG/L |

Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=GAMMA-CHLORDANE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.113 | UG/L |
| 19975 | . | 0.113 | UG/L |
| 19976 | . | 0.113 | UG/L |
| 19977 | . | 0.113 | UG/L |
| 19978 | . | 0.113 | UG/L |
| 19979 | . | 0.207 | UG/L |
| 19980 | . | 0.113 | UG/L |
| 19981 | . | 0.113 | UG/L |
| 19982 | . | 0.113 | UG/L |

---------- Pollutant=HEPTACHLOR ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 0.25 | . | UG/L |
| 19975 | . | 0.063 | UG/L |
| 19976 | . | 0.063 | UG/L |
| 19977 | . | 0.063 | UG/L |
| 19978 | . | 0.063 | UG/L |
| 19979 | . | 0.115 | UG/L |
| 19980 | . | 0.063 | UG/L |
| 19981 | . | 0.063 | UG/L |
| 19982 | . | 0.063 | UG/L |

---------- Pollutant=HEXACHLOROBENZENE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=HEXACHLOROBUTADIENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=LEAD

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 121.00 | . | UG/L |
| 19975 | . | 50.000 | UG/L |
| 19976 | . | 50.000 | UG/L |
| 19977 | . | 50.000 | UG/L |
| 19978 | . | 50.000 | UG/L |
| 19979 | 70.30 | . | UG/L |
| 19980 | 79.30 | . | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | . | 50.000 | UG/L |

### Pollutant=LINDANE(GAMMA-BHC)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.138 | UG/L |
| 19975 | . | 0.138 | UG/L |
| 19976 | . | 0.138 | UG/L |
| 19977 | 0.13 | . | UG/L |
| 19978 | . | 0.138 | UG/L |
| 19979 | . | 0.253 | UG/L |
| 19980 | 0.25 | . | UG/L |
| 19981 | . | 0.138 | UG/L |
| 19982 | . | 0.138 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=MERCURY

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.200 | UG/L |
| 19975 | . | 0.200 | UG/L |
| 19976 | . | 0.200 | UG/L |
| 19977 | 0.30 | . | UG/L |
| 19978 | . | 0.200 | UG/L |
| 19979 | 1.30 | . | UG/L |
| 19980 | 0.45 | . | UG/L |
| 19981 | 0.50 | . | UG/L |
| 19982 | 4.05 | . | UG/L |

### Pollutant=MOLYBDENUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 14.40 | . | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 10.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=N-NITROSODIMETHYLAMINE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 50.000 | UG/L |
| 19975 | . | 50.000 | UG/L |
| 19976 | . | 50.000 | UG/L |
| 19977 | . | 50.000 | UG/L |
| 19978 | . | 50.000 | UG/L |
| 19979 | . | 100.000 | UG/L |
| 19980 | . | 50.000 | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | . | 50.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=NICKEL

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 40.000 | UG/L |
| 19975 | . | 40.000 | UG/L |
| 19976 | . | 40.000 | UG/L |
| 19977 | 79.80 | . | UG/L |
| 19978 | 61.80 | . | UG/L |
| 19979 | 105.00 | . | UG/L |
| 19980 | 41.90 | . | UG/L |
| 19981 | . | 40.000 | UG/L |
| 19982 | 41.60 | . | UG/L |

### Pollutant=NITRATE+NITRITE (AS N)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 0.20 | . | MG/L |
| 19975 | . | 0.100 | MG/L |
| 19976 | . | 0.100 | MG/L |
| 19977 | 0.90 | . | MG/L |
| 19978 | 0.20 | . | MG/L |
| 19979 | 0.60 | . | MG/L |
| 19980 | 0.60 | . | MG/L |
| 19981 | 0.60 | . | MG/L |
| 19982 | 0.20 | . | MG/L |

### Pollutant=PCB(TOTAL)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 1.750 | UG/L |
| 19975 | . | 1.750 | UG/L |
| 19976 | . | 1.750 | UG/L |
| 19977 | . | 1.750 | UG/L |
| 19978 | . | 1.750 | UG/L |
| 19979 | . | 3.218 | UG/L |
| 19980 | . | 1.750 | UG/L |
| 19981 | . | 1.750 | UG/L |
| 19982 | . | 1.750 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=SELENIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 50.000 | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | . | 5.000 | UG/L |
| 19979 | 30.50 | . | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | 32.00 | . | UG/L |

### Pollutant=TOTAL KJELDAHL NITROGEN

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 142.00 | . | MG/L |
| 19975 | 9.00 | . | MG/L |
| 19976 | 55.00 | . | MG/L |
| 19977 | 31.00 | . | MG/L |
| 19978 | 70.00 | . | MG/L |
| 19979 | 119.00 | . | MG/L |
| 19980 | 115.00 | . | MG/L |
| 19981 | 175.00 | . | MG/L |
| 19982 | 152.00 | . | MG/L |

### Pollutant=TOTAL PHOSPHOROUS

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 32.00 | . | MG/L |
| 19975 | 1.70 | . | MG/L |
| 19976 | 7.00 | . | MG/L |
| 19977 | 25.00 | . | MG/L |
| 19978 | 12.00 | . | MG/L |
| 19979 | 48.00 | . | MG/L |
| 19980 | 36.00 | . | MG/L |
| 19981 | 46.00 | . | MG/L |
| 19982 | 41.00 | . | MG/L |

## Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=ZINC ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 5990.00 | . | UG/L |
| 19975 | 182.00 | . | UG/L |
| 19976 | 519.00 | . | UG/L |
| 19977 | 6210.00 | . | UG/L |
| 19978 | 1120.00 | . | UG/L |
| 19979 | 23800.00 | . | UG/L |
| 19980 | 3810.00 | . | UG/L |
| 19981 | 2850.00 | . | UG/L |
| 19982 | 3190.00 | . | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=TOTAL SOLIDS

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 4880.00 | . | MG/L |
| 19975 | 733.00 | . | MG/L |
| 19976 | 653.00 | . | MG/L |
| 19977 | 142000.00 | . | MG/L |
| 19978 | 2310.00 | . | MG/L |
| 19979 | 18500.00 | . | MG/L |
| 19980 | 11300.00 | . | MG/L |
| 19981 | 6580.00 | . | MG/L |
| 19982 | 11700.00 | . | MG/L |

### Pollutant=TOXAPHENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 11.375 | UG/L |
| 19975 | . | 11.375 | UG/L |
| 19976 | . | 0.910 | UG/L |
| 19977 | . | 11.375 | UG/L |
| 19978 | . | 11.375 | UG/L |
| 19979 | . | 20.920 | UG/L |
| 19980 | . | 11.375 | UG/L |
| 19981 | . | 11.735 | UG/L |
| 19982 | . | 11.375 | UG/L |

### Pollutant=TRICHLOROETHENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

# APPENDIX C

## Plant Uptake Tables

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## TABLE C-1

## UPTAKE OF ARSENIC BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 0<br>3.03 | <0.25<br><0.25 | 0.001 | *Baxter et al., 1983* |
| A | Rape | Sludge | N.R.(3) | 0<br>0.4 | 0.37<br>0.73 | 0.9 | *Anderson & Nilsson, 1972, p.176* |

## TABLE C-2

## UPTAKE OF ARSENIC BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Tomato/Fruit | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.1 | 0.001 | *Elfving et al., 1978, p.96.* |
| C | Broccoli/Fruit | Arsenic acid | N.R. | 200 | 0.4 | 0.002 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Tomato/Fruit | Arsenic acid | N.R. | 200 | 0.11 | 0.001 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Pea/Grain | Arsenic | N.R. | 0<br>300 | 0.01<br>0.18 | 0.001 | *Walsh et al, 1977.* |
| C | Pea/Pod | Arsenic | N.R. | 0<br>300 | 0.05<br>0.88 | 0.003 | *Walsh et al, 1977.* |

## TABLE C-3

## UPTAKE OF ARSENIC BY GRAINS AND CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Millet | Lead arsenate | 7.5 | 6.2 | 0.2 | 0.013 | *Elfving et al., 1978, p.96.* |
| | | | | 62 | 0.9 | | |

## TABLE C-4

## UPTAKE OF ARSENIC BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Swiss Chard | Sludge | 5.5 | 0<br>1.47 | 0.16<br>0.66 | 0.340 | *Furr et al., 1976, p. 87.* |
| A | Swiss Chard | Sludge | 6.5 | 0<br>1.47 | 0.63<br>0.16 | 0.001 | *Furr et al., 1976, p. 87.* |
| C | Swiss Chard | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.37 | 0.004 | *Chisholm, 1972, p. 586.* |
| C | Cabbage | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.1 | 0.001 | *Elfving et al., 1978, p.96.* |
| C | Cabbage | Arsenic acid | N.R. | 200 | <0.01 | 0.001 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Swiss Chard | Arsenic acid | N.R. | 200 | 1 | 0.005 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Lettuce | Arsenic acid | N.R. | 200 | 0.55 | 0.003 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |

## TABLE C-5

## UPTAKE OF ARSENIC BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Green Bean/ Grain | Lead arsenate | N.R. | 49<br>245 | 0.05<br>0.22 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Green Bean/ Grain | Lead arsenate | N.R. | 49<br>245 | 0.08<br>0.17 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Green Bean/ Grain | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.06 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Bush Bean/ Grain | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.1 | 0.001 | *Elfving et al., 1978, p.96.* |
| C | Green Bean/ Grain | Arsenic acid | N.R. | 200 | 0.14 | 0.001 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Bean/Grain | Arsenic | N.R. | 0<br>300 | 0.01<br>0.07 | 0.001 | *Walsh et al, 1977.* |
| C | Bean/Pod | Arsenic | N.R. | 0<br>300 | 0.27<br>0.79 | 0.002 | *Walsh et al, 1977.* |

## TABLE C-6

## UPTAKE OF ARSENIC BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| C | Potato/Tuber | Lead arsenate | N.R. | 49<br>245 | 0.05<br>0.11 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Potato/Peel | Lead arsenate | N.R. | 49<br>245 | 0.08<br>0.56 | 0.002 | *Chisholm, 1972, p. 586.* |
| C | Potato/Tuber | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.09 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Potato/Peel | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>1.1 | 0.012 | *Chisholm, 1972, p. 586.* |
| C | Potato/Tuber | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.1 | 0.001 | *Elfving et al., 1978, p.96.* |
| C | Potato/Tuber | Arsenic acid | N.R. | 200 | 1.19 | 0.006 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |
| C | Potato/Tuber | Sodium arsenate | 5.5 | 0<br>45<br>90<br>180<br>720 | 0.1<br>0.1<br>0.002<br>0.002<br>0.005 | 0.001 | *Stevens et al, 1972. Soil treated with Fe(SO(4))(3).* |
| C | Potato/Tuber | Sodium arsenate | 5.5 | 0<br>45<br>90<br>180<br>720 | 0.1<br>0.1<br>0.1<br>0.4<br>0.006 | 0.001 | *Stevens et al, 1972. Soil treated with Al(2)(SO(4))(3).* |

## TABLE C-7

## UPTAKE OF ARSENIC BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Carrot/Tuber | Lead arsenate | N.R. | 49<br>245 | 0.05<br>0.27 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Carrot/Tuber | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.26 | 0.003 | *Chisholm, 1972, p. 586.* |
| C | Turnip/Tuber | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.1 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Turnip/Peel | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>1.08 | 0.012 | *Chisholm, 1972, p. 586.* |
| C | Carrot/Tuber | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.9 | 0.014 | *Elfving et al., 1978, p.96.* |
| C | Onions/Bulb | Lead arsenate | 7.5 | 6.2<br>62 | 0.1<br>0.4 | 0.005 | *Elfving et al., 1978, p.96.* |
| C | Beet/Tuber | Arsenic acid | N.R. | 200 | 0.86 | 0.004 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |

## TABLE C-8

## UPTAKE OF ARSENIC BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Corn/Grain | Lead arsenate | N.R. | 49<br>245 | 0.05<br>0.07 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Corn/Grain | Lead arsenate | N.R. | 18.8<br>107.2 | 0.001<br>0.04 | 0.001 | *Chisholm, 1972, p. 586.* |
| C | Sweet Corn/ Grain | Arsenic acid | N.R. | 200 | <0.01 | 0.001 | *Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.* |

## TABLE C-9

## UPTAKE OF CADMIUM BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 0.78 | 0.11 | 1.702 | *Baxter et al., 1983* |
| | | | | 1.35 | 1.08 | | *Means reported* |
| A | Pea/Vine | Sludge | 5.3 | 0 | 0.02 | 0.049 | *Dowdy & Larson,* |
| | | | | 0.83 | 0.13 | | *1975.* |
| | | | | 1.66 | 0.16 | | |
| | | | | 3.32 | 0.2 | | |
| A | Corn/Leaf | Sludge | 5.3 | 0.000 | 0.026 | 0.339 | *Dowdy & Larson,* |
| | | | | 0.830 | 0.027 | | *1975.* |
| | | | | 1.660 | 0.61 | | |
| | | | | 3.320 | 1.32 | | |
| A | Corn/Forage | Sludge | 5.4 | 0 | 1 | 1.330 | *Giordano, Mortvedt,* |
| | | | | 0.008 | 2.3 | | *Mays, 1975, p. 394.* |
| | | | | 1.6 | 3.3 | | *1972 data used.* |
| | | | | 3.2 | 5.3 | | |
| A | Corn | Sludge | 5.4 | 0 | 1 | 0.255 | *Giordano, Mortvedt,* |
| | | | | 2.5 | 3.7 | | *Mays, 1975, p. 394.* |
| | | | | 5 | 3.5 | | *1972 data used.* |
| | | | | 10 | 4.1 | | |
| A | Bean/Vine | Compost | 5.4 | 0 | 0.5 | 0.001 | *Giordano, Mortvedt,* |
| | | | | 0.8 | 0.5 | | *Mays, 1975, p. 394.* |
| | | | | 1.6 | 0.5 | | *1972 data used.* |
| | | | | 3.2 | 0.5 | | |
| A | Bean/Vine | Compost | 5.4 | 0 | 0.5 | 0.059 | *Giordano, Mortvedt,* |
| | | | | 2.5 | 1.1 | | *Mays, 1975, p. 394.* |
| | | | | 5 | 1.2 | | *1972 data used.* |
| | | | | 10 | 1.2 | | |
| A | Corn | Compost | 5.4 | 0 | 1.1 | 0.688 | *Giordano, Mortvedt,* |
| | | | | 1.6 | 3 | | *Mays, 1975, p. 394.* |
| | | | | 3.2 | 3.9 | | *1973 data used.* |
| | | | | 6.4 | 5.7 | | |
| A | Corn | Sludge | 5.4 | 0 | 1.1 | 0.299 | *Giordano, Mortvedt,* |
| | | | | 5 | 5.9 | | *Mays, 1975, p. 394.* |
| | | | | 10 | 6.6 | | *1973 data used.* |
| | | | | 20 | 7.9 | | |
| A | Bean/Vine | Compost | 5.4 | 0 | 0.3 | 0.130 | *Giordano, Mortvedt,* |
| | | | | 1.6 | 0.4 | | *Mays, 1975, p. 394.* |
| | | | | 3.2 | 0.4 | | *1973 data used.* |
| | | | | 6.4 | 0.4 | | |

## TABLE C-9 (cont.)

## UPTAKE OF CADMIUM BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Bean/Vine | Sludge | 5.4 | 0<br>5<br>10<br>20 | 0.3<br>1.1<br>1.1<br>1.3 | 0.042 | *Giordano, Mortvedt, Mays, 1975, p. 394. 1973 data used.* |
| A | Corn/Leaf | Sludge | 5.2-5.6 Limed | 0<br>0.75<br>1.5<br>3 | 0.83<br>3.68<br>6.73<br>8.45 | 2.510 | *Pepper et al, 1983, p. 272 Sultan-corn type.* |
| A | Corn/Leaf | Sludge | 4.5-4.6 Limed | 0<br>0.75<br>1.5<br>3 | 1.01<br>5.11<br>7.45<br>8.3 | 2.276 | *Pepper et al, 1983, p. 272 Sultan-corn type.* |
| A | Corn/Leaf | Sludge | 5.1-5.6 Limed | 0<br>0.75<br>1.5<br>3 | 0.2<br>0.66<br>2.08<br>4.96 | 1.651 | *Pepper et al, 1983, p. 272. Puyallup-corn type.* |
| A | Corn/Leaf | Sludge | 4.4-4.6 Unlimed | 0<br>0.75<br>1.5<br>3 | 0.2<br>1.2<br>1.5<br>3.09 | 0.926 | *Pepper et al, 1983, p. 272. Puyallup-corn type.* |
| A | Corn | Sludge | 7.0 | 0<br>21.56 | 0.05<br>1.7 | 0.077 | *Heffron et al, 1980, p. 59.* |
| A | Corn | Sludge | 5.4 | 0<br>25.3 | 0.29<br>3.88 | 0.142 | *Telford et al, 1982.* |
| A | Corn/Grain | Sludge | 5.9-6.0 | 0<br>0.9<br>1.8 | 0.01<br>0.01<br>0.01 | 0.001 | *Rapppaport et al, 1987. 1984 data used.* |
| A | Corn | Sludge | 5.9-6.0 | 0<br>0.9<br>1.8 | 0.03<br>0.13<br>0.07 | 0.022 | *Rapppaport et al, 1987. 1984 data used.* |
| A | Barley | Sludge | 5.9-6.0 | 0<br>0.9<br>1.8 | 0.12<br>0.13<br>0.14 | 0.110 | *Rapppaport et al, 1987. 1984 data used.* |
| A | Sweet Corn/ Leaf | Sludge | 6.5 | 0<br>1.5 | 0.28<br>0.49 | 0.139 | *Hemphill et al, 1982. Portland sludge* |
| A | Sweet Corn/ Leaf | Sludge | 6.5 | 0<br>1.5 | 0.28<br>0.22 | 0.001 | *Hemphill et al, 1982. Rockcreek sludge.* |

## TABLE C-9 (cont.)

## UPTAKE OF CADMIUM BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Leaf | Sludge | 6.5 | 0<br>0.21 | 0.28<br>0.24 | 0.001 | *Hemphill et al, 1982.*<br>*Salem sludge.* |
| A | Ryegrass | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.11<br>0.3 | 0.048 | *Carlton Smith, 1988.*<br>*Means of 5 years used.*<br>*Sandy loam.* |
| A | Ryegrass | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.11<br>0.28 | 0.014 | *Carlton Smith, 1988.*<br>*Means of 4 years used.*<br>*Sandy loam.* |
| A | Ryegrass | Liquid sludge | 6.7 | 1.4<br>6.7 | 0.19<br>0.48 | 0.055 | *Carlton Smith, 1988.*<br>*Means of 5 years used.*<br>*Clay.* |
| A | Ryegrass | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 0.17<br>0.48 | 0.023 | *Carlton Smith, 1988.*<br>*Means of 4 years used.*<br>*Clay.* |
| A | Ryegrass | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.04<br>0.13 | 0.020 | *Carlton Smith, 1988.*<br>*Means of 5 years used.*<br>*Calcareous loam.* |
| A | Ryegrass | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.05<br>0.35 | 0.015 | *Carlton Smith, 1988.*<br>*Means of 4 years used.*<br>*Calcareous loam.* |
| A | Barley/Leaf | Sludge | 6.2-6.4 | 0<br>23 | 0.67<br>0.76 | 0.004 | *Sommers et al, 1991.*<br>*Ohio data used.* |

## TABLE C-10

## UPTAKE OF CADMIUM BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cantaloupe/ Fruit | Sludge | 4.6-6.0 | 0<br>11 | 18<br>25 | 0.636 | *Giordano et al., 1979*<br>*Year 3 (1977)*<br>*No heat, no lime* |
| A | Broccoli/ Fruit | Sludge | 4.7-6.2 | 0<br>11 | 0.27<br>0.89 | 0.056 | *Giordano et al., 1979*<br>*Year 2 (1976)*<br>*No heat* |
| A | Eggplant/ Fruit | Sludge | 4.7-6.2 | 0<br>11 | 0.54<br>1.64 | 0.100 | *Giordano et al., 1979*<br>*Year 2 (1976)*<br>*No heat* |
| A | Tomato/ Fruit | Sludge | 4.7-6.2 | 0<br>11 | 0.52<br>1.04 | 0.047 | *Giordano et al., 1979*<br>*Year 2 (1976)*<br>*No heat* |
| A | Pepper/ Fruit | Sludge | 4.7-6.2 | 0 | 29 | 0.364 | *Giordano et al., 1979*<br>*Year 3 (1977)*<br>*No heat, no lime* |
| A | Squash/ Fruit | Sludge | 5.1-6.0 | 0<br>11 | 0.15<br>0.27 | 0.011 | *Giordano et al., 1979*<br>*Year 1 (1979)*<br>*No heat. Yellow Crookneck squash* |
| A | Pepper/ Fruit | Sludge | 5.1-6.0 | 0<br>11 | 0.3<br>1.3 | 0.091 | *Giordano et al., 1979*<br>*Year 1 (1979)*<br>*No heat. California Wonder Variety* |
| A | Pea/Grain | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.03<br>0.04<br>0.04<br>0.04 | 0.002 | *Dowdy & Larson, 1975.* |
| A | Tomato/Fruit | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.08<br>0.2<br>0.33<br>0.33 | 0.074 | *Dowdy & Larson, 1975.* |
| A | Pea/Pod | Sludge | 5.3 | 0.000<br>0.830<br>1.660<br>3.320 | 0.020<br>0.080<br>0.080<br>0.060 | 0.008 | *Dowdy & Larson, 1975.* |
| A | Tomato/Fruit | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.39<br>0.55<br>0.5 | 0.079 | *Keefer et al, 1986.*<br>*Blue Plains sludge.*<br>*Early fruiting.* |

## TABLE C-10 (cont.)

## UPTAKE OF CADMIUM BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Tomato/Fruit | Sludge | 6.6 | 0 | 0.32 | 0.057 | *Keefer et al, 1986.* |
| | | | | 0.7 | 0.4 | | *Blue Plains sludge.* |
| | | | | 1.4 | 0.4 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 7.1 | 0 | 0.39 | 0.018 | *Keefer et al, 1986.* |
| | | | | 3.1 | 0.75 | | *Huntington sludge.* |
| | | | | 6.2 | 0.5 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 7.1 | 0 | 0.32 | 0.029 | *Keefer et al, 1986.* |
| | | | | 3.1 | 0.4 | | *Huntington sludge.* |
| | | | | 6.2 | 0.5 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 6.9 | 0 | 0.39 | 0.114 | *Keefer et al, 1986.* |
| | | | | 0.7 | 0.4 | | *Martinsburg sludge.* |
| | | | | 1.4 | 0.55 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 6.9 | 0 | 0.32 | 0.079 | *Keefer et al, 1986.* |
| | | | | 0.7 | 0.45 | | *Martinsburg sludge.* |
| | | | | 1.4 | 0.43 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 6.3 | 0 | 0.39 | 0.325 | *Keefer et al, 1986.* |
| | | | | 0.4 | 0.45 | | *Parkersburg sludge.* |
| | | | | 0.8 | 0.65 | | |
| A | Tomato/Fruit | Sludge | 6.3 | 0 | 0.32 | 0.001 | *Keefer et al, 1986.* |
| | | | | 0.4 | 0.43 | | *Parkersburg sludge.* |
| | | | | 0.8 | 0.26 | | |
| A | Tomato/Fruit | Sludge | N.R. | 0 | 0.9 | 0.053 | *Lue-Hing et al, 1984.* |
| | | | | 4 | 1.3 | | *1977 data used.* |
| | | | | 8 | 1.5 | | *Nu-Earth.* |
| | | | | 16 | 1.9 | | |
| | | | | 20 | 2 | | |

## TABLE C-11

## UPTAKE OF CADMIUM BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Wheat/Grain | Sludge | N.R.(3) | 0<br>1.5<br>6 | 0.066<br>0.159<br>0.19 | 0.017 | *Sabey & Hart, 1975.* |
| A | Corn/Grain | Sludge | 4.9-6.5 | 0<br>38.6 | 0.010<br>0.170 | 0.004 | *Lisk et al, 1982.* |
| A | Corn/Grain | Sludge | 5.2-5.6 | 0<br>0.75<br>1.5<br>3 | 0.27<br>0.41<br>0.6<br>0.41 | 0.045 | *Pepper et al, 1983, p. 272 Sultan-corn type.* |
| A | Corn/Grain | Sludge | 4.5-4.6 | 0<br>0.75<br>1.5<br>3 | 0.29<br>0.5<br>0.5<br>0.61 | 0.094 | *Pepper et al, 1983, p. 272 Sultan-corn type.* |
| A | Corn/Grain | Sludge | 5.1-5.6 | 0<br>0.75<br>1.5<br>3 | 0.12<br>0.27<br>0.43<br>0.64 | 0.173 | *Pepper et al, 1983, p. 272. Puyallup-corn type.* |
| A | Corn/Grain | Sludge | 4.4-4.6 | 0<br>0.75<br>1.5<br>3 | 0.16<br>0.2<br>0.39<br>0.37 | 0.076 | *Pepper et al, 1983, p. 272. Puyallup-corn type.* |
| A | Corn/Earleaf | Sludge | 5.9-6.0 | 0<br>0.9<br>1.8 | 0.07<br>0.07<br>0.06 | 0.001 | *Rapppaport et al, 1987. 1984 data used.* |
| A | Wheat/Grain | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.13<br>0.29 | 0.041 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.14<br>0.33 | 0.016 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid sludge | 6.7 | 1.4<br>6.7 | 0.26<br>0.52 | 0.049 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 0.26<br>0.55 | 0.021 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |

## TABLE C-11 (cont.)

## UPTAKE OF CADMIUM BY GRAINS/CEREALS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Wheat/Grain | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.052<br>0.15 | 0.022 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.08<br>0.27 | 0.009 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Barley/Grain | Sludge | 6.2-6.4 | 0<br>23 | 0.04<br>0.05 | 0.001 | *Sommers et al, 1991. Ohio data used.* |

## TABLE C-12

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Kale | Sludge | 8.4 | 5.49 | 1.669 | 0.304 | *Giordano & Mays, 1977 Year 1 Decatur sludge* |
| A | Kale | Sludge | 8.4 | 3.92 | 0.004 | 0.001 | *Giordano & Mays, 1977 Year 1 Tuscumbia sludge* |
| A | Lettuce | Sludge | 8.4 | 5.49 | 7.576 | 1.380 | *Giordano & Mays, 1977 Year 1 Decatur sludge* |
| A | Lettuce | Sludge | 8.4 | 3.92 | 2.391 | 0.610 | *Giordano & Mays, 1977 Year 1 Tuscumbia sludge* |
| A | Spinach | Sludge | 8.4 | 5.49 | 1.801 | 0.328 | *Giordano & Mays, 1977 Year 1 Decatur sludge* |
| A | Spinach | Sludge | 8.4 | 3.92 | 0.004 | 0.001 | *Giordano & Mays, 1977 Year 1 Tuscumbia sludge* |
| A | Lettuce | Sludge | 8.4 | 5.49 | 5.929 | 1.080 | *Giordano & Mays, 1977 Year 1 Decatur sludge* |
| A | Lettuce | Sludge | 8.4 | 3.92 | 1.439 | 0.367 | *Giordano & Mays, 1977 Year 1 Tuscumbia sludge* |
| A | Lettuce | Sludge | 5.6 | 1.26 | 0.5544 | 0.440 | *Schauereta, 1980 Year 1 Warwick sludge* |
| A | Lettuce | Sludge | 5.6 | 1.26 | 2.457 | 1.950 | *Schauereta, 1980 Year 1 Warwick sludge* |
| A | Swiss Chard | Sludge | 5.7 | 0.84 | 1.000 | 1.190 | *Chaney et al., 1978b Backriver sludge* |
| A | Swiss Chard | Sludge | 5.6 | 2.24 | 2.200 | 0.982 | *Chaney et al., 1978b Blue Plains sludge* |
| A | Swiss Chard | Digcompost | 6.6 | 1.5 | 0.900 | 0.600 | *Chaney et al., 1978b* |
| A | Swiss Chard | Dried DC | 5.5 | 3.3 | 23.298 | 7.060 | *Chaney et al., 1978c* |

## TABLE C-12 (cont.)

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Swiss Chard | Sludge | 4.9 | 0.76 | 0.897 | 1.180 | *Chaney & Hornick, 1978 CAST 1980 City 4 sludge* |
| A | Swiss Chard | Sludge | 6.0 | 0.78 | 0.095 | 0.122 | *Chaney & Hornick, 1978 CAST 1980 City 4L sludge* |
| A | Swiss Chard | Sludge | 4.9 | 1.48 | 0.049 | 0.033 | *Chaney & Hornick, 1978 CAST 1980 City 9 Sludge* |
| A | Swiss Chard | Sludge | 6.3 | 1.95 | 0.630 | 0.323 | *Chaney & Hornick, 1978 CAST 1980 City 9L sludge* |
| A | Swiss Chard | Sludge | 5.5 | 9.00 | 25.830 | 2.870 | *Chaney & Hornick, 1978 CAST 1980 City 13 sludge* |
| A | Swiss Chard | Sludge | 6.2 | 6.92 | 2.484 | 0.359 | *Chaney & Hornick, 1978 CAST 1980 City 13L sludge* |
| A | Swiss Chard | Sludge | 5.5 | 3.19 | 4.530 | 1.420 | *Chaney & Hornick, 1978 CAST 1980 City 1 sludge* |
| A | Swiss Chard | Sludge | 6.2 | 4.43 | 1.675 | 0.378 | *Chaney & Hornick, 1978 CAST 1980 City 1L sludge* |
| A | Swiss Chard | Sludge | 6.6 | 2.47 | 0.785 | 0.318 | *Chaney & Hornick, 1978 CAST 1980 City 1H sludge* |
| A | Swiss Chard | Sludge | 5.9 | 0.32 | 0.115 | 0.359 | *Chaney & Hornick, 1978 CAST 1980 City 19H sludge* |
| A | Swiss Chard | Sludge | 6.7 | 12.65 | 1.505 | 0.119 | *Chaney & Hornick, 1978 CAST 1980 City 39H sludge* |
| A | Lettuce | Heat-Treated Sludge | 5.3-5.4 | 0<br>3 | 1.26<br>2.62 | 0.453 | *Chaney et al, 1982 Romaine Lettuce 1981 data* |

## TABLE C-12 (cont.)

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Heat-Treated Sludge | 6.2 | 0<br>3 | 0.62<br>0.93 | 0.103 | *Chaney et al, 1982 Romaine Lettuce `1981 data* |
| A | Lettuce | Nu-Earth | 5.3-5.6 | 0<br>21 | 1.26<br>30.6 | 1.397 | *Chaney et al, 1982 Romaine Lettuce `1981 data* |
| A | Lettuce | Nu-Earth | 6.2-6.6 | 0<br>21 | 0.62<br>6.34 | 0.272 | *Chaney et al, 1982 Romaine Lettuce `1981 data* |
| A | Swiss Chard | Heat-Treated Sludge | 5.7 | 0<br>3 | 0.7<br>1.63 | 0.310 | *Chaney et al., 1982 `1978 data* |
| A | Swiss Chard | Heat-Treated Sludge | 6.7-6.8 | 0<br>3 | 0.33<br>0.98 | 0.217 | *Chaney et al. 1982 `1978 data* |
| A | Swiss Chard | Nu-Earth | 5.7-6.3 | 0<br>21 | 0.7<br>1.63 | 0.044 | *Chaney et al., 1982 `1978 data* |
| A | Swiss Chard | Nu-Earth | 6.7 | 0<br>21 | 0.33<br>0.98 | 0.031 | *Chaney et al., 1982 `1978 data* |
| A | Collard Greens | Heat-Treated Sludge | 5.5-5.6 | 0<br>3 | 0.62<br>0.54 | 0.001 | *Chaney et al., 1982 `1980 data* |
| A | Collard Greens | Heat-Treated Sludge | 6.4-6.3 | 0<br>3 | 0.53<br>0.42 | 0.001 | *Chaney et al., 1982 `1980 data* |
| A | Collard Greens | Nu-Earth | 5.5-6.3 | 0<br>21 | 0.62<br>2.86 | 0.107 | *Chaney et al., 1982 `1980* |
| A | Collard Greens | Nu-Earth | 6.4-6.8 | 0<br>21 | 0.53<br>2.2 | 0.080 | *Chaney et al., 1982 `1980* |
| A | Lettuce | Sludge | 4.6-6.0 | 0<br>11 | 1.18<br>8.4 | 0.656 | *Giordano et al., 1979 Year 3 (1977) No heat, no lime Bibb lettuce* |
| A | Lettuce | Sludge | 4.6-6.0 | 0<br>11 | 0.88<br>2.25 | 0.125 | *Giordano et al., 1979 Year 3 (1977) No heat, no lime Romaine lettuce* |

## TABLE C-12 (cont.)

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Sludge | 4.6-6.0 | 0<br>11 | 0.95<br>3.1 | 0.195 | *Giordano et al., 1979*<br>*Year 3 (1977)*<br>*No heat, no lime*<br>*Boston Lettuce* |
| A | Cabbage | Sludge | 4.6-6.0 | 0<br>11 | 0.19<br>0.35 | 0.015 | *Giordano et al., 1979*<br>*Year 3 (1977)*<br>*No heat, no lime* |
| A | Lettuce | Sludge | 4.7-6.2 | 0<br>11 | 0.86<br>3.56 | 0.245 | *Giordano et al., 1979*<br>*Year 2 (1976)*<br>*No heat*<br>*Great Lakes Lettuce* |
| A | Lettuce | Sludge | 5.1-6.0 | 0<br>11 | 0.3<br>10.4 | 0.918 | *Giordano et al., 1979*<br>*Year 3 (1977)*<br>*No heat, no lime*<br>*Great Lakes Lettuce* |
| A | Lettuce | Sludge | 5.8 | 0<br>0.84 | 0.6<br>1.7 | 1.310 | *Chaney et al., 1978*<br>*Romaine Lettuce*<br>*Backriver sludge* |
| A | Lettuce | Sludge | 6.0 | 0<br>2.24 | 0.6<br>2.5 | 0.848 | *Chaney et al., 1978*<br>*Romaine lettuce*<br>*Blue Plains sludge* |
| A | Lettuce | Sludge | 6.7 | 0<br>1.5 | 0.6<br>1.1 | 0.333 | *Chaney et al., 1978*<br>*Romaine lettuce*<br>*DigCompost* |
| A | Lettuce | Sludge | 5.6 | 0<br>5.04 | 0.6<br>26.4 | 5.119 | *Chaney et al., 1978*<br>*Romaine lettuce*<br>*Milorganite* |
| A | Lettuce | Sludge | 5.5 | 0<br>3.3 | 0.6<br>11.6 | 3.333 | *Chaney et al., 1978*<br>*Romaine lettuce*<br>*Dried DC* |
| A | Lettuce | Sludge | 6.5 | 0<br>0.83<br>1.66<br>3.32 | 0.61<br>1.28<br>1.72<br>2.67 | 0.607 | *Dowdy & Larson, 1975.* |
| A | Turnip/Greens | Sludge | 5.8 | 0<br>3<br>5.1 | 1.000<br>3.600<br>4.400 | 0.680 | *Miller & Boswell, 1979, p. 1361.* |

## TABLE C-12 (cont.)

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.08<br>0.12<br>0.1 | 0.014 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Cabbage | Sludge | 7.1 | 0<br>3.1<br>6.2 | 0.08<br>0.11<br>0.14 | 0.010 | *Keefer et al, 1986. Huntington sludge.* |
| A | Cabbage | Sludge | 6.9 | 0<br>0.7<br>1.4 | 0.08<br>0.12<br>0.1 | 0.014 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Cabbage | Sludge | 6.3 | 0<br>0.4<br>0.8 | 0.08<br>0.14<br>0.19 | 0.138 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Lettuce | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.5<br>2.2<br>3.1<br>4.4 | 0.664 | *Chang et al., 1978* |
| A | Swiss Chard | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.2<br>0.4<br>0.7<br>2.1 | 0.337 | *Chang et al., 1978* |
| A | Turnip/Greens | Composted Sludge | N.R. | 0<br>1.2<br>2.2<br>4.3 | 1.0<br>1.2<br>2.7<br>2.6 | 0.414 | *Chang et al., 1978* |
| A | Lettuce | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.77<br>2.36 | 0.406 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Lettuce | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.73<br>2.27 | 0.129 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Lettuce | Liquid sludge | 6.7 | 1.4<br>6.7 | 5.72<br>7.38 | 0.313 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Lettuce | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 4.65<br>5.74 | 0.079 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Lettuce | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.63<br>1.39 | 0.172 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |

## TABLE C-12 (cont.)

## UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.62<br>1.99 | 0.066 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Cabbage | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.11<br>0.15 | 0.010 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Cabbage | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.12<br>0.23 | 0.009 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Cabbage | Liquid sludge | 6.7 | 1.4<br>6.7 | 0.27<br>0.28 | 0.002 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Cabbage | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 0.25<br>0.29 | 0.003 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Cabbage | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.05<br>0.15 | 0.023 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Cabbage | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.05<br>0.39 | 0.016 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Spinach | Sludge | N.R. | 0<br>4<br>8<br>16<br>20 | 5.4<br>11.9<br>18.8<br>16.9<br>14.6 | 0.405 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Swiss Chard | Sludge | N.R. | 0<br>4<br>8<br>16<br>20 | 2.2<br>4.9<br>8.4<br>7<br>10.2 | 0.323 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |

## TABLE C-13

## UPTAKE OF CADMIUM BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Bean/ Grain | Sludge | 5.1-6.0 | 0<br>11 | 0.1<br>0.2 | 0.009 | *Giordano et al., 1979*<br>*Year 1 (1979)*<br>*No heat*<br>*Contender variety* |
| A | Bean/Pod | Compost | 5.4 | 0<br>0.8<br>1.6<br>3.2 | 0.2<br>0.2<br>0.2<br>0.1 | 0.001 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Bean/Pod | Sludge | 5.4 | 0<br>2.5<br>5<br>10 | 0.2<br>0.2<br>0.2<br>0.2 | 0.001 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Bean/Pod | Compost | 5.4 | 0<br>1.6<br>3.2<br>6.4 | 0.1<br>0.1<br>0.1<br>0.1 | 0.001 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Bean/Pod | Sludge | 5.4 | 0<br>5<br>10<br>20 | 0.1<br>0.2<br>0.2<br>0.2 | 0.004 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Green Bean/ Pod & Seed | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.1<br>0.1<br>0.1 | 0.001 | *Keefer et al, 1986.*<br>*Blue Plains sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 7.1 | 0<br>3.1<br>6.2 | 0.1<br>0.1<br>0.1 | 0.001 | *Keefer et al, 1986.*<br>*Huntington sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 6.9 | 0<br>0.7<br>1.4 | 0.1<br>0.1<br>0.1 | 0.001 | *Keefer et al, 1986.*<br>*Martinsburg sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 6.3 | 0<br>0.4<br>0.8 | 0.1<br>0.1<br>0.1 | 0.001 | *Keefer et al, 1986.*<br>*Parkersburg sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | N.R. | 0<br>4<br>8<br>16<br>20 | 0.1<br>0.1<br>0.2<br>0.3<br>0.3 | 0.012 | *Lue-Hing et al, 1984.*<br>*1977 data used.*<br>*Nu-Earth.* |

## TABLE C-13 (cont.)

## UPTAKE OF CADMIUM BY LEGUMES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Soybean/ Grain | Limed digested sludge | 7.3-7.5 | 0.1<br>0.3<br>0.54<br>0.66<br>1.08<br>1.42 | 0.28<br>0.14<br>0.25<br>0.2<br>0.05<br>0.1 | 0.001 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Limed raw sludge | 7.3-7.7 | 0.1<br>0.28<br>0.32<br>0.74 | 0.28<br>0.14<br>0.09<br>0.07 | 0.001 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Raw sludge compost | 6.6-7.3 | 0.1<br>0.4<br>0.76<br>1.26<br>2.620<br>4.820 | 0.280<br>0.190<br>0.190<br>0.220<br>0.280<br>0.250 | 0.001 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge High pH | 5.9-6.0 | 0.140<br>0.860<br>1.260<br>2.840 | 0.140<br>0.110<br>0.190<br>0.20 | 0.027 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge Low pH | 5.3-5.6 | 0.140<br>0.780<br>1.220<br>2.860 | 0.340<br>0.240<br>0.210<br>0.230 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |

## TABLE C-14

## UPTAKE OF CADMIUM BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Potato/ Tuber | Sludge | 4.7-6.2 | 0<br>11 | 0.11<br>0.1 | 0.001 | *Giordano et al., 1979 Year 2 (1976) No heat* |
| A | Potato | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.12<br>0.11<br>0.021<br>0.23 | 0.038 | *Dowdy & Larson, 1975.* |
| A | Potato/ Tuber | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.15<br>0.19 | 0.01 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Potato/ Tuber | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.16<br>0.2 | 0.003 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Potato/ Tuber | Liquid sludge | 6.7 | 1.4<br>6.7 | 0.52<br>0.49 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Potato/ Tuber | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 0.53<br>0.41 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Potato/ Tuber | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.06<br>0.12 | 0.014 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Potato/ Tuber | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.06<br>0.15 | 0.004 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.29 | 0.007 | *Harris et al, 1978. Vanessa-potato type.* |
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.2 | 0.005 | *Harris et al, 1978. Pentland Savelin-potato type.* |
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.41 | 0.010 | *Harris et al, 1978. Home Guard-potato type.* |
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.15 | 0.004 | *Harris et al, 1978. Desiree-potato type.* |

## TABLE C-14 (cont.)

## UPTAKE OF CADMIUM BY POTATOES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.32 | 0.008 | *Harris et al, 1978. King Edward-potato type.* |
| C | Potato/ Tuber | Organic, metal contaminated soil | 6.6 | 39.2 | 0.32 | 0.008 | *Harris et al, 1978. Majestic-potato type.* |

## TABLE C-15

## UPTAKE OF CADMIUM BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Carrot/Tuber | Sludge | 4.6-6.0 | 0<br>11 | 0.96<br>2.29 | 0.121 | *Giordano et al., 1979 Year 3 (1977) No heat, no lime* |
| A | Carrot | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.48<br>0.69<br>0.95<br>1.15 | 0.202 | *Dowdy & Larson, 1975.* |
| A | Radish | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.13<br>0.14<br>0.18<br>0.31 | 0.056 | *Dowdy & Larson, 1975.* |
| A | Radish/Tuber | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.53<br>0.66<br>0.68 | 0.107 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Carrot/Tuber | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.2<br>0.32<br>0.2 | 0.001 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Radish/Tuber | Sludge | 7.1 | 0<br>3.1<br>6.2 | 0.53<br>0.79<br>0.77 | 0.039 | *Keefer et al, 1986. Huntington sludge.* |
| A | Carrot/Tuber | Sludge | 7.1 | 0<br>3.1<br>6.2 | 0.200<br>0.200<br>0.200 | 0.001 | *Keefer et al, 1986. Huntington sludge.* |
| A | Radish/Tuber | Sludge | 6.9 | 0<br>0.7<br>1.4 | 0.53<br>0.51<br>0.57 | 0.029 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Carrot/Tuber | Sludge | 6.9 | 0<br>0.7<br>1.4 | 0.2<br>0.46<br>0.2 | 0.001 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Radish/Tuber | Sludge | 6.3 | 0<br>0.4<br>0.8 | 0.53<br>0.35<br>0.39 | 0.001 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Carrot/Tuber | Sludge | 6.3 | 0<br>0.4<br>0.8 | 0.2<br>0.2<br>0.2 | 0.001 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Radish | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.5<br>0.7<br>1.9<br>2.8 | 0.432 | *Chang et al., 1978* |

## TABLE C-15 (cont.)

## UPTAKE OF CADMIUM BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Radish/Tuber | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.2<br>0.4<br>0.6<br>0.9 | 0.123 | *Chang et al., 1978* |
| A | Carrot/Tuber | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.4<br>0.9<br>1.6<br>2.4 | 0.358 | *Chang et al., 1978* |
| A | Carrot | Composted Sludge | N.R. | 0<br>1.6<br>2.9<br>5.7 | 0.5<br>1.6<br>2.5<br>3.9 | 0.594 | *Chang et al., 1978* |
| A | Turnip/Tuber | Composted Sludge | N.R. | 0<br>1.2<br>2.2<br>4.3 | 0.2<br>0.3<br>0.3<br>0.4 | 0.043 | *Chang et al., 1978* |
| A | Ryegrass | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.11<br>0.3 | 0.048 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Liquid sludge | 6.5 | 0.6<br>4.52 | 0.29<br>0.63 | 0.087 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.5 | 0.6<br>12.57 | 0.23<br>0.69 | 0.038 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Liquid sludge | 6.7 | 1.4<br>6.7 | 1.0<br>1.22 | 0.042 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.7 | 1.4<br>15.12 | 0.8<br>1.26 | 0.034 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Red Beet/ Tuber | Liquid sludge | 8.0 | 1.44<br>5.86 | 0.1<br>0.26 | 0.036 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 8.0 | 1.5<br>22.12 | 0.1<br>0.49 | 0.018 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |

## TABLE C-15 (cont.)

## UPTAKE OF CADMIUM BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Beet/ Tuber | Sludge | N.R. | 0 | 0.5 | 0.078 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| | | | | 4 | 1 | | |
| | | | | 8 | 1 | | |
| | | | | 16 | 2 | | |
| | | | | 20 | 2 | | |
| A | Carrot/ Tuber | Sludge | N.R. | 0 | 1 | 0.061 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| | | | | 4 | 1.3 | | |
| | | | | 8 | 1.3 | | |
| | | | | 16 | 1.8 | | |
| | | | | 20 | 1.7 | | |

## TABLE C-16

## UPTAKE OF CADMIUM BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Grain | Sludge | 5.1-6.0 | 0<br>11 | 0.1<br>1.8 | 0.155 | *Giordano et al., 1979*<br>*Year 1 (1979)*<br>*No heat*<br>*Silver Queen corn* |
| A | Sweet Corn/ Grain | Sludge | 5.3 | 0<br>0.83<br>1.66<br>3.32 | 0.02<br>0.02<br>0.03<br>0.05 | 0.01 | *Dowdy & Larson, 1975.* |
| A | Sweet Corn/ Grain | Compost | 5.4 | 0<br>0.8<br>1.6<br>3.2 | 0.3<br>0.7<br>0.9<br>1.1 | 0.236 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Sweet Corn/ Grain | Sludge | 5.4 | 0<br>2.5<br>5<br>10 | 0.3<br>0.9<br>1<br>1.2 | 0.08 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1972 data used.* |
| A | Corn/Grain | Compost | 5.4 | 0<br>1.6<br>3.2<br>6.4 | 0.5<br>0.5<br>0.6<br>0.8 | 0.05 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1973 data used.* |
| A | Corn/Grain | Sludge | 5.4 | 0<br>5<br>10<br>20 | 0.5<br>0.7<br>1.1<br>1 | 0.026 | *Giordano, Mortvedt, Mays, 1975, p. 394.*<br>*1973 data used.* |
| A | Sweet Corn/ Grain | Sludge | 6.6 | 0<br>0.7<br>1.4 | 0.08<br>0.16<br>0.17 | 0.064 | *Keefer et al, 1986.*<br>*Blue Plains sludge.* |
| A | Sweet Corn/ Grain | Sludge | 7.1 | 0<br>3.1<br>6.2 | 0.08<br>0.1<br>0.15 | 0.011 | *Keefer et al, 1986.*<br>*Huntington sludge.* |
| A | Sweet Corn/ Grain | Sludge | 6.9 | 0<br>0.7<br>1.4 | 0.08<br>0.11<br>0.18 | 0.071 | *Keefer et al, 1986.*<br>*Martinsburg sludge.* |
| A | Sweet Corn/ Grain | Sludge | 6.3 | 0<br>0.4<br>0.8 | 0.08<br>0.11<br>0.16 | 0.1 | *Keefer et al, 1986.*<br>*Parkersburg sludge.* |
| A | Sweet Corn/ Grain | Sludge | 6.5 | 0<br>1.5 | 0.05<br>0.09 | 0.026 | *Hemphill et al, 1982.*<br>*Portland sludge.* |
| A | Sweet Corn/ Grain | Sludge | 6.5 | 0<br>1.5 | 0.05<br>0.1 | 0.333 | *Hemphill et al, 1982.*<br>*Rockcreek sludge.* |

## TABLE C-17

## UPTAKE OF COPPER BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 13.2<br>27.1 | 2.28<br>12.5 | 0.738 | *Baxter et al., 1983 Means reported* |
| A | Corn/Leaf | Sludge | 6.6 | 0.000<br>152<br>304 | 8.0<br>6.1<br>4.9 | 0.001 | *Rappaport, 1987. 1984 data.* |
| A | Corn/Leaf | Sludge | 6.6 | 0<br>152<br>304 | 7.80<br>7.7<br>8.2 | 0.001 | *Rappaport, 1987. 1985 data.* |
| A | Corn | Sludge | 6.6 | 0<br>152<br>304 | 4.90<br>5.3<br>4.5 | 0.001 | *Rappaport, 1987. 1984 data.* |
| A | Corn | Sludge | 6.6 | 0<br>152<br>304 | 6.60<br>6.9<br>6.7 | 0.003 | *Rappaport, 1987. 1985 data.* |
| A | Barley | Sludge | 6.6 | 0<br>152<br>304 | 1.0<br>2.5<br>2.8 | 0.006 | *Rappaport, 1987. 1985 data.* |
| A | Orchardgrass | Sludge | 6.6-7.2 | 0<br>50 | 9.58<br>10.72 | 0.023 | *Alberici, 1989.* |
| A | Quackgrass | Sludge | 6.6-7.2 | 0<br>50 | 5.96<br>8.55 | 0.052 | *Alberici, 1989.* |
| A | Bird's Foot Trefoil | Sludge | 6.6-7.2 | 0<br>50 | 10.83<br>11.8 | 0.019 | *Alberici, 1989.* |
| A | Tall Fescue | Sludge | 6.6-7.2 | 0<br>50 | 7.17<br>8.22 | 0.021 | *Alberici, 1989.* |
| A | Corn/Leaf | Sludge | 5.3-6.5 | 2<br>70<br>132 | 5.4<br>7.1<br>8 | 0.020 | *Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient data (1976) used.* |
| A | Corn | Sludge | 5.3-6.5 | 2<br>70<br>132 | 7.3<br>7.6<br>9.6 | 0.017 | *Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient data (1976) used.* |

## TABLE C-17 (cont.)

## UPTAKE OF COPPER BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Clover | Sludge | 5.3-6.3 | 2<br>70<br>132 | 7.3<br>10.1<br>13.9 | 0.051 | *Sheaffer et al, 1979. Arrowleaf clover.* |
| A | Clover | Sludge | 5.3-6.3 | 2<br>70<br>132 | 7.1<br>8.4<br>9.4 | 0.018 | *Sheaffer et al, 1979. Crimson clover.* |
| A | Corn/Leaf | Sludge | 7.0-7.1 | 0<br>67 | 9.50<br>9.5 | 0.001 | *Webber et al, 1983, p. 190-193. Brantford site.* |
| A | Corn | Sludge | 5.8-6.3 | 0<br>12 | 4.9 0<br>5.5 | 0.05 | *Webber et al, 1983, p. 190-193. Burlington site.* |
| A | Corn/Leaf | Sludge | 6.1-6.6 | 0<br>53 | 9.40<br>6.9 | 0.001 | *Webber et al, 1983, p. 190-193. Galt site.* |
| A | Corn/Leaf | Sludge | 5.7-6.1 | 0<br>10 | 9. 00<br>9.7 | 0.07 | *Webber et al, 1983, p. 190-193. Georgetown site.* |
| A | Corn/Leaf | Sludge | 6.2-6.3 | 0<br>33 | 9.70<br>9.5 | 0.001 | *Webber et al, 1983, p. 190-193. Guelph site.* |
| A | Corn/Leaf | Sludge | 6.4-6.6 | 0<br>59 | 7.20<br>6 | 0.001 | *Webber et al, 1983, p. 190-193. Kitchener site.* |
| A | Corn/Leaf | Sludge | 6.5 | 0<br>111 | 8.0<br>7.8 | 0.001 | *Webber et al, 1983, p. 190-193. Stratford site.* |
| A | Sudax | Sludge | 5.0-6.0 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 6.10<br>7.2<br>6.4<br>7.3<br>6.6<br>9.4 | 0.031 | *Kelling et al, 1977, p. 353. Arlington site.* |
| A | Sudax | Sludge | 5.3-6.2 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 5.10<br>8<br>9.5<br>11.5<br>12.3<br>14.1 | 0.087 | *Kelling et al, 1977, p. 353. Jonesville site.* |

## TABLE C-17 (cont.)

## UPTAKE OF COPPER BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | 5.0-6.0 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 2.20<br>2.1<br>2.2<br>2.5<br>2.8<br>4 | 0.022 | *Kelling et al, 1977, p. 353. Burlington site- 4th year.* |
| A | Corn | Sludge | 5.3-6.2 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 2.20<br>2.1<br>2.1<br>2<br>2.6<br>3.1 | 0.012 | *Kelling et al, 1977, p. 353. Jonesville- 3rd crop.* |
| A | Ryegrass | Liquid sludge | 6.5 | 42<br>120 | 6.40<br>11.9 | 0.071 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Ryegrass | Bed-dried Sludge | 6.5 | 34<br>257 | 6.40<br>15.4 | 0.040 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Ryegrass | Liquid sludge | 6.7 | 50<br>147 | 8.4<br>13.5 | 0.037 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Ryegrass | Bed-dried Sludge | 6.7 | 50<br>290 | 8.2<br>13.5 | 0.022 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Ryegrass | Liquid sludge | 8.0 | 33<br>113 | 9.6<br>12.3 | 0.034 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Ryegrass | Bed-dried Sludge | 8.0 | 33<br>381 | 9.3<br>16.7 | 0.021 | *Carlton Smith, 1988. Means of 4 years* used. *Calcareous loam.* |
| A | Barley/Leaf | Sludge | 6.2-6.4 | 0<br>135 | 4.23<br>4.63 | 0.003 | *Sommers et al, 1991. Ohio data used.* |
| B | Rape | Sludge | 5.6 | 0<br>34.35<br>68.7 | 25.75<br>7.19<br>6.95 | 0.001 | *Narwal et al, 1983. 1st harvest.* |
| B | Rape | Sludge | 6.0 | 0<br>34.35<br>68.7 | 11.27<br>7.02<br>7.54 | 0.001 | *Narwal et al, 1983. 1st harvest.* |

## TABLE C-17 (cont.)

## UPTAKE OF COPPER BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| B | Rape | Sludge | 7.5 | 0 | 6.88 | 0.110 | *Narwal et al, 1983. 1st harvest.* |
| | | | | 34.35 | 7 | | |
| | | | | 68.7 | 14.47 | | |
| B | Rape | Sludge | 5.6 | 0 | 19.35 | 0.001 | *Narwal et al, 1983. 2nd harvest.* |
| | | | | 34.35 | 12.36 | | |
| | | | | 68.7 | 8.7 | | |
| B | Rape | Sludge | 6.0 | 0 | 17.71 | 0.001 | *Narwal et al, 1983. 2nd harvest.* |
| | | | | 34.35 | 8.51 | | |
| | | | | 68.7 | 9.01 | | |
| B | Rape | Sludge | 7.5 | 0 | 8.37 | 0.069 | *Narwal et al, 1983. 2nd harvest.* |
| | | | | 34.35 | 8.78 | | |
| | | | | 68.7 | 13.09 | | |

## TABLE C-18

## UPTAKE OF COPPER BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 9.3 | 0.056 | *Keefer et al, 1986.* |
| | | | | 17 | 11.6 | | *Blue Plains sludge.* |
| | | | | 34 | 11.2 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 8.6 | 0.038 | *Keefer et al, 1986.* |
| | | | | 17 | 12.7 | | *Blue Plains sludge.* |
| | | | | 34 | 9.9 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 9.3 | 0.007 | *Keefer et al, 1986.* |
| | | | | 342 | 11.9 | | *Huntington sludge.* |
| | | | | 684 | 14.3 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 8.6 | 0.003 | *Keefer et al, 1986.* |
| | | | | 342 | 9.7 | | *Huntington sludge.* |
| | | | | 684 | 10.6 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 9.3 | 0.042 | *Keefer et al, 1986.* |
| | | | | 24 | 10 | | *Martinsburg sludge.* |
| | | | | 48 | 11.3 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 8.6 | 0.054 | *Keefer et al, 1986.* |
| | | | | 24 | 11.4 | | *Martinsburg sludge.* |
| | | | | 48 | 11.2 | | *Late fruiting.* |
| A | Celery | Sludge | 7.3 | 0 | 4.3 | 0.001 | *Peterson et al, 1989.* |
| | | | | 11.05 | 6.1 | | |
| | | | | 22.1 | 5 | | |
| | | | | 44.2 | 4.6 | | |
| A | Tomato/Fruit | Sludge | 7.3 | 0 | 16.2 | 0.001 | *Peterson et al, 1989.* |
| | | | | 11.05 | 18.6 | | |
| | | | | 22.1 | 15.7 | | |
| | | | | 44.2 | 15.9 | | |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 9.3 | 0.0145 | *Keefer et al, 1986.* |
| | | | | 11 | 12.9 | | *Parkersburg sludge.* |
| | | | | 22 | 12.5 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 8.6 | 0.068 | *Keefer et al, 1986.* |
| | | | | 11 | 11.9 | | *Parkersburg sludge.* |
| | | | | 22 | 10.1 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | N.R. | 0 | 17 | 0.036 | *Lue-Hing et al, 1984.* |
| | | | | 26 | 17 | | *1977 data used.* |
| | | | | 52 | 19 | | *Nu-Earth.* |
| | | | | 103 | 26 | | |
| | | | | 129 | 18 | | |

## TABLE C-18 (cont.)

## UPTAKE OF COPPER BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Green Pepper/ Fruit | Sludge | 6.4 | 0 | 5.8 | 0.021 | *Furr et al, 1981.* |
| | | | | 249 | 11 | | *Acid soil, 2nd year.* |
| B | Green Pepper/ Fruit | Sludge | 6.4 | 0 | 7.1 | 0.01 | *Furr et al, 1981.* |
| | | | | 249 | 9.6 | | *Neutral soil, 2nd year.* |
| B | Pea/Grain | Sludge | 6.4 | 0 | 4.6 | 0.014 | *Furr et al, 1981.* |
| | | | | 249 | 8.2 | | *Acid soil, 2nd year.* |
| B | Pea/Grain | Sludge | 6.4 | 0 | 6.1 | 0.012 | *Furr et al, 1981.* |
| | | | | 249 | 9.1 | | *Neutral soil, 2nd year.* |

## TABLE C-19

## UPTAKE OF COPPER BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn/Grain | Sludge | 6.6 | 0<br>152<br>304 | 4.5<br>3.8<br>3.9 | 0.001 | *Rappaport, 1987. 1984 data.* |
| A | Corn/Grain | Sludge | 6.6 | 0<br>152<br>304 | 2.2<br>2.9<br>2.3 | 0.004 | *Rappaport, 1987. 1985 data.* |
| A | Corn/Grain | Sludge | 5.3-6.5 | 2<br>70<br>132 | 1.1<br>1.7<br>1.6 | 0.004 | *Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient temp. data (1976) used.* |
| A | Oats/Grain | Sludge | 5.3-6.3 | 2<br>70<br>132 | 1.5<br>2.6<br>2.5 | 0.008 | *Sheaffer et al, 1979.* |
| A | Rye/Grain | Sludge | 5.3-6.3 | 2<br>70<br>132 | 4.5<br>6.6<br>6.7 | 0.017 | *Sheaffer et al, 1979.* |
| A | Wheat/Grain | Sludge | 5.3-6.3 | 2<br>70<br>132 | 2.1<br>3.2<br>3.7 | 0.012 | *Sheaffer et al, 1979.* |
| A | Wheat/Grain | Sludge | N.R.(3) | 0<br>90<br>360 | 3.5<br>4.46<br>5.96 | 0.007 | *Sabey and Hart, 1975, p. 255.* |
| A | Rye/Grain | Sludge | 5.0-6.0 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 3.9<br>5.8<br>7<br>8.2<br>9.4<br>11.7 | 0.08 | *Kelling et al, 1977, p. 353. Arlington site.* |
| A | Rye/Grain | Sludge | 5.3-6.2 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 5.6<br>5.3<br>5.5<br>5.7<br>7<br>8.9 | 0.042 | *Kelling et al, 1977, p. 353. Jonesville site.* |
| A | Corn/Grain | Sludge | 5.0-6.0 | 0<br>5.4<br>10.8<br>21.5<br>43<br>86 | 1.4<br>1.4<br>1.2<br>1.1<br>1.2<br>1.2 | 0.001 | *Kelling et al, 1977, p. 353 Burlington site-4th year.* |

## TABLE C-19 (cont.)

## UPTAKE OF COPPER BY GRAINS/CEREALS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Wheat/Grain | Liquid sludge | 6.5 | 42<br>120 | 5<br>7 | 0.026 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 34<br>257 | 5<br>8 | 0.013 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid sludge | 6.7 | 50<br>147 | 6<br>7 | 0.010 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 50<br>290 | 6<br>8 | 0.008 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Wheat/Grain | Liquid sludge | 8.0 | 33<br>113 | 5<br>6 | 0.013 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 33<br>381 | 5<br>7 | 0.006 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Barley/Grain | Sludge | 6.2-6.4 | 0<br>135 | 3.49<br>3.55 | 0.001 | *Sommers et al, 1991. Ohio data used.* |

## TABLE C-20

## UPTAKE OF COPPER BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Heat-Treated Sludge | 5.3-5.4 | 0<br>90 | 7.7<br>11.5 | 0.042 | *Chaney et al., 1982 Romaine Lettuce* |
| A | Lettuce | Heat-Treated Sludge | 6.2 | 0<br>90 | 7.5<br>10.5 | 0.033 | *Chaney et al., 1982 Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 5.3-5.6 | 0<br>116 | 7.7<br>10.7 | 0.026 | *Chaney et al., 1982 Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 6.2-6.6 | 0<br>116 | 7.5<br>8.7 | 0.01 | *Chaney et al., 1982 Romaine Lettuce* |
| A | Swiss Chard | Heat-Treated Sludge | 5.7 | 0<br>90 | 10.3<br>21.2 | 0.121 | *Chaney et al., 1982* |
| A | Swiss Chard | Heat-Treated Sludge | 6.7-6.8 | 0<br>90 | 10.8<br>16.4 | 0.062 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 5.7-6.3 | 0<br>116 | 10.3<br>15.8 | 0.047 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 6.7 | 0<br>116 | 10.8<br>13.9 | 0.027 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 5.5-5.6 | 0<br>90 | 5.5<br>7.5 | 0.022 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 6.3-6.4 | 0<br>90 | 4.5<br>6.9 | 0.027 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 5.5-6.3 | 0<br>116 | 5.5<br>6.4 | 0.008 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 6.4-6.8 | 0<br>116 | 4.5<br>5.9 | 0.012 | *Chaney et al., 1982* |
| A | Cabbage | Sludge | 5.9-7.1 | 0<br>17<br>34 | 3.1<br>3.4<br>3.3 | 0.006 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Cabbage | Sludge | 5.9-7.1 | 0<br>342<br>684 | 3.1<br>4.1<br>4.4 | 0.002 | *Keefer et al, 1986. Huntington sludge.* |
| A | Cabbage | Sludge | 5.9-7.1 | 0<br>24<br>48 | 3.1<br>3.7<br>3.4 | 0.006 | *Keefer et al, 1986. Martinsburg sludge.* |

## TABLE C-20 (cont.)

## UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Sludge | 5.9-7.1 | 0<br>11<br>22 | 3.1<br>3.4<br>3.7 | 0.027 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Cabbage | Sludge | 7.3 | 0<br>11.05<br>22.1<br>44.2 | 2.9<br>3.4<br>3.1<br>3.1 | 0.001 | *Peterson et al, 1989.* |
| A | Lettuce | Sludge | 7.3 | 0<br>11.05<br>22.1<br>44.2 | 18.8<br>16.4<br>16.1<br>15.7 | 0.001 | *Peterson et al, 1989.* |
| A | Lettuce | Liquid sludge | 6.5 | 42<br>120 | 11<br>16 | 0.064 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Lettuce | Bed-dried Sludge | 6.5 | 34<br>257 | 8<br>19 | 0.049 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Lettuce | Liquid sludge | 6.7 | 50<br>147 | 18<br>18 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Lettuce | Bed-dried Sludge | 6.7 | 50<br>290 | 17<br>16 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Lettuce | Liquid sludge | 8.0 | 33<br>113 | 13<br>14 | 0.013 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Lettuce | Bed-dried Sludge | 8.0 | 33<br>381 | 13<br>16 | 0.009 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Cabbage | Liquid sludge | 6.5 | 42<br>120 | 3.7<br>4.9 | 0.015 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Cabbage | Bed-dried Sludge | 6.5 | 34<br>257 | 3.8<br>5.6 | 0.008 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Cabbage | Liquid sludge | 6.7 | 50<br>147 | 3.3<br>4.8 | 0.015 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |

## TABLE C-20 (cont.)

## UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Bed-dried Sludge | 6.7 | 50<br>290 | 3.2<br>4.6 | 0.006 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Cabbage | Liquid sludge | 8.0 | 33<br>113 | 2.8<br>3.8 | 0.023 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Cabbage | Bed-dried Sludge | 8.0 | 33<br>381 | 2.8<br>5.8 | 0.009 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Spinach | Sludge | N.R. | 0<br>26<br>52<br>103<br>129 | 13<br>17<br>20<br>18<br>18 | 0.029 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Swiss Chard | Sludge | N.R. | 0<br>26<br>52<br>103<br>129 | 21<br>29<br>36<br>27<br>32 | 0.048 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| B | Lettuce | Sludge | 5.8-7.7 | 0<br>19.8<br>39.6<br>79.2 | 17.2<br>26.3<br>18.5<br>16.3 | 0.001 | *Hue et al, 1988. Akaka Andept soil.* |
| B | Lettuce | Sludge | 8.2-8.4 | 0<br>19.8<br>39.6<br>79.2 | 21<br>24<br>31.8<br>36 | 0.197 | *Hue et al, 1988. Lualualei Vertical soil.* |
| B | Lettuce | Sludge | 5.4-8.1 | 0<br>19.8<br>39.6<br>79.2 | 26.5<br>27.2<br>24.8<br>21.3 | 0.001 | *Hue et al, 1988. Wahiawa Oxisol soil.* |
| B | Lettuce | Sludge | 6.4 | 0<br>249 | 6.7<br>8.7 | 0.008 | *Furr et al, 1981. Acid soil, 2nd year.* |

## TABLE C-20 (cont.)

## UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Spinach | Sludge | 6.4 | 0 | 4.2 | 0.031 | *Furr et al, 1981.* |
| | | | | 249 | 12 | | *Acid soil, 2nd year.* |
| B | Lettuce | Sludge | 6.4 | 0 | 6.5 | 0.011 | *Furr et al, 1981.* |
| | | | | 249 | 9.3 | | *Neutral soil, 2nd year.* |
| B | Spinach | Sludge | 6.4 | 0 | 5.3 | 0.023 | *Furr et al, 1981.* |
| | | | | 249 | 11.1 | | *Neutral soil, 2nd year.* |

## TABLE C - 21

## UPTAKE OF COPPER BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Green Bean/ Grain | Sludge | 5.9-7.1 | 0<br>17<br>34 | 10.5<br>9.8<br>9.5 | 0.001 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Green Bean/ Grain | Sludge | 5.9-7.1 | 0<br>342<br>684 | 10.5<br>10<br>10.9 | 0.001 | *Keefer et al, 1986. Huntington sludge.* |
| A | Green Bean/ Grain | Sludge | 5.9-7.1 | 0<br>24<br>48 | 10.5<br>10.4<br>10.3 | 0.001 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Green Bean/ Grain | Sludge | 5.9-7.1 | 0<br>11<br>22 | 10.5<br>11.3<br>10.4 | 0.001 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Snap Bean/ Grain | Sludge | 5.3-6.5 | 0<br>130<br>269<br>520 | 2.9<br>8<br>8.3<br>8.5 | 0.009 | *Dowdy et al, 1978, p. 255. 3rd year data used.* |
| A | Snap Bean/ Grain | Sludge | 5.3-6.5 | 0<br>26.3<br>52.6<br>66<br>105<br>132<br>263 | 4.1<br>6.7<br>7.4<br>8<br>8.8<br>8.4<br>8.6 | 0.013 | *Latterell et al, 1978, p. 255.* |
| A | Bean/ Grain | Sludge | 7.3 | 0<br>11.05<br>22.1<br>44.2 | 10.7<br>9.9<br>15.1<br>24.5 | 0.339 | *Peterson et al, 1989.* |
| A | Green Bean/ Pod & Seed | Sludge | N.R. | 0<br>26<br>52<br>103<br>129 | 10<br>10<br>10<br>9<br>9 | 0.001 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Soybean/ Grain | Limed digested sludge | 7.3-7.5 | 14<br>21<br>26<br>38<br>56<br>74 | 14.8<br>13.8<br>13.4<br>12.7<br>12.6<br>13.5 | 0.001 | *Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.* |

## TABLE C - 21 (cont.)

## UPTAKE OF COPPER BY LEGUMES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Soybean/ Grain | Limed raw sludge | 7.3-7.7 | 14<br>25<br>25<br>47 | 14.8<br>14.3<br>14.1<br>13.2 | 0.001 | *Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Raw sludge compost | 6.6-7.3 | 14<br>23<br>33<br>38<br>97<br>172 | 14.8<br>13.2<br>12.7<br>13<br>13.5<br>13.3 | 0.001 | *Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge High pH | 5.9-6.0 | 12<br>37<br>40<br>78 | 14.5<br>14.3<br>14.1<br>13.7 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge Low pH | 5.3-5.6 | 13<br>34<br>46<br>87 | 13.7<br>13.2<br>12.4<br>11 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |

## TABLE C-22

## UPTAKE OF COPPER BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Potato/Tuber | Liquid sludge | 6.5 | 42<br>120 | 0.15<br>0.19 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.5 | 34<br>257 | 0.16<br>0.2 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Potato/Tuber | Liquid sludge | 6.7 | 50<br>147 | 0.52<br>0.61 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.7 | 50<br>290 | 0.53<br>0.41 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Potato/Tuber | Liquid sludge | 8.0 | 33<br>113 | 0.05<br>0.116 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 8.0 | 33<br>381 | 0.06<br>0.15 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| B | Sweet Potato/ Tuber | Sludge | 6.4 | 0<br>249 | 3.4<br>5.2 | 0.007 | *Furr et al, 1981. Acid soil, 2nd year.* |
| B | Sweet Potato/ Tuber | Sludge | 6.9 | 0<br>249 | 4.6<br>5.9 | 0.005 | *Furr et al, 1981. Neutral soil, 2nd year.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 7.71 | 0.005 | *Harris et al, 1978. Vanessa-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 0.55 | 0.006 | *Harris et al, 1978. Pentland Javelin-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 8.55 | 0.006 | *Harris et al, 1978. Home Guard-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 8.33 | 0.006 | *Harris et al, 1978. Desiree-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 6.76 | 0.004 | *Harris et al, 1978. King Edward-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 1504 | 9.03 | 0.006 | *Harris et al, 1978. Majestic-potato type.* |

## TABLE C-23

## UPTAKE OF COPPER BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Radish/Tuber | Sludge | 5.9-7.1 | 0<br>17<br>34 | 3.9<br>4.7<br>4.4 | 0.015 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Carrot/Tuber | Sludge | 5.9-7.1 | 0<br>17<br>34 | 7.5<br>6.5<br>7.1 | 0.001 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Radish/Tuber | Sludge | 5.9-7.1 | 0<br>342<br>684 | 3.9<br>5.4<br>6.4 | 0.004 | *Keefer et al, 1986. Huntington sludge.* |
| A | Carrot/Tuber | Sludge | 5.9-7.1 | 0<br>342<br>684 | 7.5<br>7.5<br>12.5 | 0.007 | *Keefer et al, 1986. Huntington sludge.* |
| A | Radish/Tuber | Sludge | 5.9-7.1 | 0<br>24<br>48 | 3.9<br>4.1<br>4.5 | 0.013 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Carrot/Tuber | Sludge | 5.9-7.1 | 0<br>24<br>48 | 7.5<br>7.8<br>7.8 | 0.006 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Radish/Tuber | Sludge | 5.9-7.1 | 0<br>11<br>22 | 3.9<br>2.4<br>2.6 | 0.001 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Carrot/Tuber | Sludge | 5.9-7.1 | 0<br>11<br>22 | 7.5<br>7<br>6.2 | 0.001 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Onion/Bulb | Sludge | 7.3 | 0<br>11.05<br>22.1<br>44.2 | 6.2<br>5.6<br>6.1<br>4.6 | 0.001 | *Peterson et al, 1989.* |
| A | Red Beet/ Tuber | Liquid sludge | 6.5 | 42<br>120 | 7.4<br>8.4 | 0.013 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.5 | 34<br>257 | 7.2<br>8.9 | 0.008 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Liquid sludge | 6.7 | 50<br>147 | 8.8<br>8.9 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |

## TABLE C-23 (cont.)

## UPTAKE OF COPPER BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.7 | 50<br>290 | 8.6<br>8.8 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Red Beet/ Tuber | Liquid sludge | 8.0 | 33<br>113 | 7.6<br>8.6 | 0.013 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 8.0 | 33<br>381 | 7.1<br>9.4 | 0.007 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| B | Kohlrabi/ Tuber | Sludge | 6.4 | 0<br>249 | 1.3<br>4.3 | 0.012 | *Furr et al, 1981. Neutral soil, 2nd year.* |
| B | Turnip/ Tuber | Sludge | 6.9 | 0<br>249 | 1.8<br>7.8 | 0.024 | *Furr et al, 1981. Neutral soil, 2nd year.* |

## TABLE C-24

## UPTAKE OF COPPER BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0 | 2.9 | 0.001 | *Keefer et al, 1986.* |
| | | | | 17 | 3.1 | | *Blue Plains sludge.* |
| | | | | 34 | 2.6 | | |
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0 | 2.9 | 0.001 | *Keefer et al, 1986.* |
| | | | | 342 | 2.7 | | *Huntington sludge.* |
| | | | | 684 | 2.9 | | |
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0 | 2.9 | 0.002 | *Keefer et al, 1986.* |
| | | | | 24 | 3.1 | | *Martinsburg sludge.* |
| | | | | 48 | 3 | | |
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0 | 2.4 | 0.005 | *Keefer et al, 1986.* |
| | | | | 11 | 3 | | *Parkersburg sludge.* |
| | | | | 22 | 3 | | |

## TABLE C-25

## UPTAKE OF LEAD BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 17.531<br>31.8 | 2.3<br>0.75 | 0.001 | *Baxter et al., 1983* |
| A | Ryegrass | Liquid Sludge | 6.5 | 56.8<br>132.8 | 2.0<br>2.2 | 0.003 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Ryegrass | Bed-dried Sludge | 6.5 | 56.6<br>218.6 | 1.7<br>2 | 0.002 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Ryegrass | Liquid Sludge | 6.7 | 63.0<br>154.4 | 1.9<br>2 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Ryegrass | Bed-dried Sludge | 6.7 | 62.4<br>225.4 | 2.2<br>2.7 | 0.003 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Ryegrass | Liquid Sludge | 8.0 | 111.2<br>159.6 | 3.5<br>3.6 | 0.002 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Ryegrass | Bed-dried Sludge | 8.0 | 110.6<br>331 | 3.3<br>3.8 | 0.002 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Corn | Sludge | 5.3-5.6 | 0.0<br>156<br>312<br>624 | 3.4<br>1.5<br>1.1<br>2.5 | 0.001 | *Giordano et al., 1975.* |
| A | Corn | Sludge | 5.3 | 0.0<br>58<br>116<br>232 | 3.5<br>5<br>5<br>4 | 0.001 | *Dowdy & Larson, 1975.* |
| A | Reed Canary Grass | Liquid sludge | 6.2-7.4 | 0<br>22 | 0.9<br>2.5 | 0.073 | *Duncomb et al., 1982.* |

## TABLE C-26

## UPTAKE OF LEAD BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Pea/Grain | Sludge | 5.3 | 0 | <0.1 | 0.001 | *Dowdy & Larson, 1975.* |
| | | | | 58 | <0.1 | | |
| | | | | 116 | <0.1 | | |
| | | | | 232 | <0.1 | | |
| A | Tomato/Fruit | Sludge | 5.3 | 0 | <0.4 | 0.001 | *Dowdy & Larson, 1975.* |
| | | | | 58 | <0.4 | | |
| | | | | 116 | <0.4 | | |
| | | | | 232 | <0.4 | | |
| A | Corn/Grain | Sludge | 5.3 | 0 | <0.2 | 0.001 | *Dowdy & Larson, 1975.* |
| | | | | 58 | <0.2 | | |
| | | | | 116 | <0.2 | | |
| | | | | 232 | <0.2 | | |
| A | Pea/Pod | Sludge | 5.3 | 0 | 0.4 | 0.001 | *Dowdy & Larson, 1975.* |
| | | | | 58 | 0.4 | | |
| | | | | 116 | 0.4 | | |
| | | | | 232 | 0.6 | | |
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.76 | 0.001 | *Keefer et al., 1986.* |
| | | | | 25 | 0.68 | | *Blue Plains sludge.* |
| | | | | 50 | 0.82 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.93 | 0.001 | *Keefer et al., 1986.* |
| | | | | 25 | 0.4 | | *Blue Plains sludge.* |
| | | | | 50 | 0.62 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 0.76 | 0.007 | *Keefer et al., 1986.* |
| | | | | 33 | 0.62 | | *Huntington sludge.* |
| | | | | 66 | 1.24 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 0.93 | 0.011 | *Keefer et al., 1986.* |
| | | | | 33 | 1.58 | | *Huntington sludge.* |
| | | | | 66 | 1.64 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.3 | 0 | 0.76 | 0.002 | *Keefer et al., 1986.* |
| | | | | 32 | 0.56 | | *Martinsburg sludge.* |
| | | | | 64 | 0.82 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.3 | 0 | 0.93 | 0.001 | *Keefer et al., 1986.* |
| | | | | 32 | 0.96 | | *Martinsburg sludge.* |
| | | | | 64 | 0.46 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.76 | 0.001 | *Keefer et al., 1986.* |
| | | | | 55 | 0.82 | | *Parkersburg sludge.* |
| | | | | 110 | 0.7 | | *Early fruiting.* |

## TABLE C-26 (cont.)

## UPTAKE OF LEAD BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.93 | 0.003 | *Keefer et al., 1986.* |
| | | | | 55 | 1.42 | | *Parkersburg sludge.* |
| | | | | 110 | 1.24 | | *Late fruiting.* |

## TABLE C-27

## UPTAKE OF LEAD BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Wheat/Grain | Liquid Sludge | 6.5 | 56.8<br>132.8 | 0.80<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 56.6<br>218.6 | 0.80<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid Sludge | 6.7 | 63.0<br>154.4 | 0.80<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 62.4<br>225.4 | 0.90<br>1 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Wheat/Grain | Liquid Sludge | 8.0 | 111.2<br>159.6 | 0.80<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 110.6<br>331 | 0.90<br>1 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Corn/Grain | Sludge | 5.3-5.6 | 0.0<br>156<br>312<br>624 | 0.9<br>0.5<br>0.6<br>1 | 0.001 | *Giordano et al., 1975.* |
| A | Corn/Grain | Sludge | 5.3 | 0.0<br>58<br>116<br>232 | <0.2<br><0.2<br><0.2<br><0.2 | 0.001 | *Dowdy & Larson, 1975.* |
| A | Oat/Grain | Limed digested sludge | 7.3-7.5 | 20.0<br>29<br>33<br>42.6<br>59.8<br>73.4 | 0.38<br>0.27<br>0.36<br>0.97<br>0.51<br>0.54 | 0.004 | *Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Oat/Grain | Limed raw sludge | 7.3-7.7 | 20.2<br>27.6<br>31.8<br>51.8 | 0.38<br>0.4<br>0.36<br>0.44 | 0.002 | *Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |

## TABLE C-27 (cont.)

## UPTAKE OF LEAD BY GRAINS/CEREALS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Oat/Grain | Raw sludge compost | 6.6-7.3 | 20.2<br>33<br>43.8<br>63<br>112.2<br>186.6 | 0.38<br>0.37<br>0.46<br>0.46<br>0.39<br>0.51 | 0.001 | *Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Oat/Grain | Heat treated sludge High pH | 5.9-6.0 | 21.4<br>47<br>48.8<br>88.8 | 0.57<br>0.36<br>0.03<br>0.03 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |
| A | Oat/Grain | Heat treated sludge Low pH | 5.3-5.6 | 21.4<br>43.8<br>52.8<br>92.8 | 0.38<br>0.36<br>0.4<br>0.67 | 0.004 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |

## TABLE C-28

## UPTAKE OF LEAD BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Heat-Treated Sludge | 5.3-5.4 | 0<br>81 | 1<br>1 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Heat-Treated Sludge | 6.2 | 0<br>81 | 1.1<br>1 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 5.3-5.6 | 0<br>87 | 1<br>1.1 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 6.2-6.6 | 0<br>87 | 1.1<br>0.6 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Swiss Chard | Heat-Treated Sludge | 5.7 | 0<br>81 | 3.4<br>2.1 | 0.001 | *Chaney et al., 1982* |
| A | Swiss Chard | Heat-Treated Sludge | 6.7-6.8 | 0<br>81 | 2.7<br>1.5 | 0.001 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 5.7 | 0<br>87 | 3.4<br>1.2 | 0.001 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 6.7-6.8 | 0<br>87 | 2.7<br>1.5 | 0.001 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 5.5-5.6 | 0<br>81 | 2.4<br>1.9 | 0.001 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 6.4-6.3 | 0<br>81 | 1.9<br>2.5 | 0.007 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 5.5-6.3 | 0<br>87 | 2.4<br>2.2 | 0.001 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 6.4-6.8 | 0<br>87 | 1.9<br>1.9 | 0.001 | *Chaney et al., 1982* |
| A | Lettuce | Liquid Sludge | 6.5 | 56.8<br>132.8 | 1.3<br>1.6 | 0.004 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Lettuce | Bed-dried Sludge | 6.5 | 56.6<br>218.6 | 0.9<br>0.9 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Lettuce | Liquid Sludge | 6.7 | 63<br>154.4 | 2.28<br>2.34 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |

## TABLE C-28 (cont.)

## UPTAKE OF LEAD BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Bed-dried Sludge | 6.7 | 62.4<br>225.4 | 1.7<br>2.7 | 0.006 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Lettuce | Liquid Sludge | 8.0 | 111.2<br>159.6 | 3.9<br>3.5 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Lettuce | Bed-dried Sludge | 8.0 | 110.6<br>331 | 3.4<br>3.4 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Cabbage | Liquid Sludge | 6.5 | 56.8<br>132.8 | 0.7<br>0.9 | 0.003 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Cabbage | Bed-dried Sludge | 6.5 | 56.6<br>218.6 | 0.8<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Cabbage | Liquid Sludge | 6.7 | 63<br>154.4 | 0.7<br>0.7 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Cabbage | Bed-dried Sludge | 6.7 | 62.4<br>225.4 | 0.8<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Cabbage | Liquid Sludge | 8.0 | 111.2<br>159.6 | 1. 0<br>1.1 | 0.002 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Cabbage | Bed-dried Sludge | 8.0 | 110.6<br>331 | 1.0<br>1.1 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Lettuce | Sludge | 5.3 | 0<br>58<br>116<br>232 | 1.1<br>1.4<br>0.7<br>0.8 | 0.001 | *Dowdy & Larson, 1975.* |
| A | Turnip Greens | Sludge | 5.2-5.8 | 0<br>57<br>114 | 7.8<br>10.5<br>12.3 | 0.039 | *Miller & Boswell, 1979.* |
| A | Cabbage | Sludge | 5.9-6.6 | 0<br>25<br>50 | 0.58<br>0.38<br>0.52 | 0.001 | *Keefer et al., 1986. Blue Plains sludge.* |

## TABLE C-28 (cont.)

## UPTAKE OF LEAD BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Sludge | 5.9-7.1 | 0 | 0.58 | 0.001 | *Keefer et al., 1986.* |
| | | | | 33 | 0.74 | | *Huntington sludge.* |
| | | | | 66 | 0.52 | | |
| A | Cabbage | Sludge | 5.9-6.3 | 0 | 0.58 | 0.004 | *Keefer et al., 1986.* |
| | | | | 32 | 0.8 | | *Martinsburg sludge.* |
| | | | | 64 | 0.84 | | |
| A | Cabbage | Sludge | 5.9-6.6 | 0 | 0.58 | 0.003 | *Keefer et al., 1986.* |
| | | | | 55 | 0.72 | | *Parkersburg sludge.* |
| | | | | 110 | 0.88 | | |

## TABLE C-29

## UPTAKE OF LEAD BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Bush Bean/ Pod | Sludge | 5.3-5.6 | 0<br>156<br>312<br>624 | 1.4<br>1.4<br>1.2<br>1.2 | 0.001 | *Giordano et al., 1975.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.6 | 0<br>25<br>50 | 0.83<br>0.66<br>0.46 | 0.001 | *Keefer et al., 1986. Blue Plains sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-7.1 | 0<br>33<br>66 | 0.83<br>0.54<br>1.2 | 0.006 | *Keefer et al., 1986. Huntington sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.3 | 0<br>32<br>64 | 0.83<br>0.86<br>0.8 | 0.001 | *Keefer et al., 1986. Martinsburg sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.6 | 0<br>55<br>110 | 0.83<br>0.8<br>0.98 | 0.001 | *Keefer et al., 1986. Parkersburg sludge.* |
| A | Soybean/ Grain | Limed digested sludge | 7.3-7.5 | 20.2<br>29.8<br>53<br>42.6<br>59.8<br>73.4 | 0.35<br>0.99<br>0.73<br>0.29<br>0.58<br>0.73 | 0.003 | *Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Limed raw sludge | 7.3-7.7 | 20.2<br>27.6<br>31.8<br>51.8 | 0.35<br>0.62<br>0.57<br>0.4 | 0.001 | *Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Raw sludge compost | 6.6-7.3 | 20.2<br>33<br>43.8<br>63<br>112.2<br>186.6 | 0.35<br>0.56<br>0.38<br>0.46<br>0.57<br>0.29 | 0.001 | *Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge High pH | 5.9-6.0 | 21.4<br>4<br>48.8<br>88.8 | 0.25<br>0.62<br>0.29<br>0.27 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge Low pH | 5.3-5.6 | 21.4<br>43.8<br>52.8<br>92.8 | 0.75<br>0.38<br>0.25<br>0.38 | 0.001 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |

## TABLE C-30

## UPTAKE OF LEAD BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Potato/Tuber | Sludge | 5.3 | 0<br>58<br>116<br>232 | <0.4<br><0.4<br><0.4<br>0.7 | 0.001 | *Dowdy & Larson, 1975* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 0.41 | 0.001 | *Harris et all, 1978. Vanessa-potato type.* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 0.55 | 0.001 | *Harris et all, 1978. Pentland Javelin-potato K20* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 0.26 | 0.001 | *Harris et all, 1978. Home Guard-potato type.* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 1.04 | 0.001 | *Harris et all, 1978. Desiree-potato type.* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 0.66 | 0.001 | *Harris et all, 1978. King Edward-potato type.* |
| C | Potato/Tuber | Organic-metal contaminated soil | 6.6 | 1742 | 0.29 | 0.001 | *Harris et all, 1978. Majestic-potato type.* |

## TABLE C-31

## UPTAKE OF LEAD BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Red Beet/ Tuber | Liquid Sludge | 6.5 | 56.8<br>132.8 | 0.7<br>0.9 | 0.003 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.5 | 56.6<br>218.6 | 0.8<br>0.9 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Red Beet/ Tuber | Liquid Sludge | 6.7 | 63<br>154.4 | 0.7<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 6.7 | 62.4<br>225.4 | 0.8<br>0.8 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Red Beet/ Tuber | Liquid Sludge | 8.0 | 111.2<br>159.6 | 1.1<br>1.1 | 0.001 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Red Beet/ Tuber | Bed-dried Sludge | 8.0 | 110.6<br>331 | 1.1<br>1.1 | 0.001 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Carrot/ Tuber | Sludge | 5.3 | 0<br>58<br>116<br>232 | <0.4<br><0.4<br>0.9<br>0.9 | 0.002 | *Dowdy & Larson, 1975.* |
| A | Radish/ Tuber | Sludge | 5.3 | 0<br>58<br>116<br>232 | 0.5<br><0.4<br>0.4<br>0.7 | 0.001 | *Dowdy & Larson, 1975.* |
| A | Radish/ Tuber | Sludge | 5.9-6.6 | 0<br>25<br>50 | 0.7<br>0.62<br>0.56 | 0.001 | *Keefer et al., 1986. Blue Plains sludge.* |
| A | Carrot/ Tuber | Sludge | 5.9-6.6 | 0<br>25<br>50 | 1.78<br>0.6<br>2.24 | 0.009 | *Keefer et al., 1986. Blue Plains sludge.* |
| A | Radish/ Tuber | Sludge | 5.9-7.1 | 0<br>33<br>66 | 0.7<br>0.58<br>0.86 | 0.002 | *Keefer et al., 1986. Huntington sludge.* |
| A | Carrot/ Tuber | Sludge | 5.9-7.1 | 0<br>33<br>66 | 1.78<br>1.24<br>1 | 0.001 | *Keefer et al., 1986. Huntington sludge.* |

## TABLE C-31 (cont.)

## UPTAKE OF LEAD BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Radish | Sludge | 5.9-6.3 | 0 | 0.7 | 0.002 | *Keefer et al., 1986. Martinsburg sludge.* |
| | | | | 32 | 0.76 | | |
| | | | | 64 | 0.82 | | |
| A | Carrot | Sludge | 5.9-6.3 | 0 | 1.78 | 0.001 | *Keefer et al., 1986. Martinsburg sludge.* |
| | | | | 32 | 1.4 | | |
| | | | | 64 | 1.1 | | |
| A | Radish/ Tuber | Sludge | 5.9-6.6 | 0 | 0.7 | 0.003 | *Keefer et al., 1986. Parkersburg sludge.* |
| | | | | 55 | 0.92 | | |
| | | | | 110 | 0.96 | | |
| A | Carrot/ Tuber | Sludge | 5.9-6.6 | 0 | 1.78 | 0.001 | *Keefer et al., 1986. Parkersburg sludge.* |
| | | | | 55 | 1.4 | | |
| | | | | 110 | 1.26 | | |

## TABLE C-32

## UPTAKE OF LEAD BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Grain | Sludge | 5.9-6.6 | 0<br>25<br>50 | <0.1<br><0.1<br><0.1 | 0.001 | *Keefer et al., 1986. Blue Plains sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0<br>33<br>66 | <0.10<br><0.10<br><0.10 | 0.001 | *Keefer et al., 1986. Huntington sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.9-6.3 | 0<br>32<br>64 | <0.10<br><0.10<br><0.10 | 0.001 | *Keefer et al., 1986. Martinsburg sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.9-6.6 | 0<br>55<br>110 | <0.10<br><0.10<br><0.10 | 0.001 | *Keefer et al., 1986. Parkersburg sludge.* |

## TABLE C-33

## UPTAKE OF MERCURY BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Broccoli/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.0031<br>0.0169 | 0.018 | *Cappon, C.T. 1981.* |
| A | Cauliflower | Sludge | 6.8 | 0<br>0.7804 | 0.0051<br>0.0109 | 0.007 | *Cappon, C.T. 1981.* |
| A | Cucumber/ Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.0012<br>0.0046 | 0.004 | *Cappon, C.T. 1981. Slicing cucumber.* |
| A | Cucumber/ Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.0080<br>0.0047 | 0.001 | *Cappon, C.T. 1981 Pickling cucumber.* |
| A | Pumpkin/ Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.0007<br>0.0025 | 0.002 | *Cappon, C.T. 1981* |
| A | Tomato/ Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.0015<br>0.0075 | 0.008 | *Cappon, C.T. 1981* |
| B | Tomato/ Fruit | Sludge | 5.3–7.1 | 0<br>2.34 | 0.1<br>0.2 | 0.043 | *Furr & Kelly 1976, p. 87.* |

## TABLE C-34

## UPTAKE OF MERCURY BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Millet/Grain | Sludge | 5.3–7.1 | 0<br>2.34 | 0.4<br>0.5 | 0.0427 | *Furr & Kelly 1976, p. 87.* |

## TABLE C - 35

## UPTAKE OF MERCURY BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Sludge | 6.8 | 0<br>0.7804 | 0.0029<br>0.0139 | 0.014 | *Cappon, C.T. 1981.* |
| A | Lettuce | Sludge | 6.8 | 0<br>0.7804 | 0.0029<br>0.0328 | 0.038 | *Cappon, C.T. 1981* |
| A | Lettuce | Sludge | 6.8 | 0<br>0.7804 | 0.0046<br>0.0405 | 0.046 | *Cappon, C.T. 1981* |
| A | Parsley | Sludge | 6.8 | 0<br>0.7804 | 0.0025<br>0.0077 | 0.007 | *Cappon, C.T. 1981* |
| A | Swiss Chard | Sludge | 5.5 | 0<br>1.3 | 1<br>0.53 | 0.001 | *Furr & Stoewsand, 1976, p. 87.* |
| A | Swiss Chard | Sludge | 6.5 | 0<br>1.3 | 1<br>0.93 | 0.001 | *Furr & Stoewsand, 1976, p. 87.* |
| A | Swiss Chard | Sludge | 5.5-6.0 | 0<br>0.09 | 0.2<br>0.1 | 0.001 | *Chaney et al, 1978. Blue Plains sludge.* |
| A | Swiss Chard | Sludge | 5.5-6.0 | 0<br>0.336 | 0.2<br><0.05 | 0.001 | *Chaney et al, 1978. Blue Plains compost.* |
| B | Cabbage | Sludge | 5.3–7.1 | 0<br>2.62 | 0.3<br>0.2 | 0.001 | *Furr & Kelly 1976, p. 87.* |

## TABLE C-36

## UPTAKE OF MERCURY BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Bush Bean/ Pod | Sludge | 6.8 | 0<br>0.7804 | 0.0036<br>0.0045 | 0.001 | *Cappon, C.T. 1981.* |
| A | Bush Bean/ Grain | Sludge | 6.8 | 0<br>0.7804 | 0.0001<br>0.0004 | 0.001 | *Cappon, C.T. 1981.* |
| B | Bush Bean/ Grain | Sludge | 5.3–7.1 | 0<br>2.62 | 0.300<br>0.100 | 0.001 | *Furr & Kelly 1976, p. 88* |

## TABLE C-37

## UPTAKE OF MERCURY BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Potato/Tuber | Sludge | 5.3–7.1 | 0 | 0.1 | 0.001 | *Furr & Kelly 1976, p. 87.* |
| | | | | 2.34 | 0.1 | | |

## TABLE C-38

## UPTAKE OF MERCURY BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Beet/Tuber | Sludge | 6.8 | 0<br>0.7804 | 0.0025<br>0.0072 | 0.006 | *Cappon, C.T. 1981.* |
| A | Onion/Bulb | Sludge | 6.8 | 0<br>0.7804 | 0.0067<br>0.0171 | 0.013 | *Cappon, C.T. 1981* |
| A | Radish/Tuber | Sludge | 6.8 | 0<br>0.7804 | 0.0013<br>0.0066 | 0.007 | *Cappon, C.T. 1981*<br>*Red radish.* |
| A | Radish/Tuber | Sludge | 6.8 | 0<br>0.7804 | 0.0008<br>0.0043 | 0.004 | *Cappon, C.T. 1981*<br>*White radish.* |
| B | Carrot/Tuber | Sludge | 5.3–7.1 | 0<br>2.62 | 0.1<br>0.04 | 0.001 | *Furr & Kelly 1976, p. 87.* |
| B | Onion/Bulb | Sludge | 5.3–7.1 | 0<br>2.34 | 0.1<br>0.2 | 0.043 | *Furr & Kelly 1976, p. 87.* |

## TABLE C-39

## UPTAKE OF MOLYBDENUM BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | 4.6-5.3 | 0 | 1.9 | 0.683 | *Pierzynski & Jacobs 1986. Year 1, Experiment 1.* |
| | | | | 33 | 29.8 | | |
| | | | | 66 | 47 | | |
| A | Corn | Sludge | 4.7-6.4 | 0 | 7.5 | 2.486 | *Pierzynski & Jacobs 1986. Year 2, Experiment 1.* |
| | | | | 63 | 265 | | |
| | | | | 141 | 365 | | |
| A | Corn | Sludge | 5.0-6.9 | 0 | 6 | 5.106 | *Pierzynski & Jacobs 1986. Year 3, Experiment 1.* |
| | | | | 63 | 300 | | |
| | | | | 141 | 724 | | |
| A | Corn/Leaf | Sludge | 4.6-5.3 | 0 | 3 | 0.909 | *Pierzynski & Jacobs 1986. Year 1, Experiment 1.* |
| | | | | 33 | 40.5 | | |
| | | | | 66 | 63 | | |
| A | Corn/Leaf | Sludge | 4.7-6.4 | 0 | 2.2 | 1.723 | *Pierzynski & Jacobs 1986. Year 2, Experiment 1.* |
| | | | | 63 | 137 | | |
| | | | | 141 | 247 | | |
| A | Corn/Leaf | Sludge | 5.0-6.9 | 0 | 8.8 | 4.907 | *Pierzynski & Jacobs 1986. Year 3, Experiment 1.* |
| | | | | 63 | 265 | | |
| | | | | 141 | 697 | | |
| A | Soybean | Sludge | 4.6-5.3 | 0 | 2.7 | 0.814 | *Pierzynski & Jacobs 1986. Year 1, Experiment 1.* |
| | | | | 33 | 43.9 | | |
| | | | | 66 | 56.4 | | |
| A | Soybean | Sludge | 4.7-6.4 | 0 | 3.1 | 2.257 | *Pierzynski & Jacobs 1986. Year 2, Experiment 1.* |
| | | | | 63 | 140 | | |
| | | | | 141 | 321 | | |
| A | Soybean | Sludge | 5.0-6.9 | 0 | 5.4 | 3.229 | *Pierzynski & Jacobs 1986. Year 3, Experiment 1.* |
| | | | | 63 | 185 | | |
| | | | | 141 | 459 | | |
| A | Soybean/ Leaf | Sludge | 4.6-5.3 | 0 | 2.1 | 0.768 | *Pierzynski & Jacobs 1986. Year 1, Experiment 1.* |
| | | | | 33 | 38.1 | | |
| | | | | 66 | 52.8 | | |
| A | Soybean/ Leaf | Sludge | 4.7-6.4 | 0 | 2.4 | 1.893 | *Pierzynski & Jacobs 1986. Year 2, Experiment 1.* |
| | | | | 63 | 103 | | |
| | | | | 141 | 268 | | |
| A | Soybean/ Leaf | Sludge | 5.0-6.9 | 0 | 9.3 | 3.164 | *Pierzynski & Jacobs 1986. Year 3, Experiment 1.* |
| | | | | 63 | 158 | | |
| | | | | 141 | 452 | | |

## TABLE C-39 (cont.)

## UPTAKE OF MOLYBDENUM BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | 4.6-5.4 | 0<br>42 | 6.6<br>92.7 | 2.050 | *Pierzynski & Jacobs 1986. Year 1, Experiment 2.* |
| A | Corn | Sludge | 4.7-6.5 | 0<br>291<br>300 | 6.6<br>730<br>330 | 1.739 | *Pierzynski & Jacobs 1986. Year 2, Experiment 2.* |
| A | Corn | Sludge | 5.0-7.1 | 0<br>291<br>300 | 6.6<br>1300<br>630 | 3.293 | *Pierzynski & Jacobs 1986. Year 3, Experiment 2.* |
| A | Corn/Leaf | Sludge | 4.6-5.4 | 0<br>42 | 6.4<br>122 | 2.752 | *Pierzynski & Jacobs 1986. Year 1, Experiment 2.* |
| A | Corn/Leaf | Sludge | 4.7-6.5 | 0<br>291<br>300 | 6.4<br>462<br>197 | 1.072 | *Pierzynski & Jacobs 1986. Year 2, Experiment 2.* |
| A | Corn/Leaf | Sludge | 5.0-7.1 | 0<br>291<br>300 | 6.4<br>804<br>130 | 1.506 | *Pierzynski & Jacobs 1986. Year 3, Experiment 2.* |
| A | Bromegrass | Sludge | N.R.(3) | 0<br>4.08 | 0.33<br>1.85 | 0.375 | *Soon & Bates, 1985. Used means of cuts 1 & 2. Calcium enriched sludge.* |
| A | Bromegrass | Sludge | N.R. | 0<br>9.44 | 0.33<br>1.4 | 0.113 | *Soon & Bates, 1985. Used means of cuts 1 & 2. Ferric chloride enriched sludge.* |
| A | Bromegrass | Sludge | N.R. | 0<br>10.8 | 0.33<br>1.155 | 0.076 | *Soon & Bates, 1985. Used means of cuts 1 & 2. Aluminum sulfate enriched sludge.* |
| A | Corn | Sludge | N.R. | 0<br>9.68 | 0.24<br>0.67 | 0.044 | *Soon & Bates, 1985. Connestoga. Calcium enriched sludge.* |
| A | Corn | Sludge | N.R. | 0<br>10 | 0.24<br>0.28 | 0.004 | *Soon & Bates, 1985. Connestoga. Ferric chloride enriched sludge.* |

## TABLE C-39 (cont.)

## UPTAKE OF MOLYBDENUM BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | N.R. | 0<br>12.16 | 0.24<br>0.28 | 0.003 | *Soon & Bates, 1985. Connestoga. Aluminum sulfate enriched sludge.* |
| A | Corn/ Forage | Sludge | N.R. | 0<br>6.08 | 1.01<br>3.67 | 0.438 | *Soon & Bates. Caledon. Calcium enriched sludge.* |
| A | Corn/ Forage | Sludge | N.R. | 0<br>11.92 | 1.01<br>0.65 | 0.001 | *Soon & Bates. Caledon. Ferric chloride enriched sludge.* |
| A | Corn/ Forage | Sludge | N.R. | 0<br>12.72 | 1.01<br>0.72 | 0.001 | *Soon & Bates. Caledon. Aluminum sulfate enriched sludge.* |
| B | Alfalfa | Sludge | 6.0-6.6 | 40<br>88<br>188 | 201<br>486<br>659 | 2.887 | *Pierzynski & Jacobs 1986. 2nd cutting.* |
| B | Alfalfa | Sludge | 7.0-7.5 | 40<br>88<br>188 | 487<br>876<br>895 | 2.367 | *Pierzynski & Jacobs 1986. 2nd cutting.* |
| B | Alfalfa | Sludge | 7.7-8.2 | 40<br>88<br>188 | 483<br>773<br>944 | 2.901 | *Pierzynski & Jacobs 1986. 2nd cutting.* |

## TABLE C-40

## UPTAKE OF MOLYBDENUM BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn/Grain | Sludge | 4.6-5.3 | 0<br>33<br>66 | 0.2<br>1.5<br>2 | 0.027 | *Pierzynski & Jacobs 1986. Year 1, Experiment 1.* |
| A | Corn/Grain | Sludge | 4.7-6.4 | 0<br>63<br>141 | 0.4<br>3.7<br>5.7 | 0.037 | *Pierzynski & Jacobs 1986. Year 2, Experiment 1.* |
| A | Corn/Grain | Sludge | 5.0-6.9 | 0<br>63<br>141 | 0.6<br>3.6<br>6.9 | 0.045 | *Pierzynski & Jacobs 1986. Year 3, Experiment 1.* |
| A | Corn/Grain | Sludge | 4.6-5.4 | 0<br>42 | 0.5<br>3.6 | 0.074 | *Pierzynski & Jacobs 1986. Year 1, Experiment 2.* |
| A | Corn/Grain | Sludge | 4.7-6.5 | 0<br>291<br>300 | 0.5<br>12<br>6.3 | 0.029 | *Pierzynski & Jacobs 1986. Year 2, Experiment 2.* |
| A | Corn/Grain | Sludge | 5.0-7.1 | 0<br>291<br>300 | 0.5<br>16.5<br>9.2 | 0.041 | *Pierzynski & Jacobs 1986. Year 3, Experiment 2.* |
| A | Corn/Grain | Sludge | N.R. | 0<br>9.68 | 0.13<br>0.25 | 0.012 | *Soon & Bates, 1985. Connestoga. Calcium enriched sludge.* |
| A | Corn/Grain | Sludge | N.R. | 0<br>10 | 0.13<br>0.17 | 0.004 | *Soon & Bates, 1985. Connestoga. Ferric chloride enriched sludge.* |
| A | Corn/Grain | Sludge | N.R. | 0<br>12.2 | 0.13<br>0.18 | 0.004 | *Soon & Bates, 1985. Connestoga. Aluminum sulfate enriched sludge.* |
| A | Corn | Sludge | N.R. | 0<br>6.08 | 0.25<br>0.73 | 0.079 | *Soon & Bates. Caledon. Calcium enriched sludge.* |
| A | Corn | Sludge | N.R. | 0<br>11.92 | 0.25<br>0.25 | 0.001 | *Soon & Bates. Caledon. Ferric chloride enriched sludge.* |

## TABLE C-40 (cont.)

## UPTAKE OF MOLYBDENUM BY GRAINS/CEREALS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | N.R. | 0<br>12.72 | 0.25<br>0.29 | 0.003 | *Soon & Bates. Caledon. Aluminum sulfate enriched sludge.* |
| B | Corn | Sludge | 6.0-6.6 | 40<br>88<br>188 | 74<br>315<br>329 | 1.482 | *Pierzynski & Jacobs 1986. 2nd cutting.* |
| B | Corn/Grain | Sludge | 7.0-7.5 | 40<br>88<br>188 | 260<br>403<br>383 | 0.674 | *Pierzynski & Jacobs 1986. 2nd cutting.* |
| B | Corn/Grain | Sludge | 7.7-8.2 | 40<br>88<br>188 | 273<br>470<br>362 | 0.346 | *Pierzynski & Jacobs 1986. 2nd cutting.* |

## TABLE C-41

## UPTAKE OF MOLYBDENUM BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Soybean/ Grain | Sludge | 4.6-5.3 | 0<br>33<br>66 | 14.3<br>70.9<br>122 | 1.632 | *Pierzynski & Jacobs, 1986. Year 1, Experiment 1.* |
| A | Soybean/ Grain | Sludge | 4.7-6.4 | 0<br>63<br>141 | 8.9<br>107<br>241 | 1.649 | *Pierzynski & Jacobs, 1986. Year 2, Experiment 1.* |
| A | Soybean/ Grain | Sludge | 5.0-6.9 | 0<br>63<br>141 | 19.9<br>114<br>242 | 1.578 | *Pierzynski & Jacobs, 1986. Year 3, Experiment 1.* |
| B | Soybean/ Grain | Sludge | 6.0-6.6 | 40<br>88<br>188 | 300<br>800<br>986 | 4.213 | *Pierzynski & Jacobs, 1986. 2nd cutting.* |
| B | Soybean/ Grain | Sludge | 7.0-7.5 | 40<br>88<br>188 | 736<br>1010<br>1070 | 2.005 | *Pierzynski & Jacobs, 1986. 2nd cutting.* |
| B | Soybean/ Grain | Sludge | 7.7-8.2 | 40<br>88<br>188 | 391<br>585<br>692 | 1.887 | *Pierzynski & Jacobs, 1986. 2nd cutting.* |

## TABLE C-42

## UPTAKE OF NICKEL BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 9.75<br>15 | <0.57<br>2.8 | 0.425 | *Baxter et al., 1983*<br>*Means reported* |
| A | Reed Canary Grass | Sludge | 6.2-7.4 | 0<br>1.3 | 2.4<br>2.6 | 0.154 | *Duncomb et al., 1982.* |
| A | Corn/Forage | Sludge | 6.2-7.4 | 0<br>1.1 | 1<br>0.9 | 0.001 | *Duncomb et al., 1982.* |
| A | Corn | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.23<br>0.36<br>0.54 | 0.018 | *Rappaport et al., 1987.*<br>*Year 1.* |
| A | Corn | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.75<br>1.32<br>1.33 | 0.034 | *Rappaport et al., 1987.*<br>*Year 1.* |
| A | Corn/Forage | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.54<br>0.66<br>0.66 | 0.007 | *Rappaport et al., 1987.*<br>*Year 2.* |
| A | Barley | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.51<br>0.92<br>0.74 | 0.013 | *Rappaport et al., 1987.*<br>*Year 2.* |
| A | Ryegrass | Liquid Sludge | 6.5 | 71.4<br>84.7 | 3.2<br>7.6 | 0.331 | *Carlton Smith, 1988.*<br>*Mean of 5 years used.*<br>*Sandy loam.* |
| A | Ryegrass | Bed-dried Sludge | 6.5 | 70.3<br>108.5 | 3.2<br>7.8 | 0.12 | *Carlton Smith, 1988.*<br>*Mean of 4 years used.*<br>*Sandy loam.* |
| A | Ryegrass | Liquid Sludge | 6.7 | 85.2<br>101.6 | 3.8<br>7.7 | 0.238 | *Carlton Smith, 1988.*<br>*Mean of 5 years used.*<br>*Clay.* |
| A | Ryegrass | Bed-dried Sludge | 6.7 | 85.1<br>140.9 | 3.7<br>7.7 | 0.072 | *Carlton Smith, 1988.*<br>*Mean of 4 years used.*<br>*Clay.* |
| A | Ryegrass | Liquid Sludge | 8.0 | 23.7<br>40.2 | 1.6<br>3.9 | 0.139 | *Carlton Smith, 1988.*<br>*Mean of 5 years used.*<br>*Calcareous loam.* |
| A | Ryegrass | Bed-dried Sludge | 8.0 | 23.9<br>126.9 | 1.5<br>14 | 0.121 | *Carlton Smith, 1988.*<br>*Mean of 5 years used.*<br>*Calcareous loam.* |

## TABLE C-42 (cont.)

## UPTAKE OF NICKEL BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Rape | Sludge | 5.6 | 0<br>2.3<br>4.6 | 1.34<br>0.46<br>0.93 | 0.001 | *Narwal et al, 1983. First harvest.* |
| B | Rape | Sludge | 6 | 0<br>2.31<br>4.62 | 0.24<br>0.3<br>0.38 | 0.03 | *Narwal et al., 1983. First harvest.* |
| B | Rape | Sludge | 7.5 | 0<br>2.31<br>4.62 | 0.11<br>0.3<br>0.46 | 0.076 | *Narwal et al., 1983. First harvest.* |
| B | Rape | Sludge | 5.6 | 0<br>2.31<br>4.62 | 3.75<br>1.42<br>1.73 | 0.001 | *Narwal et al., 1983. Second harvest.* |
| B | Rape | Sludge | 6 | 0<br>2.31<br>4.62 | 1.3<br>0.62<br>0.81 | 0.001 | *Narwal et al., 1983. Second harvest.* |
| B | Rape | Sludge | 7.5 | 0<br>2.31<br>4.62 | 0.49<br>0.38<br>0.37 | 0.001 | *Narwal et al., 1983. Second harvest.* |

## TABLE C-43

## UPTAKE OF NICKEL BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.61 | 0.001 | *Keefer et al., 1986.* |
| | | | | 8 | 0.65 | | *Blue Plains sludge.* |
| | | | | 16 | 0.35 | | |
| A | Tomato/Fruit | Sludge | 5.9-6.6 | 0 | 0.43 | 0.001 | *Keefer et al., 1986.* |
| | | | | 8 | 0.6 | | *Blue Plains sludge.* |
| | | | | 16 | 0.4 | | |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 0.61 | 0.001 | *Keefer et al., 1986.* |
| | | | | 1270 | 0.5 | | *Huntington sludge.* |
| | | | | 2540 | 0.5 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-7.1 | 0 | 0.43 | 0.001 | *Keefer et al., 1986.* |
| | | | | 1270 | 0.55 | | *Huntington sludge.* |
| | | | | 2540 | 0.45 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.9 | 0 | 0.61 | 0.083 | *Keefer et al., 1986.* |
| | | | | 2 | 0.6 | | *Martinsburg sludge.* |
| | | | | 4 | 0.94 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.9 | 0 | 0.43 | 0.093 | *Keefer et al., 1986.* |
| | | | | 2 | 0.65 | | *Martinsburg sludge.* |
| | | | | 4 | 0.8 | | *Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.3 | 0 | 0.61 | 0.003 | *Keefer et al., 1986.* |
| | | | | 24 | 0.6 | | *Parkersburg sludge.* |
| | | | | 48 | 0.75 | | *Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.9-6.3 | 0 | 0.43 | 0.001 | *Keefer et al., 1986.* |
| | | | | 24 | 0.45 | | *Parkersburg sludge.* |
| | | | | 48 | 0.4 | | |
| A | Celery | Sludge | 7.3 | 0 | <0.3 | 0.001 | *Peterson et al., 1989.* |
| | | | | 2.856 | <0.3 | | |
| | | | | 5.712 | <0.3 | | |
| | | | | 11.424 | <0.3 | | |
| A | Tomato/Fruit | Sludge | 7.3 | 0 | <0.3 | 0.001 | *Peterson et al., 1989.* |
| | | | | 2.856 | <0.3 | | |
| | | | | 5.712 | <0.3 | | |
| | | | | 11.424 | <0.3 | | |
| A | Tomato/Fruit | Sludge | N.R. | 0 | 1.1 | 0.022 | *Lue-Hing et al, 1984.* |
| | | | | 9 | 1.3 | | *1977 data used.* |
| | | | | 17 | 1.1 | | *Nu-Earth.* |
| | | | | 34 | 2.2 | | |
| | | | | 43 | 1.8 | | |

## TABLE C-43 (cont.)

## UPTAKE OF NICKEL BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Green Pepper/ Fruit | Sludge | 6.4 | 0<br>38 | 0.4<br>2.3 | 0.05 | *Furr et al., 1981.* |
| B | Green Pepper/ Fruit | Sludge | 6.9 | 0<br>38 | 0.4<br>1.5 | 0.029 | *Furr et al., 1981.* |
| B | Pea/Grain | Sludge | 6.4 | 0<br>38 | 1.7<br>5.3 | 0.095 | *Furr et al., 1981.* |
| B | Pea/Grain | Sludge | 6.9 | 0<br>38 | 1.3<br>2.4 | 0.029 | *Furr et al., 1981.* |

## TABLE C-44

## UPTAKE OF NICKEL BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn/Grain | Sludge | 6.2-7.4 | 0<br>1.1 | 0.6<br>0.4 | 0.001 | *Duncomb et al., 1982* |
| A | Corn/Grain | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.39<br>1.04<br>1.34 | 0.055 | *Rappaport et al., 1987. Year 1.* |
| A | Corn/Grain | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.11<br>0.34<br>0.37 | 0.015 | *Rappaport et al., 1987. Year 2.* |
| A | Corn | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.14<br>0.18<br>0.18 | 0.002 | *Rappaport et al., 1987. Year 2.* |
| A | Wheat/Grain | Liquid Sludge | 6.5 | 71.4<br>84.7 | 1.5<br>1.8 | 0.023 | *Carlton Smith, 1988. Mean of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 70.3<br>108.5 | 1.3<br>1.5 | 0.005 | *Carlton Smith, 1988. Mean of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid Sludge | 6.7 | 85.2<br>101.6 | 1.6<br>1.4 | 0.001 | *Carlton Smith, 1988. Mean of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 85.1<br>140.9 | 0.9<br>1.4 | 0.009 | *Carlton Smith, 1988. Mean of 4 years used. Clay.* |
| A | Wheat/Grain | Liquid Sludge | 8.0 | 23.7<br>40.2 | 0.8<br>0.9 | 0.006 | *Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 23.9<br>126.9 | 0.9<br>1.1 | 0.002 | *Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.* |

## TABLE C-43 (cont.)

## UPTAKE OF NICKEL BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Green Pepper/ Fruit | Sludge | 6.4 | 0<br>38 | 0.4<br>2.3 | 0.05 | *Furr et al., 1981.* |
| B | Green Pepper/ Fruit | Sludge | 6.9 | 0<br>38 | 0.4<br>1.5 | 0.029 | *Furr et al., 1981.* |
| B | Pea/Grain | Sludge | 6.4 | 0<br>38 | 1.7<br>5.3 | 0.095 | *Furr et al., 1981.* |
| B | Pea/Grain | Sludge | 6.9 | 0<br>38 | 1.3<br>2.4 | 0.029 | *Furr et al., 1981.* |

## TABLE C-44

## UPTAKE OF NICKEL BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn/Grain | Sludge | 6.2-7.4 | 0<br>1.1 | 0.6<br>0.4 | 0.001 | *Duncomb et al., 1982* |
| A | Corn/Grain | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.39<br>1.04<br>1.34 | 0.055 | *Rappaport et al., 1987. Year 1.* |
| A | Corn/Grain | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.11<br>0.34<br>0.37 | 0.015 | *Rappaport et al., 1987. Year 2.* |
| A | Corn | Sludge | 6.6 | 0<br>8.6<br>17.2 | 0.14<br>0.18<br>0.18 | 0.002 | *Rappaport et al., 1987. Year 2.* |
| A | Wheat/Grain | Liquid Sludge | 6.5 | 71.4<br>84.7 | 1.5<br>1.8 | 0.023 | *Carlton Smith, 1988. Mean of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 70.3<br>108.5 | 1.3<br>1.5 | 0.005 | *Carlton Smith, 1988. Mean of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid Sludge | 6.7 | 85.2<br>101.6 | 1.6<br>1.4 | 0.001 | *Carlton Smith, 1988. Mean of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 85.1<br>140.9 | 0.9<br>1.4 | 0.009 | *Carlton Smith, 1988. Mean of 4 years used. Clay.* |
| A | Wheat/Grain | Liquid Sludge | 8.0 | 23.7<br>40.2 | 0.8<br>0.9 | 0.006 | *Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 23.9<br>126.9 | 0.9<br>1.1 | 0.002 | *Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.* |

## TABLE C-45

## UPTAKE OF NICKEL BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Swiss Chard | Nu-Earth | `5.7-6.3 | 0<br>0.6 | 2.9<br>11.9 | 15.000 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 6.7 | 0<br>0.6 | 1.7<br>6 | 7.167 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | `5.5-5.6 | 0<br>8 | 2.9<br>2.4 | 0.001 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | `6.4-6.3 | 0<br>8 | 1.8<br>1.5 | 0.001 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | `5.5-6.3 | 0<br>0.6 | 2.9<br>4.2 | 2.167 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | `6.4-6.8 | 0<br>0.6 | 1.8<br>3.9 | 3.500 | *Chaney et al., 1982* |
| A | Lettuce | Heat-Treated Sludge | `5.3-5.4 | 0<br>8 | 1.8<br>2.4 | 0.075 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Heat-Treated Sludge | `6.2-5.4 | 0<br>8 | 1.6<br>0.8 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | `5.3-5.6 | 0<br>0.6 | 1.8<br>4.5 | 4.500 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | `6.2-6.6 | 0<br>0.6 | 1.6<br>1.6 | 0.001 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Swiss Chard | Heat-Treated Sludge | 5.7 | 0<br>8 | 2.9<br>8.3 | 0.675 | *Chaney et al., 1982* |
| A | Swiss Chard | Heat-Treated Sludge | `6.7-6.8 | 0<br>8 | 1.7<br>1.5 | 0.001 | *Chaney et al., 1982* |
| A | Cabbage | Sludge | 5.9-6.6 | 0<br>8<br>16 | 0.2<br>0.22<br>0.6 | 0.025 | *Keefer et al., 1986.*<br>*Blue Plains sludge.* |
| A | Cabbage | Sludge | 5.9-7.1 | 0<br>1270<br>2540 | 0.2<br>0.22<br>0.26 | 0.001 | *Keefer et al., 1986.*<br>*Huntington sludge.* |
| A | Cabbage | Sludge | 5.9-6.9 | 0<br>2<br>4 | 0.2<br>0.3<br>0.22 | 0.005 | *Keefer et al., 1986.*<br>*Martinsburg sludge.* |

## TABLE C-45 (cont.)

## UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Sludge | 5.9-6.3 | 0 | 0.2 | 0.003 | *Keefer et al., 1986.* |
| | | | | 24 | 0.2 | | *Parkersburg sludge.* |
| | | | | 48 | 0.32 | | |
| A | Cabbage | Sludge | 7.3 | 0 | <0.3 | 0.002 | *Peterson et al., 1989.* |
| | | | | 2.856 | 1.2 | | |
| | | | | 5.712 | 0.5 | | |
| | | | | 11.424 | 0.6 | | |
| A | Lettuce | Sludge | 7.3 | 0 | 2 | 0.001 | *Peterson et al., 1989.* |
| | | | | 2.856 | 2.6 | | |
| | | | | 5.712 | 1.9 | | |
| | | | | 11.424 | 1.8 | | |
| A | Lettuce | Liquid Sludge | 6.5 | 71.4 | 1.3 | 0.023 | *Carlton Smith, 1988.* |
| | | | | 84.7 | 1.6 | | *Mean of 5 years used.* |
| | | | | | | | *Sandy loam.* |
| A | Lettuce | Bed-dried Sludge | 6.5 | 70.3 | 0.9 | 0.001 | *Carlton Smith, 1988.* |
| | | | | 108.5 | 0.9 | | *Mean of 4 years used.* |
| | | | | | | | *Sandy loam.* |
| A | Lettuce | Liquid Sludge | 6.7 | 85.2 | 2.3 | 0.001 | *Carlton Smith, 1988.* |
| | | | | 101.6 | 2.3 | | *Mean of 5 years used.* |
| | | | | | | | *Clay.* |
| A | Lettuce | Bed-dried Sludge | 6.7 | 85.1 | 1.7 | 0.018 | *Carlton Smith, 1988.* |
| | | | | 140.9 | 2.7 | | *Mean of 4 years used.* |
| | | | | | | | *Clay.* |
| A | Lettuce | Liquid Sludge | 8.0 | 23.7 | 1.2 | 0.018 | *Carlton Smith, 1988.* |
| | | | | 40.2 | 1.5 | | *Mean of 5 years used.* |
| | | | | | | | *Calcareous loam.* |
| A | Lettuce | Bed-dried Sludge | 8.0 | 23.9 | 1.3 | 0.012 | *Carlton Smith, 1988.* |
| | | | | 126.9 | 2.5 | | *Mean of 4 years used.* |
| | | | | | | | *Calcareous loam.* |
| A | Cabbage | Liquid Sludge | 6.5 | 71.4 | 4 | 0.053 | *Carlton Smith, 1988.* |
| | | | | 84.7 | 4.7 | | *Mean of 5 years used.* |
| | | | | | | | *Sandy loam.* |
| A | Cabbage | Bed-dried Sludge | 6.5 | 70.3 | 3.9 | 0.001 | *Carlton Smith, 1988.* |
| | | | | 108.5 | 3.6 | | *Mean of 4 years used.* |
| | | | | | | | *Sandy loam.* |
| A | Cabbage | Liquid Sludge | 6.7 | 85.2 | 2 | 0.110 | *Carlton Smith, 1988.* |
| | | | | 101.6 | 3.8 | | *Mean of 5 years used.* |
| | | | | | | | *Clay.* |
| A | Cabbage | Bed-dried Sludge | 6.7 | 85.1 | 2.1 | 0.030 | *Carlton Smith, 1988.* |
| | | | | 140.9 | 3.8 | | *Mean of 4 years used.* |

## TABLE C-45 (cont.)

## UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | *Clay.* |
| A | Cabbage | Liquid Sludge | 8.0 | 23.7<br>40.2 | 0.9<br>1.6 | 0.042 | *Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.* |
| A | Cabbage | Bed-dried Sludge | 8.0 | 23.9<br>126.9 | 1<br>3.2 | 0.021 | *Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.* |
| A | Spinach | Sludge | N.R.(3) | 0<br>9<br>17<br>34<br>43 | 2.9<br>3<br>4.7<br>4.8<br>4.2 | 0.037 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Swiss Chard | Sludge | N.R. | 0<br>9<br>17<br>34<br>43 | 2<br>1.4<br>1.7<br>2.8<br>4 | 0.051 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Romaine | Sludge | 5.75-7.7 | 0<br>3.8 | 1.7<br>0.7 | 0.001 | *Chaney et al., 1982. Limed raw sludge.* |
| A | Romaine | Sludge | 5.75-7.7 | 0<br>3.4 | 1.7<br>0.5 | 0.001 | *Chaney et al., 1982. Digested sludge.* |
| A | Romaine | Sludge | 5.75-7.6 | 0<br>45 | 1.7<br>0.6 | 0.001 | *Chaney et al., 1982. Compost sludge.* |
| A | Romaine | Sludge | 5.75-6.9 | 0<br>45 | 1.7<br>0.6 | 0.001 | *Chaney et al., 1982. Compost sludge.* |
| A | Romaine | Sludge | 5.75-5.8 | 0<br>8.3 | 1.7<br>1.6 | 0.001 | *Chaney et al., 1982. Heat treated sludge.* |
| A | Romaine | Sludge | 5.75-6.1 | 0<br>59 | 1.7<br>3.05 | 0.023 | *Chaney et al., 1982. Nu-Earth.* |
| A | Swiss Chard | Sludge | 5.75-7.7 | 0<br>3.8 | 2.3<br>0.8 | 0.001 | *Chaney et al., 1982. Limed raw sludge.* |
| A | Swiss Chard | Sludge | 5.75-7.6 | 0<br>3.4 | 2.3<br>1.2 | 0.001 | *Chaney et al., 1982. Digested sludge.* |
| A | Swiss Chard | Sludge | 5.75-7.7 | 0<br>45 | 2.3<br>0.8 | 0.001 | *Chaney et al., 1982. Composted sludge.* |
| A | Swiss Chard | Sludge | 5.75-6.9 | 0<br>8.3 | 2.3<br>4.9 | 0.313 | *Chaney et al., 1982. Heat treated sludge.* |

## TABLE C-45 (cont.)

## UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Swiss Chard | Sludge | 5.75-5.8 | 0<br>59 | 2.3<br>8.95 | 0.113 | *Chaney et al., 1982. Nu Earth sludge.* |
| A | Collard Greens | Sludge | 5.75-7.7 | 0<br>3.8 | 5<br>5.6 | 0.158 | *Chaney et al., 1982. Limed raw sludge* |
| A | Collard Greens | Sludge | 5.75-7.6 | 0<br>3.4 | 5<br>6.6 | 0.471 | *Chaney et al., 1982. Digested sludge.* |
| A | Collard Greens | Sludge | 5.75-6.9 | 0<br>45 | 5<br>6.3 | 0.029 | *Chaney et al., 1982. Composted sludge.* |
| A | Collard Greens | Sludge | 5.75-5.8 | 0<br>83 | 5<br>7.2 | 0.027 | *Chaney et al., 1982. Heat treated sludges* |
| A | Collard Greens | Sludge | 5.75-6.1 | 0<br>59 | 5<br>6.15 | 0.019 | *Chaney et al., 1982. Nu Earth sludge.* |
| B | Lettuce | Sludge | N.R. | 0<br>1.3<br>2.6<br>5.2 | 2.1<br>2.5<br>2.2<br>2 | 0.001 | *Hue et al., 1988. Akaka Andept-soil type.* |
| B | Lettuce | Sludge | N.R. | 0<br>1.3<br>2.6<br>5.2 | 5.1<br>6.9<br>7.3<br>5.8 | 0.068 | *Hue et al., 1988. Lualualei Vertisol-soil type.* |
| B | Lettuce | Sludge | N.R. | 0<br>1.3<br>2.6<br>5.2 | 4.8<br>10.4<br>12.4<br>17.2 | 2.251 | *Hue et al., 1988. Wahiawa Oxisol-soil type.* |
| B | Lettuce | Sludge | 6.4 | 0<br>38 | 0.6<br>3 | 0.063 | *Furr et al., 1981.* |
| B | Lettuce | Sludge | 6.9 | 0<br>38 | 0.8<br>1.7 | 0.024 | *Furr et al., 1981.* |
| B | Spinach | Sludge | 6.4 | 0<br>38 | 1<br>3.9 | 0.076 | *Furr et al., 1981.* |
| B | Spinach | Sludge | 6.9 | 0<br>38 | 0.7<br>3 | 0.061 | *Furr et al., 1981.* |

## TABLE C-46

## UPTAKE OF NICKEL BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.6 | 0<br>8<br>16 | 0.24<br>0.26<br>0.18 | 0.001 | *Keefer et al., 1986. Blue Plains sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-7.1 | 0<br>1270<br>2540 | 0.24<br>0.14<br>0.24 | 0.001 | *Keefer et al., 1986. Huntington sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.9 | 0<br>2<br>4 | 0.24<br>0.3<br>0.74 | 0.125 | *Keefer et al., 1986. Martinsburg sludge.* |
| A | Green Bean/ Pod & Seed | Sludge | 5.9-6.3 | 0<br>24<br>48 | 0.24<br>0.3<br>0.48 | 0.005 | *Keefer et al., 1986. Parkersburg sludge.* |
| A | Bean/Grain | Sludge | 7.3 | 0<br>2.856<br>5.712<br>11.424 | 1.5<br>2.3<br>2.1<br>2.7 | 0.09 | *Peterson et al., 1989.* |
| A | Green Bean/ Pod & Seed | Sludge | N.R. | 0<br>9<br>17<br>34<br>43 | 2.1<br>2.8<br>4.4<br>6.1<br>7.1 | 0.119 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Soybean/ Grain | Limed Digested Sludge | 7.3-7.5 | 22.6<br>22.6<br>20.6<br>19.2<br>23.8<br>24.6 | 7.41<br>2<br>8.25<br>7.16<br>10.37<br>7.48 | 0.23 | *Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Limed Raw Sludge | 7.3-7.7 | 22.6<br>22.4<br>23.8<br>22 | 7.41<br>6.27<br>7.29<br>6.42 | 0.502 | *Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Raw Sludge Compost | 6.6-7.3 | 22.6<br>24<br>28.2<br>37.2<br>56.6<br>80 | 7.41<br>8.72<br>6.69<br>7.47<br>6.96<br>4.15 | 0.001 | *Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.* |

## TABLE C-46 (cont.)

## UPTAKE OF NICKEL BY LEGUMES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Soybean/ Grain | Heat Treated Sludge High pH | 5.9-6.0 | 24.6<br>28<br>20.4<br>20.4 | 8.13<br>7.21<br>5.69<br>6.4 | 0.198 | *Chaney et al., 1977. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat Treated Sludge Low pH | 5.3-5.6 | 21.6<br>23.8<br>26<br>25.4 | 6.81<br>9.49<br>7.74<br>7.78 | 0.152 | *Chaney et al., 1977. Chaney's values are means of 3 reps.* |

## TABLE C-47

## UPTAKE OF NICKEL BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Potato/Tuber | Liquid Sludge | 6.5 | 71.4<br>84.7 | 1.5<br>1.7 | 0.015 | *Carlton Smith, 1988. Mean of 5 years used. Sandy loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.5 | 70.3<br>108.5 | 1.5<br>1.7 | 0.005 | *Carlton Smith, 1988. Mean of 4 years used. Sandy loam.* |
| A | Potato/Tuber | Liquid Sludge | 6.7 | 85.2<br>101.6 | 1.2<br>1.7 | 0.03 | *Carlton Smith, 1988. Mean of 5 years used. Clay.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.7 | 85.1<br>140.9 | 1<br>1.4 | 0.007 | *Carlton Smith, 1988. Mean of 4 years used. Clay.* |
| A | Potato/Tuber | Liquid Sludge | 8.0 | 23.7<br>40.2 | 0.6<br>0.6 | 0.001 | *Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 8.0 | 23.9<br>126.9 | 0.7<br>0.8 | 0.001 | *Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.* |
| B | Sweet Potato/ Tuber | Sludge | 6.4 | 0<br>38 | 0.3<br>1.2 | 0.024 | *Furr et al., 1981.* |
| B | Sweet Potato/ Tuber | Sludge | 6.9 | 0<br>38 | 0.1<br>0.5 | 0.011 | *Furr et al., 1981.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 4 | 0.011 | *Harris et al, 1978. Vanessa-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 4.75 | 0.013 | *Harris et al, 1978. Portland Javelin-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 4.25 | 0.012 | *Harris et al, 1978. Home Guard-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 4.01 | 0.011 | *Harris et al, 1978. Desiree-potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 3.47 | 0.009 | *Harris et al, 1978. King Edward-potato type.* |

## TABLE C-47 (cont.)

## UPTAKE OF NICKEL BY POTATOES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 368 | 5.46 | 0.015 | *Harris et al, 1978. Majestic-potato type.* |

## TABLE C-48

## UPTAKE OF NICKEL BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Radish/Tuber | Sludge | 5.9-6.6 | 0 | 0.92 | 0.001 | *Keefer et al., 1986.* |
| | | | | 8 | 1.34 | | *Blue Plains sludge.* |
| | | | | 16 | 0.7 | | |
| A | Carrot/Tuber | Sludge | 5.9-6.6 | 0 | 0.4 | 0.001 | *Keefer et al., 1986.* |
| | | | | 8 | 0.4 | | *Blue Plains sludge.* |
| | | | | 16 | 0.4 | | |
| A | Radish/Tuber | Sludge | 5.9-7.1 | 0 | 0.92 | 0.001 | *Keefer et al., 1986.* |
| | | | | 1270 | 1.08 | | *Huntington sludge.* |
| | | | | 2540 | 1.92 | | |
| A | Carrot/Tuber | Sludge | 5.9-7.1 | 0 | 0.4 | 0.001 | *Keefer et al., 1986.* |
| | | | | 1270 | 0.4 | | *Huntington sludge.* |
| | | | | 2540 | 0.4 | | |
| A | Radish/Tuber | Sludge | 5.9-6.9 | 0 | 0.92 | 0.001 | *Keefer et al., 1986.* |
| | | | | 2 | 0.68 | | *Martinsburg sludge.* |
| | | | | 4 | 0.72 | | |
| A | Carrot/Tuber | Sludge | 5.9-6.9 | 0 | 0.4 | 0.001 | *Keefer et al., 1986.* |
| | | | | 2 | 0.4 | | *Martinsburg sludge.* |
| | | | | 4 | 0.4 | | |
| A | Radish/Tuber | Sludge | 5.9-6.3 | 0 | 0.92 | 0.001 | *Keefer et al., 1986.* |
| | | | | 24 | 0.58 | | *Parkersburg sludge.* |
| | | | | 48 | 0.64 | | |
| A | Carrot/Tuber | Sludge | 5.9-6.3 | 0 | 0.4 | 0.001 | *Keefer et al., 1986.* |
| | | | | 24 | 0.4 | | *Parkersburg sludge.* |
| | | | | 48 | 0.4 | | |
| A | Red Beet/Tuber | Sludge | 6.2 | 0 | 2.5 | 0.004 | *Williams, 1977.* |
| | | | | 285 | 2.5 | | |
| | | | | 570 | 3.8 | | |
| | | | | 1140 | 6.3 | | |
| A | Red Beet/Tuber | Sludge | 7 | 0 | 1.3 | 0.003 | *Williams, 1977.* |
| | | | | 285 | 2.5 | | |
| | | | | 570 | 6.3 | | |
| | | | | 1140 | 5 | | |
| A | Onion/Bulb | Sludge | 6.3 | 0 | 6.3 | 0.031 | *Williams, 1977.* |
| | | | | 285 | 16.3 | | |
| | | | | 570 | 23.8 | | |

## TABLE C-48 (cont.)

## UPTAKE OF NICKEL BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Onion/Bulb | Sludge | 6.8 | 0 | 2.5 | 0.014 | *Williams, 1977.* |
| | | | | 285 | 6.3 | | |
| | | | | 570 | 7.5 | | |
| | | | | 1140 | 18.8 | | |
| A | Onion/Bulb | Sludge | 7.3 | 0 | <0.3 | 0.001 | *Peterson et al., 1989.* |
| | | | | 2.856 | <0.3 | | |
| | | | | 5.712 | <0.3 | | |
| | | | | 11.424 | <0.3 | | |
| A | Red Beet/Tuber | Liquid Sludge | 6.5 | 71.4 | 3.4 | 0.038 | *Carlton Smith, 1988. Mean of 5 years used. Sandy loam.* |
| | | | | 84.7 | 3.9 | | |
| A | Red Beet/Tuber | Bed-dried Sludge | 6.5 | 70.3 | 2.2 | 0.013 | *Carlton Smith, 1988. Mean of 4 years used. Sandy loam.* |
| | | | | 108.5 | 2.7 | | |
| A | Red Beet/Tuber | Liquid Sludge | 6.7 | 85.2 | 1.6 | 0.067 | *Carlton Smith, 1988. Mean of 5 years used. Clay.* |
| | | | | 101.6 | 2.7 | | |
| A | Red Beet/Tuber | Bed-dried Sludge | 6.7 | 85.1 | 1.6 | 0.007 | *Carlton Smith, 1988. Mean of 4 years used. Clay.* |
| | | | | 140.9 | 2 | | |
| A | Red Beet/Tuber | Liquid Sludge | 8.0 | 23.7 | 1 | 0.001 | *Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.* |
| | | | | 40.2 | 1 | | |
| A | Red Beet/Tuber | Bed-dried Sludge | 8.0 | 23.9 | 1.1 | 0.001 | *Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.* |
| | | | | 126.9 | 1.1 | | |
| A | Beet/Tuber | Sludge | N.R. | 0 | 0.4 | 0.027 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth* |
| | | | | 9 | 0.6 | | |
| | | | | 17 | 0.6 | | |
| | | | | 34 | 0.9 | | |
| | | | | 43 | 1.6 | | |
| A | Carrot/Tuber | Sludge | N.R. | 0 | 1.1 | 0.036 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| | | | | 9 | 0.9 | | |
| | | | | 17 | 1.5 | | |
| | | | | 34 | 1.7 | | |
| | | | | 43 | 2.7 | | |
| B | Kohlrabi/Tuber | Sludge | 6.4 | 0 | 0.9 | 0.116 | *Furr et al., 1981.* |
| | | | | 38 | 5.3 | | |

## TABLE C-48 (cont.)

## UPTAKE OF NICKEL BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Kohlrabi/Tuber | Sludge | 6.9 | 0<br>38 | 0.2<br>1.1 | 0.024 | *Furr et al., 1981.* |
| B | Turnip/Tuber | Sludge | 6.4 | 0<br>38 | 0.7<br>3 | 0.061 | *Furr et al., 1981.* |
| B | Turnip/Tuber | Sludge | 6.9 | 0<br>38 | 0.2<br>0.9 | 0.018 | *Furr et al., 1981.* |

## TABLE C-49

## UPTAKE OF NICKEL BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Grain | Sludge | 5.9-6.6 | 0 | 0.17 | 0.001 | *Keefer et al., 1986.* |
| | | | | 8 | 0.52 | | *Blue Plains sludge.* |
| | | | | 16 | 0.1 | | |
| A | Sweet Corn/ Grain | Sludge | 5.9-7.1 | 0 | 0.17 | 0.001 | *Keefer et al., 1986.* |
| | | | | 1270 | 0.14 | | *Huntington sludge.* |
| | | | | 2540 | 0.42 | | |
| A | Sweet Corn | Sludge | 5.9-6.9 | 0 | 0.17 | 0.001 | *Keefer et al., 1986.* |
| | | | | 2 | 0.12 | | *Martinsburg sludge.* |
| | | | | 4 | 0.14 | | |
| A | Sweet Corn/ Grain | Sludge | 5.9-6.3 | 0 | 0.17 | 0.001 | *Keefer et al., 1986.* |
| | | | | 24 | 0.32 | | *Parkersburg sludge.* |
| | | | | 48 | 0.12 | | |

## TABLE C-50

## UPTAKE OF SELENIUM BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Barley | Sludge | 5.8-7.0 | 0<br>3.64 | <0.05<br>0.08 | 0.008 | *Logan et al., 1987. Greenfield.* |
| A | Barley | Sludge | 7 | 0<br>3.6 | 0.06<br>0.05 | 0.001 | *Logan et al., 1987. Domino.* |
| B | Millet | Sludge | 6.8 | 0<br>1.446 | 0.04<br>0.06 | 0.014 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Millet | Sludge | 5.5 | 0<br>1.111 | 0.03<br>0.03 | 0.001 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |

## TABLE C-51

## UPTAKE OF SELENIUM BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Broccoli/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.016<br>0.026 | 0.013 | Cappon, C.T. 1981. |
| A | Cauliflower | Sludge | 6.8 | 0<br>0.7804 | 0.025<br>0.0348 | 0.012 | Cappon, C.T. 1981. |
| A | Cucumber/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.006<br>0.0102 | 0.006 | Cappon, C.T. 1981. Slicing cucumber. |
| A | Cucumber/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.005<br>0.0076 | 0.004 | Cappon, C.T. 1981. Pickling cucumber. |
| A | Pumpkin/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.012<br>0.0183 | 0.008 | Cappon, C.T. 1981. |
| A | Tomato/Fruit | Sludge | 6.8 | 0<br>0.7804 | 0.026<br>0.0564 | 0.039 | Cappon, C.T. 1981. |
| B | Tomato/Tuber | Sludge | 6.8 | 0<br>1.446 | 0.03<br>0.08 | 0.035 | Furr et al, 1980. Kalamazoo sludge/ Teel soil. |
| B | Tomato/Fruit | Sludge | 5.5 | 0<br>1.111 | 0.01<br>0.02 | 0.009 | Furr et al, 1980. Indianapolis sludge/ Darien Soil. |

## TABLE C-52

## UPTAKE OF SELENIUM BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Barley/Grain | Sludge | 5.8-7.0 | 0<br>3.6 | 0.05<br>0.05 | 0.001 | *Logan et al., 1987. Greenfield.* |
| A | Barley/Grain | Sludge | 7 | 0<br>3.6 | <0.05<br><0.05 | 0.001 | *Logan et al., 1987. Domino.* |
| B | Millet/Grain | Sludge | 6.8 | 0<br>1.446 | 0.03<br>0.11 | 0.055 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Millet/Grain | Sludge | 5.5 | 0<br>1.111 | 0.02<br>0.03 | 0.009 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |

## TABLE C-53

## UPTAKE OF SELENIUM BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Swiss Chard | Sludge | 6.1-7.8 | 0<br>4.17<br>8.34 | 0.06<br>0.08<br>0.08 | 0.002 | *Logan et al., 1987. Romona.* |
| A | Cabbage | Sludge | 6.8 | 0<br>0.7804 | 0.0120<br>0.0348 | 0.029 | *Cappon, C.T. 1981.* |
| A | Lettuce | Sludge | 6.8 | 0<br>0.7804 | 0.0150<br>0.0234 | 0.011 | *Cappon, C.T. 1981.* |
| A | Lettuce | Sludge | 6.8 | 0<br>0.7804 | 0.0121<br>0.0414 | 0.038 | *Cappon, C.T. 1981.* |
| A | Parsley | Sludge | 6.8 | 0<br>0.7804 | 0.0048<br>0.0043 | 0.001 | *Cappon, C.T. 1981.* |
| B | Cabbage | Sludge | 6.8 | 0<br>1.446 | 0.07<br>0.1 | 0.021 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Cabbage | Sludge | 5.5 | 0<br>1.111 | 0.03<br>0.03 | 0.001 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |

## TABLE C-54

## UPTAKE OF SELENIUM BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Bush Bean/ Pod | Sludge | 6.8 | 0<br>0.7804 | 0.0084<br>0.0174 | 0.012 | *Cappon, C.T. 1981.* |
| A | Bush Bean/ Seed | Sludge | 6.8 | 0<br>0.7804 | 0.0012<br>0.0110 | 0.013 | *Cappon, C.T. 1981.* |
| B | Bean/ Grain | Sludge | 5.5 | 0<br>1.111 | 0.02<br>0.05 | 0.027 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |
| B | Bean/ Grain | Sludge | 6.8 | 0<br>1.446 | 0.04<br>0.12 | 0.055 | *Furr et al, 1980. Kalamazoo sludge/ Teel Soil.* |

## TABLE C-55

## UPTAKE OF SELENIUM BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| B | Potato/Tuber | Sludge | 6.8 | 0<br>1.446 | 0.03<br>0.1 | 0.048 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Potato/Tuber | Sludge | 5.5 | 0<br>1.111 | 0.01<br>0.02 | 0.009 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |

## TABLE C-56

## UPTAKE OF SELENIUM BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Radish/Tuber | Sludge | 6.1-7.8 | 0<br>4.17<br>8.34 | 0.2<br>0.21<br>0.22 | 0.002 | *Logan et al., 1987. Romona.* |
| A | Beet/Tuber | Sludge | 6.8 | 0<br>0.7804 | 0.0033<br>0.0078 | 0.006 | *Cappon, C.T. 1981.* |
| A | Onion/Bulb | Sludge | 6.8 | 0<br>0.7804 | 0.0273<br>0.0467 | 0.025 | *Cappon, C.T. 1981.* |
| A | Radish/Tuber | Sludge | 6.8 | 0<br>0.7804 | 0.0271<br>0.0565 | 0.038 | *Cappon, C.T. 1981.* |
| B | Carrot/Tuber | Sludge | 6.8 | 0<br>1.446 | 0.04<br>0.11 | 0.048 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Onion/Bulb | Sludge | 6.8 | 0<br>1.446 | 0.02<br>0.08 | 0.042 | *Furr et al, 1980. Kalamazoo sludge/ Teel soil.* |
| B | Carrot/Tuber | Sludge | 5.5 | 0<br>1.111 | 0.02<br>0.03 | 0.009 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |
| B | Onion/Bulb | Sludge | 5.5 | 0<br>1.111 | 0.01<br>0.02 | 0.009 | *Furr et al, 1980. Indianapolis sludge/ Darien Soil.* |

## TABLE C-57

## UPTAKE OF ZINC BY FORAGE

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Natural Forage | Sludge | N.R. | 45.5 | 11.7 | 1.412 | *Baxter et al., 1983* |
| | | | | 90.9 | 75.8 | | *Means reported* |
| A | Barley | Sludge compost | 7.2-7.5 | 0 | 20.3 | 0.031 | *Chang et al, 1983.* |
| | | | | 80 | 23.5 | | *Domino loam.* |
| | | | | 160 | 29 | | *1976.* |
| | | | | 320 | 30 | | |
| A | Barley | Sludge compost | 7.0-7.1 | 0 | 14.2 | 0.038 | *Chang et al, 1983.* |
| | | | | 160 | 20 | | *Domino loam.* |
| | | | | 320 | 22.5 | | *1977.* |
| | | | | 640 | 30.2 | | |
| A | Barley | Sludge compost | 7.1-7.3 | 0 | 17.9 | 0.027 | *Chang et al, 1983.* |
| | | | | 240 | 17.1 | | *Domino loam.* |
| | | | | 480 | 20.4 | | *1978.* |
| | | | | 960 | 43 | | |
| A | Barley | Sludge compost | 6.8-7.1 | 0 | 23.3 | 0.021 | *Chang et al, 1983.* |
| | | | | 320 | 29.2 | | *Domino loam.* |
| | | | | 640 | 27.6 | | *1979.* |
| | | | | 1280 | 51 | | |
| A | Barley | Sludge compost | 6.6-7.2 | 0 | 21.1 | 0.008 | *Chang et al, 1983.* |
| | | | | 500 | 25.9 | | *Domino loam.* |
| | | | | 800 | 31.6 | | *1980.* |
| | | | | 1600 | 33.6 | | |
| A | Barley | Sludge compost | 6.4-7.1 | 0 | 20.7 | 0.010 | *Chang et al, 1983.* |
| | | | | 480 | 15.6 | | *Domino loam.* |
| | | | | 960 | 29.5 | | *1981.* |
| | | | | 1920 | 40.7 | | |
| A | Barley | Liquid sludge | 5.3-6.1 | 0 | 16.5 | 0.108 | *Chang et al, 1983.* |
| | | | | 67.7 | 28.8 | | *Domino loam.* |
| | | | | 130.4 | 31.8 | | *1977.* |
| | | | | 252.4 | 48.8 | | |
| A | Barley | Liquid sludge | 5.3-5.8 | 0 | 18.4 | 0.014 | *Chang et al, 1983.* |
| | | | | 135.4 | 41.5 | | *Domino loam.* |
| | | | | 440.8 | 29.2 | | *1978.* |
| | | | | 504.8 | 34.6 | | |
| A | Barley | Liquid sludge | 5.6-6.6 | 0 | 16.1 | 0.033 | *Chang et al, 1983.* |
| | | | | 203.1 | 25 | | *Domino loam.* |
| | | | | 391.2 | 34.3 | | *1979.* |
| | | | | 757.2 | 41.2 | | |

## TABLE C-57 (cont.)

## UPTAKE OF ZINC BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Barley | Liquid sludge | 5.8-6.8 | 0 | 20.1 | 0.018 | *Chang et al, 1983. Domino loam. 1980.* |
| | | | | 270.8 | 29.9 | | |
| | | | | 521.6 | 46.8 | | |
| | | | | 1009.6 | 37.9 | | |
| A | Barley | Liquid sludge | 5.8-6.9 | 0 | 24.6 | 0.019 | *Chang et al, 1983. Domino loam. 1981.* |
| | | | | 338.5 | 37.9 | | |
| | | | | 652 | 41.4 | | |
| | | | | 1262 | 51.4 | | |
| A | Barley | Sludge composted | 7.2-7.5 | 0 | 16.3 | 0.034 | *Chang et al, 1983. Greenfield sandy loam. 1976.* |
| | | | | 80 | 19.4 | | |
| | | | | 160 | 19.8 | | |
| | | | | 320 | 27.5 | | |
| A | Barley | Sludge composted | 7.0-7.1 | 0 | 12.5 | 0.016 | *Chang et al, 1983. Greenfield sandy loam. 1977.* |
| | | | | 160 | 21.8 | | |
| | | | | 320 | 22.8 | | |
| | | | | 640 | 24.5 | | |
| A | Barley | Sludge composted | 7.1-7.3 | 0 | 25 | 0.014 | *Chang et al, 1983. Greenfield sandy loam. 1978.* |
| | | | | 240 | 23 | | |
| | | | | 480 | 33.4 | | |
| | | | | 960 | 36.5 | | |
| A | Barley | Sludge composted | 6.8-7.1 | 0 | 21.2 | 0.013 | *Chang et al, 1983. Greenfield sandy loam. 1979.* |
| | | | | 320 | 31.5 | | |
| | | | | 640 | 33 | | |
| | | | | 1280 | 39.4 | | |
| A | Barley | Sludge composted | 6.6-7.2 | 0 | 17.8 | 0.013 | *Chang et al, 1983. Greenfield sandy loam. 1980.* |
| | | | | 500 | 31.5 | | |
| | | | | 800 | 33 | | |
| | | | | 1600 | 39.4 | | |
| A | Barley | Sludge composted | 6.4-7.1 | 0 | 22.4 | 0.017 | *Chang et al, 1983. Greenfield sandy loam. 1981.* |
| | | | | 580 | 47.1 | | |
| | | | | 960 | 55.9 | | |
| | | | | 1920 | 57.3 | | |
| A | Barley | Liquid sludge | 5.3-6.1 | 0 | 26.1 | 0.117 | *Chang et al, 1983. Greenfield sandy loam. 1977.* |
| | | | | 66.8 | 31 | | |
| | | | | 132.5 | 49.5 | | |
| | | | | 248.7 | 53 | | |
| A | Barley | Liquid sludge | 5.3-6.2 | 0 | 19.6 | 0.072 | *Chang et al, 1983. Greenfield sandy loam. 1978.* |
| | | | | 133.6 | 35.3 | | |
| | | | | 265 | 57.3 | | |
| | | | | 497.4 | 49.6 | | |

## TABLE C-57 (cont.)

## UPTAKE OF ZINC BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Barley | Liquid sludge | 5.6-6.6 | 0 | 18.4 | 0.031 | *Chang et al, 1983.* |
| | | | | 200.4 | 32.1 | | *Greenfield sandy loam.* |
| | | | | 397.5 | 35.2 | | *1979.* |
| | | | | 746.1 | 43.7 | | |
| A | Barley | Liquid sludge | 5.8-6.8 | 0 | 18.4 | 0.024 | *Chang et al, 1983.* |
| | | | | 267.2 | 32.1 | | *Greenfield sandy loam.* |
| | | | | 530 | 35.2 | | *1980.* |
| | | | | 994.8 | 43.7 | | |
| A | Barley | Liquid sludge | 5.5-6.9 | 0 | 20.9 | 0.047 | *Chang et al, 1983.* |
| | | | | 334 | 43.2 | | *Greenfield sandy loam.* |
| | | | | 662.5 | 50.6 | | *1981.* |
| | | | | 1243.5 | 81.9 | | |
| A | Corn/Leaf | Sludge | 7.4 | 0 | 14.5 | 0.084 | *Hinesly et al, 1982.* |
| | | | | 432 | 39.9 | | *1978.* |
| | | | | 770 | 61.3 | | |
| | | | | 1204 | 118 | | |
| A | Corn | Sludge | 7.4 | 0 | 6.12 | 0.153 | *Hinesly et al, 1982.* |
| | | | | 432 | 32.9 | | *1978.* |
| | | | | 770 | 79.3 | | |
| | | | | 1204 | 192 | | |
| A | Corn/Leaf | Sludge | 7.4 | 0 | 14.8 | 0.201 | *Hinesly et al, 1982.* |
| | | | | | | | *1979.* |
| | | | | 200 | 75 | | |
| | | | | 390 | 73 | | |
| | | | | 606 | 139 | | |
| A | Corn | Sludge | 7.4 | 0 | 5.47 | 0.305 | *Hinesly et al, 1982.* |
| | | | | 200 | 36.5 | | *1979.* |
| | | | | 390 | 93.2 | | |
| | | | | 606 | 190 | | |
| A | Corn/Leaf | Sludge | 7.4 | 0 | 13.7 | 0.217 | *Hinesly et al, 1982.* |
| | | | | 268 | 49.2 | | *1980.* |
| | | | | 321 | 76 | | |
| | | | | 537 | 130 | | |
| A | Corn | Sludge | 7.4 | 0 | 10.4 | 0.245 | *Hinesly et al, 1982.* |
| | | | | 268 | 51.7 | | *1980.* |
| | | | | 321 | 109 | | |
| | | | | 537 | 204 | | |

## TABLE C-57 (cont.)

## UPTAKE OF ZINC BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 22<br>79<br>186<br>293 | 0.576 | *Dowdy & Larson, 1975.* |
| A | Corn | Sludge | 5.9-6.0 | 0<br>124<br>248 | 21<br>18<br>28 | 0.028 | *Rappaport et al, 1987. Year 1 (1984).* |
| A | Corn | Sludge | 5.9-6.0 | 0<br>124<br>248 | 14<br>50<br>53 | 0.157 | *Rappaport et al, 1987. Year 1 (1984).* |
| A | Corn | Sludge | 5.9-6.0 | 0<br>124<br>248 | 14<br>27<br>31 | 0.069 | *Rappaport et al, 1987. Year 2 (1985).* |
| A | Corn | Sludge | 5.9-6.0 | 0<br>124<br>248 | 10<br>37<br>45 | 0.141 | *Rappaport et al, 1987. Year 2 (1985).* |
| A | Corn | Sludge | 5.7 | 0<br>81 | 28<br>36 | 0.099 | *Hemphill et al, 1982. Portland sludge.* |
| A | Corn | Sludge | 5.7 | 0<br>35 | 28<br>29 | 0.029 | *Hemphill et al, 1982. Rockcreek sludge.* |
| A | Corn | Sludge | 5.7 | 0<br>30 | 28<br>25 | 0.001 | *Hemphill et al, 1982. Salem sludge.* |
| A | Ryegrass | Liquid sludge | 6.5 | 232<br>395 | 25<br>68 | 0.264 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Ryegrass | Bed-dried Sludge | 6.5 | 232<br>606 | 24<br>58 | 0.091 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Ryegrass | Liquid sludge | 6.7 | 276<br>494 | 29<br>70 | 0.188 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Ryegrass | Bed-dried Sludge | 6.7 | 276<br>702 | 28<br>59 | 0.073 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Ryegrass | Liquid sludge | 8.0 | 138<br>292 | 35<br>54 | 0.123 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |

## TABLE C-57 (cont.)

## UPTAKE OF ZINC BY FORAGE (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Ryegrass | Bed-dried Sludge | 8.0 | 138<br>776 | 34<br>73 | 0.061 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Barley/Leaf | Sludge | 6.2-6.4 | 0<br>480 | 18.6<br>15.5 | 0.001 | *Sommers et al, 1991. Ohio data used.* |

## TABLE C-58

## UPTAKE OF ZINC BY GARDEN FRUITS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Squash/Fruit | Sludge | 5.1-6.0 | 0<br>403 | 19<br>21 | 0.005 | *Giordano et al, 1979. Year 1 (1975).* |
| A | Pepper/Fruit | Sludge | 5.1-6.0 | 0<br>403 | 36<br>45 | 0.022 | *Giordano et al, 1979. Year 1 (1975).* |
| A | Broccoli/Fruit | Sludge | 4.7-6.2 | 0<br>403 | 87<br>99 | 0.030 | *Giordano et al, 1979. Year 2 (1976).* |
| A | Eggplant/Fruit | Sludge | 4.7-6.2 | 0<br>403 | 15<br>22 | 0.017 | *Giordano et al, 1979. Year 2 (1976).* |
| A | Tomato/Fruit | Sludge | 4.7-6.2 | 0<br>403 | 26<br>40 | 0.035 | *Giordano et al, 1979. Year 2 (1976).* |
| A | Cantaloupe/ Fruit | Sludge | 4.6-6.7 | 0<br>403 | 18<br>25 | 0.017 | *Giordano et al, 1979. Year 3 (1977).* |
| A | Pepper/Fruit | Sludge | 4.6-6.7 | 0<br>403 | 29<br>33 | 0.010 | *Giordano et al, 1979. Year 3 (1977).* |
| A | Pea/Grain | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 70<br>106<br>105<br>130 | 0.111 | *Dowdy & Larson, 1975.* |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 9<br>18<br>22<br>31 | 0.044 | *Dowdy & Larson, 1975.* |
| A | Pea/Pod | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 28<br>95<br>106<br>134 | 0.197 | *Dowdy & Larson, 1975.* |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 0<br>81<br>162 | 42<br>59<br>52 | 0.062 | *Keefer et al, 1986. Blue Plains sludge. Early fruiting.* |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 0<br>81<br>162 | 38<br>51<br>47 | 0.056 | *Keefer et al, 1986. Blue Plains sludge. Late fruiting.* |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 0<br>238<br>476 | 42<br>60<br>65 | 0.048 | *Keefer et al, 1986. Huntington sludge. Early fruiting.* |

## TABLE C-58 (cont.)

## UPTAKE OF ZINC BY GARDEN FRUITS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 0 | 38 | 0.048 | *Keefer et al, 1986.* |
| | | | | 238 | 48 | | *Huntington sludge.* |
| | | | | 476 | 46 | | *Late fruiting.* |
| | | | | 0 | 42 | | |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 176 | 44 | 0.004 | *Keefer et al, 1986.* |
| | | | | 352 | 46 | | *Martinsburg sludge.* |
| | | | | | | | *Early fruiting.* |
| | | | | 0 | 38 | | |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 176 | 47 | 0.026 | *Keefer et al, 1986.* |
| | | | | 352 | 47 | | *Martinsburg sludge.* |
| | | | | | | | *Late fruiting.* |
| | | | | 0 | 42 | | |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 63 | 52 | 0.127 | *Keefer et al, 1986.* |
| | | | | 126 | 58 | | *Parkersburg sludge.* |
| | | | | | | | *Early fruiting.* |
| | | | | 0 | 38 | | |
| A | Tomato/Fruit | Sludge | 5.3-6.5 | 63 | 48 | 0.063 | *Keefer et al, 1986.* |
| | | | | 126 | 46 | | *Parkersburg sludge.* |
| | | | | | | | *Late fruiting.* |
| | | | | 0 | 26 | | |
| A | Celery | Sludge | 7.3 | 36 | 45 | 0.001 | *Peterson et al, 1989.* |
| | | | | 71 | 31 | | |
| | | | | 143 | 31 | | |
| | | | | 0 | 31 | | |
| A | Tomato/Fruit | Sludge | 7.3 | 36 | 30 | 0.001 | *Peterson et al, 1989.* |
| | | | | 71 | 31 | | |
| | | | | 143 | 28 | | |
| | | | | 0 | 36 | | |
| A | Tomato/Fruit | Sludge | N.R. | 66 | 38 | 0.020 | *Lue-Hing et al, 1984.* |
| | | | | 132 | 38 | | *1977 data used.* |
| | | | | 265 | 43 | | *Nu-Earth.* |
| | | | | 331 | 42 | | |

## TABLE C-59

## UPTAKE OF ZINC BY GRAINS/CEREALS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Corn/Grain | Sludge | 7.4 | 0<br>432<br>770<br>1204 | 19.5<br>26.3<br>31.2<br>38 | 0.015 | *Hinesly et al, 1982. 1978.* |
| A | Corn/Grain | Sludge | 7.4 | 0<br>200<br>390<br>606 | 12.8<br>21<br>31.2<br>27.1 | 0.026 | *Hinesly et al, 1982. 1979.* |
| A | Corn/Grain | Sludge | 7.4 | 0<br>268<br>321<br>537 | 15.4<br>23.5<br>29.4<br>37.4 | 0.041 | *Hinesly et al, 1982. 1980.* |
| A | Corn/Grain | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 41<br>47<br>48<br>65 | 0.049 | *Dowdy & Larson, 1975.* |
| A | Corn/Grain | Sludge | 5.9-6.0 | 0<br>124<br>248 | 30<br>40<br>36 | 0.024 | *Rappaport et al, 1987. Year 1 (1984).* |
| A | Corn/Grain | Sludge | 5.9-6.0 | 0<br>124<br>248 | 17<br>28<br>26 | 0.036 | *Rappaport et al, 1987. Year 2 (1985).* |
| A | Wheat/Grain | Liquid sludge | 6.5 | 232<br>395 | 29<br>59 | 0.184 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.5 | 232<br>606 | 30<br>62 | 0.86 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Wheat/Grain | Liquid sludge | 6.7 | 276<br>494 | 32<br>54 | 0.101 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Wheat/Grain | Bed-dried Sludge | 6.7 | 276<br>702 | 31<br>55 | 0.056 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Wheat/Grain | Liquid sludge | 8.0 | 138<br>292 | 38<br>49 | 0.071 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |

## TABLE C-59 (cont.)

## UPTAKE OF ZINC BY GRAINS/CEREALS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Wheat/Grain | Bed-dried Sludge | 8.0 | 138<br>776 | 40<br>61 | 0.033 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Barley/Grain | Sludge | 6.2-6.4 | 0<br>480 | 19.9<br>0.008 | 0.008 | *Sommers et al, 1991. Ohio data used.* |

## TABLE C-60

## UPTAKE OF ZINC BY LEAFY VEGETABLES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Heat-Treated Sludge | 5.3-5.4 | 0<br>297 | 76<br>225 | 0.502 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Heat-Treated Sludge | 6.2 | 0<br>297 | 39<br>67 | 0.094 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 5.3-5.6 | 0<br>414 | 76<br>242 | 0.401 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Lettuce | Nu-Earth | 6.2-6.6 | 0<br>414 | 39<br>74 | 0.085 | *Chaney et al., 1982*<br>*Romaine Lettuce* |
| A | Swiss Chard | Heat-Treated Sludge | 5.7 | 0<br>297 | 97<br>420 | 1.088 | *Chaney et al., 1982* |
| A | Swiss Chard | Heat-Treated Sludge | 6.7-6.8 | 0<br>297 | 38<br>115 | 0.259 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 5.7 | 0<br>414 | 97<br>420 | 0.78 | *Chaney et al., 1982* |
| A | Swiss Chard | Nu-Earth | 6.7-6.8 | 0<br>414 | 38<br>115 | 0.186 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 5.5-5.6 | 0<br>297 | 47<br>170 | 0.414 | *Chaney et al., 1982* |
| A | Collard Greens | Heat-Treated Sludge | 6.3-6.4 | 0<br>297 | 37<br>74 | 0.125 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 5.5-6.3 | 0<br>414 | 47<br>88 | 0.099 | *Chaney et al., 1982* |
| A | Collard Greens | Nu-Earth | 6.4-6.8 | 0<br>414 | 37<br>75 | 0.092 | *Chaney et al., 1982* |
| A | Lettuce | Sludge | 6.0 | 0<br>305.8 | 47<br>419 | 1.216 | *Chaney et al., 1978*<br>*Romaine Lettuce* |
| A | Lettuce | Sludge | 6.0 | 0<br>301.3 | 47<br>307 | 0.863 | *Chaney et al., 1978*<br>*Romaine Lettuce* |
| A | Lettuce | Sludge | 6.0 | 0<br>208.3 | 47<br>75 | 0.134 | *Chaney et al., 1978*<br>*Romaine Lettuce* |
| A | Lettuce | Sludge | 6.0 | 0<br>79.5 | 47<br>187 | 1.761 | *Chaney et al., 1978*<br>*Romaine Lettuce* |

## TABLE C-60 (cont.)

## UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Lettuce | Sludge | 6.0 | 0<br>72.2 | 47<br>209 | 2.244 | *Chaney et al., 1978*<br>*Romaine Lettuce* |
| A | Lettuce | Sludge | 5.1-6.0 | 0<br>403 | 54<br>131 | 0.191 | *Giordano et al, 1979.*<br>*Year 1 (1975).*<br>*Great Lakes lettuce.* |
| A | Lettuce | Sludge | 4.7-6.2 | 0<br>403 | 48<br>74 | 0.065 | *Giordano et al, 1979.*<br>*Year 2 (1976).*<br>*Great Lakes lettuce.* |
| A | Lettuce | Sludge | 4.6-6.7 | 0<br>403 | 46<br>103 | 0.141 | *Giordano et al, 1979.*<br>*Year 3 (1977).*<br>*Bibb lettuce.* |
| A | Lettuce | Sludge | 4.6-6.7 | 0<br>403 | 35<br>53 | 0.045 | *Giordano et al, 1979.*<br>*Year 3 (1977).*<br>*Romaine lettuce.* |
| A | Lettuce | Sludge | 4.6-6.7 | 0<br>403 | 29<br>116 | 0.216 | *Giordano et al, 1979.*<br>*Year 3 (1977).*<br>*Boston lettuce.* |
| A | Cabbage | Sludge | 4.6-6.7 | 0<br>403 | 48<br>59 | 0.027 | *Giordano et al, 1979.*<br>*Year 3 (1977).* |
| A | Lettuce | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 21<br>94<br>155<br>225 | 0.415 | *Dowdy & Larson, 1975* |
| A | Cabbage | Sludge | 5.3-6.5 | 0<br>81<br>162 | 27<br>28<br>28 | 0.006 | *Keefer et al, 1986.*<br>*Blue Plains sludge.* |
| A | Cabbage | Sludge | 5.3-6.5 | 0<br>238<br>476 | 27<br>26<br>26 | 0.001 | *Keefer et al, 1986.*<br>*Huntington sludge.* |
| A | Cabbage | Sludge | 5.3-6.5 | 0<br>176<br>352 | 27<br>35<br>33 | 0.017 | *Keefer et al, 1986.*<br>*Martinsburg sludge.* |
| A | Cabbage | Sludge | 5.3-6.5 | 0<br>63<br>126 | 27<br>41<br>51 | 0.19 | *Keefer et al, 1986.*<br>*Parkersburg sludge.* |

## TABLE C-60 (cont.)

## UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Turnip/Greens | Sludge | 5.2-5.8 | 0<br>170<br>340 | 83<br>346<br>421 | 0.994 | *Miller & Boswell, 1979.* |
| A | Cabbage | Sludge | 7.3 | 0<br>36<br>71<br>143 | 30<br>33<br>32<br>32 | 0.009 | *Peterson et al, 1989.* |
| A | Lettuce | Sludge | 7.3 | 0<br>36<br>71<br>143 | 85<br>108<br>85<br>98 | 0.039 | *Peterson et al, 1989.* |
| A | Lettuce | Liquid sludge | 6.5 | 232<br>395 | 59<br>103 | 0.27 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Lettuce | Bed-dried Sludge | 6.5 | 232<br>606 | 57<br>91 | 0.091 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Lettuce | Liquid sludge | 6.7 | 276<br>484 | 80<br>135 | 0.252 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Lettuce | Bed-dried Sludge | 6.7 | 276<br>702 | 75<br>106 | 0.073 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Lettuce | Liquid sludge | 8.0 | 138<br>292 | 64<br>74 | 0.065 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Lettuce | Bed-dried Sludge | 8.0 | 138<br>776 | 67<br>80 | 0.02 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Cabbage | Liquid sludge | 6.5 | 232<br>395 | 395<br>36 | 0.067 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Cabbage | Bed-dried Sludge | 6.5 | 232<br>606 | 26<br>38 | 0.032 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |

## TABLE C-60 (cont.)

## UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Cabbage | Liquid sludge | 6.7 | 276<br>494 | 23<br>41 | 0.083 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Cabbage | Bed-dried Sludge | 6.7 | 276<br>702 | 21<br>38 | 0.04 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Cabbage | Liquid sludge | 8.0 | 138<br>292 | 2<br>32 | 0.045 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Cabbage | Bed-dried Sludge | 8.0 | 138<br>776 | 25<br>48 | 0.036 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Spinach | Sludge | N.R.(3) | 0<br>66<br>132<br>265<br>331 | 166<br>310<br>523<br>358<br>365 | 0.487 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Swiss Chard | Sludge | N.R. | 0<br>66<br>132<br>265<br>331 | 78<br>148<br>234<br>141<br>225 | 0.283 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |

## TABLE C-61

## UPTAKE OF ZINC BY LEGUMES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Bean/Pod | Sludge | 5.1-6.0 | 0<br>403 | 31<br>51 | 0.05 | *Giordano et al, 1979. Year 1 (1975).* |
| A | Bean/Grain | Sludge | 5.1-6.0 | 0<br>403 | 64<br>73 | 0.022 | *Giordano et al, 1979. Year 1 (1975).* |
| A | Green Bean/ Grain | Sludge | 5.3-6.5 | 0<br>81<br>162 | 39<br>35<br>38 | 0.001 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Green Bean/ Grain | Sludge | 5.3-6.5 | 0<br>476<br>238 | 39<br>47<br>35 | 0.017 | *Keefer et al, 1986.* |
| A | Green Bean/ Grain | Sludge | 5.3-6.5 | 0<br>176<br>352 | 39<br>42<br>44 | 0.014 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Green Bean/ Grain | Sludge | 5.3-6.5 | 0<br>63<br>126 | 39<br>42<br>42 | 0.024 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Green Bean/ Grain | Sludge | 7.3 | 0<br>36<br>71<br>143 | 38<br>52<br>49<br>44 | 0.018 | *Peterson et al, 1989.* |
| A | Green Bean/ Pod & Seed | Sludge | N.R. | 0<br>66<br>132<br>265<br>331 | 34<br>36<br>38<br>36<br>37 | 0.006 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Soybean/ Grain | Limed digested sludge | 7.3-7.5 | 70.6<br>107.4<br>87.2<br>132.4<br>179.2<br>225.2 | 39.5<br>43.5<br>43.1<br>40.4<br>43.9<br>44.1 | 0.02 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Limed raw sludge | 7.3-7.7 | 70.6<br>95.8<br>95<br>151.8 | 39.5<br>42.3<br>42.2<br>42.4 | 0.027 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |

## TABLE C-61 (cont.)

## UPTAKE OF ZINC BY LEGUMES (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Soybean/ Grain | Raw sludge compost | 6.6-7.3 | 70.6<br>101.4<br>125.4<br>196.4<br>318.8<br>525.6 | 39.5<br>44.8<br>44.1<br>47.5<br>45.9<br>54.5 | 0.026 | *Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge High pH | 5.9-6.0 | 75.2<br>150.2<br>170.4<br>298.4 | 44<br>48.5<br>52<br>56.5 | 0.055 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |
| A | Soybean/ Grain | Heat treated sludge Low pH | 5.3-5.6 | 78.2<br>144.6<br>176<br>325 | 44.8<br>57<br>51.6<br>55.3 | 0.032 | *Chaney et al, 1977. Chaney's values are means of 3 reps.* |

## TABLE C-62

## UPTAKE OF ZINC BY POTATOES

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Potato/Tuber | Sludge | 4.7-6.2 | 0<br>403 | 16<br>19 | 0.007 | *Giordano et al, 1979. Year 2 (1976).* |
| A | Potato/Tuber | Sludge | 5.3-6.5 | 0<br>120<br>241<br>482 | 24<br>31<br>41<br>53 | 0.061 | *Dowdy & Larson, 1975.* |
| A | Potato/Tuber | Liquid sludge | 6.5 | 232<br>395 | 13<br>16 | 0.018 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.5 | 232<br>606 | 13<br>16 | 0.008 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Potato/Tuber | Liquid sludge | 6.7 | 276<br>494 | 15<br>18 | 0.014 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Potato/Tuber | Bed-dried Sludge | 6.7 | 276<br>702 | 15<br>17 | 0.005 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Potato/Tuber | Liquid sludge | 8.0 | 138<br>292 | 7<br>9 | 0.013 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Potato/Tuber | Bed-dried Sludge | 8.0 | 138<br>776 | 8<br>12 | 0.006 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 36.2 | 0.01 | *Harris et al, 1978. Vanessa--potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 48 | 0.013 | *Harris et al, 1978. Pentland Javelin--potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 55.2 | 0.015 | *Harris et al, 1978. Home Guard--potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 52.7 | 0.015 | *Harris et al, 1978. Desiree--potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 36.2 | 0.010 | *Harris et al, 1978. King Edward--potato type.* |
| C | Potato/Tuber | Organic, metal contaminated soil | 6.6 | 3622 | 43.7 | 0.012 | *Harris et al, 1978. Majestic-potato type.* |

## TABLE C-63

## UPTAKE OF ZINC BY ROOTS

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Carrot/Tuber | Sludge | 4.6-6.7 | 0 | 29 | 0.001 | *Giordano et al, 1979.* |
| | | | | 403 | 30 | | *Year 3 (1977).* |
| A | Carrot/Tuber | Sludge | 5.3-6.5 | 0 | 23 | 0.164 | *Dowdy & Larson, 1975.* |
| | | | | 120 | 53 | | |
| | | | | 241 | 72 | | |
| | | | | 482 | 104 | | |
| A | Radish/Tuber | Sludge | 5.3-6.5 | 0 | 37 | 0.131 | *Dowdy & Larson, 1975.* |
| | | | | 120 | 40 | | |
| | | | | 241 | 50 | | |
| | | | | 482 | 98 | | |
| A | Radish/Tuber | Sludge | 5.3-6.5 | 0 | 42 | 0.006 | *Keefer et al, 1986.* |
| | | | | 81 | 43 | | *Blue Plains sludge.* |
| | | | | 162 | 43 | | |
| A | Carrot/Tuber | Sludge | 5.3-6.5 | 0 | 99 | 0.025 | *Keefer et al, 1986.* |
| | | | | 81 | 232 | | *Blue Plains sludge.* |
| | | | | 162 | 103 | | |
| A | Radish/Tuber | Sludge | 5.3-6.5 | 0 | 42 | 0.08 | *Keefer et al, 1986.* |
| | | | | 238 | 52 | | *Huntington sludge.* |
| | | | | 476 | 42 | | |
| A | Carrot/Tuber | Sludge | 5.3-6.5 | 0 | 99 | 0.001 | *Keefer et al, 1986.* |
| | | | | 238 | 67 | | *Huntington sludge.* |
| | | | | 476 | 51 | | |
| A | Radish/Tuber | Sludge | 5.3-6.5 | 0 | 42 | 0.054 | *Keefer et al, 1986.* |
| | | | | 176 | 52 | | *Martinsburg sludge.* |
| | | | | 352 | 61 | | |
| A | Carrot/Tuber | Sludge | 5.3-6.5 | 0 | 99 | 0.004 | *Keefer et al, 1986.* |
| | | | | 176 | 84 | | *Martinsburg sludge.* |
| | | | | 352 | 83 | | |
| A | Radish/Tuber | Sludge | 5.3-6.5 | 0 | 42 | 0.206 | *Keefer et al, 1986.* |
| | | | | 63 | 65 | | *Parkersburg sludge.* |
| | | | | 126 | 68 | | |
| A | Carrot/Tuber | Sludge | 5.3-6.5 | 0 | 99 | 0.001 | *Keefer et al, 1986.* |
| | | | | 63 | 66 | | *Parkersburg sludge.* |
| | | | | 126 | 60 | | |
| A | Onion/Bulb | Sludge | 7.3 | 0 | 35 | 0.001 | *Peterson et al, 1989.* |
| | | | | 36 | 31 | | |
| | | | | 71 | 29 | | |
| | | | | 143 | 31 | | |

## TABLE C-63 (cont.)

## UPTAKE OF ZINC BY ROOTS (cont.)

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | Reference/ Comments |
|---|---|---|---|---|---|---|---|
| A | Red Beet/Tuber | Liquid sludge | 6.5 | 232<br>395 | 27<br>57 | 0.184 | *Carlton Smith, 1988. Means of 5 years used. Sandy loam.* |
| A | Red Beet/Tuber | Bed-dried Sludge | 6.5 | 232<br>606 | 25<br>43 | 0.048 | *Carlton Smith, 1988. Means of 4 years used. Sandy loam.* |
| A | Red Beet/Tuber | Liquid sludge | 6.7 | 276<br>494 | 31<br>73 | 0.193 | *Carlton Smith, 1988. Means of 5 years used. Clay.* |
| A | Red Beet/Tuber | Bed-dried Sludge | 6.7 | 276<br>702 | 30<br>53 | 0.054 | *Carlton Smith, 1988. Means of 4 years used. Clay.* |
| A | Red Beet/Tuber | Liquid sludge | 8.0 | 138<br>292 | 26<br>32 | 0.039 | *Carlton Smith, 1988. Means of 5 years used. Calcareous loam.* |
| A | Red Beet/Tuber | Bed-dried Sludge | 8.0 | 138<br>776 | 25<br>32 | 0.009 | *Carlton Smith, 1988. Means of 4 years used. Calcareous loam.* |
| A | Beet/Tuber | Sludge | N.R. | 0<br>66<br>132<br>265<br>331 | 29<br>37<br>44<br>51<br>60 | 0.087 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |
| A | Carrot/Tuber | Sludge | N.R. | 0<br>66<br>132<br>265<br>331 | 26<br>21<br>27<br>29<br>30 | 0.019 | *Lue-Hing et al, 1984. 1977 data used. Nu-Earth.* |

## TABLE C-64

## UPTAKE OF ZINC BY SWEET CORN

| Study Type (1) | Plant/ Tissue | Chemical Form Applied | Soil pH | Application Rates (kg/ha) | Tissue Concentration (µg/g DW) | Uptake Slope (2) | *Reference/ Comments* |
|---|---|---|---|---|---|---|---|
| A | Sweet Corn/ Grain | Sludge | 5.1-6.0 | 0<br>403 | 25<br>40 | 0.037 | *Giordano et al, 1979. Year 1 (1975).* |
| A | Sweet Corn/ Grain | Sludge | 5.3-6.5 | 0<br>81<br>162 | 24<br>26<br>27 | 0.019 | *Keefer et al, 1986. Blue Plains sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.3-6.5 | 0<br>238<br>476 | 24<br>25<br>24 | 0.001 | *Keefer et al, 1986. Huntington sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.3-6.5 | 0<br>176<br>352 | 24<br>29<br>31 | 0.02 | *Keefer et al, 1986. Martinsburg sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.3-6.5 | 0<br>63<br>126 | 24<br>30<br>35 | 0.095 | *Keefer et al, 1986. Parkersburg sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.7 | 0<br>81 | 40<br>45 | 0.062 | *Hemphill et al, 1982. Portland sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.7 | 0<br>35 | 40<br>40 | 0.001 | *Hemphill et al, 1982. Rockcreek sludge.* |
| A | Sweet Corn/ Grain | Sludge | 5.7 | 0<br>30 | 40<br>39 | 0.001 | *Hemphill et al, 1982. Salem sludge.* |

# APPENDIX D

## Animal Uptake Tables

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## TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [g] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | 6 | Kidney | 6 | Sludge amended diet | | | 0.77 | 0.31 | | 77.02 | 1.34809913 | 0.638 | Boyer et al., 1981 (p.286) | 1 | h |
| | | | | | | | 12.3 | 2.0 | | 77.02 | 8.70322019 | | | | |
| Cattle | 6 | Kidney | 9 | Sludge amended diet | | | 0.14 | | | | 1.19 | 1.277 | Johnson et al., 1981 (p.112) | 1 | h |
| | | | | | | | 10.6 | | | | 14.55 | | | | |
| Cattle | 12 | Kidney | 4 | [l] | 2 | 18 | 0.1111 | 270 | 46 | 77.02 | 1174.93473 | 1033.943 | Vreman et al., 1986 | 1 | h,l,m |
| | | | 4 | | 152 | 18 | 8.4444 | 2250 | 660 | 77.02 | 9791.12272 | | | | |
| Cattle | 8 | Kidney | 2 | [l] | 2 | 20 | 0.1 | 300 | 130 | 77.02 | 23106 | 296783.733 | Vreman et al., 1986 | 1 | h,l,n |
| | | | 2 | | 32 | 20 | 1.6 | 6060 | 700 | 77.02 | 468281.6 | | | | |
| Cattle | 8 | Kidney | 2 | Harbor sludge | 2 | 20 | 0.1 | 300 | 130 | 77.02 | 23106 | 280489.291 | Vreman et al., 1986 | 1 | h,n |
| | | | 1 | | 10 | 21 | 0.4762 | 1670 | | 77.02 | 128623.4 | | | | |
| Cattle | 8 | Kidney | 2 | Sewage sludge | 2 | 20 | 0.1 | 300 | 130 | 77.02 | 23106 | 53914.000 | Vreman et al., 1986 | 1 | h,n |
| | | | 2 | | 6 | 21 | 0.2857 | 430 | 70 | 77.02 | 33118.6 | | | | |
| Cattle | 6 | Muscle | 6 | Sludge amended diet | | | 0.77 | 0.02 | | 70.62 | 0.06807352 | 0.003 | Boyer et al., 1981 (p.286) | 1 | h |
| | | | | | | | 12.3 | 0.03 | | 70.62 | 0.10211028 | | | | |
| Cattle | 6 | Muscle | 3 | Sludge amended diet | | | 0.14 | | | | 0.01 | 0.002 | Johnson et al., 1981 (p.112) | 1 | h |
| | | | | | | | 10.6 | | | | 0.03 | | | | |
| Cattle | 12 | Muscle | 12 | [l] | 2 | 18 | 0.1111 | 5 | 1 | 70.62 | 17.0183799 | 0.001 | Vreman et al., 1986 | 1 | h,l,m |
| | | | 12 | | 152 | 18 | 8.4444 | 4 | 1 | 70.62 | 13.6147039 | | | | |
| Cattle | 8 | Muscle | 2 | [l] | 2 | 20 | 0.1 | 2 | 0 | 70.62 | 6.80735194 | 11.346 | Vreman et al., 1986 | 1 | h,l,n |
| | | | 2 | | 32 | 20 | 1.6 | 7 | 1 | 70.62 | 23.8257318 | | | | |
| Cattle | 8 | Muscle | 2 | Harbor sludge | 2 | 20 | 0.1 | 2 | 0 | 70.62 | 6.80735194 | 18.095 | Vreman et al., 1986 | 1 | h,n |
| | | | 1 | | 10 | 21 | 0.4762 | 4 | | 70.62 | 13.6147039 | | | | |
| Cattle | 8 | Muscle | 2 | Sewage sludge | 2 | 20 | 0.1 | 2 | 0 | 70.62 | 6.80735194 | 18.327 | Vreman et al., 1986 | 1 | h,n |
| | | | 2 | | 6 | 21 | 0.2857 | 3 | 1 | 70.62 | 10.2110279 | | | | |
| Cattle | 6 | Liver | 6 | Sludge amended diet | | | 0.77 | 0.08 | | 68.99 | 0.2579613 | 0.397 | Boyer et al., 1981 (p.286) | 2 | h |
| | | | | | | | 12.3 | 1.5 | | 68.99 | 4.83714931 | | | | |
| Cattle | 6 | Liver | 6 | Sludge amended diet | | | 0.14 | | | | 0.19 | 0.452 | Johnson et al., 1981 (p.112) | 2 | h |
| | | | | | | | 10.6 | | | | 4.92 | | | | |
| Cattle | 12 | Liver | 4 | [l] | 2 | 18 | 0.1111 | 65 | 14 | 68.99 | 209.609603 | 454.692 | Vreman et al., 1986 | 2 | h,l,m |
| | | | 4 | | 152 | 18 | 8.4444 | 1240 | 200 | 68.99 | 3998.71009 | | | | |
| Cattle | 8 | Liver | 2 | [l] | 2 | 20 | 0.1 | 60 | 20 | 68.99 | 193.485972 | 3095.776 | Vreman et al., 1986 | 2 | h,l,n |
| | | | 2 | | 32 | 20 | 1.6 | 1500 | 160 | 68.99 | 4837.14931 | | | | |
| Cattle | 8 | Liver | 2 | Harbor sludge | 2 | 20 | 0.1 | 60 | 20 | 68.99 | 193.485972 | 857.216 | Vreman et al., 1986 | 2 | h,n |
| | | | 1 | | 10 | 21 | 0.4762 | 160 | | 68.99 | 515.962593 | | | | |
| Cattle | 8 | Liver | 2 | Sewage sludge | 2 | 20 | 0.1 | 60 | 20 | 68.99 | 193.485972 | 694.565 | Vreman et al., 1986 | 2 | h,n |

## TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | | 6 | 21 | 0.2857 | 100 | 30 | 68.99 | 322.47662 | | | | |
| Cattle | 12 | Milk | 12 | [l] | 2 | 18 | 0.1111 | 0.26 | | 87.30 | 2.04724409 | 0.123 | Vreman et al., 1986 | 6 | h,l,m |
| | | | 12 | | 152 | 18 | 8.4444 | 0.39 | | 87.30 | 3.07086614 | | | | |
| Cattle | 8 | Milk | 4 | [l] | 2 | 20 | 0.1 | 0.15 | | 87.30 | 1.18110236 | 0.262 | Vreman et al., 1986 | 6 | h,l,n |
| | | | 4 | | 32 | 20 | 1.6 | 0.20 | | 87.30 | 1.57480315 | | | | |
| Cattle | 8 | Milk | 4 | Harbor sludge | 2 | 20 | 0.1 | 0.15 | | 87.30 | 1.18110236 | 0.001 | Vreman et al., 1986 | 6 | h,n |
| | | | 2 | | 10 | 21 | 0.4762 | 0.10 | | 87.30 | 0.78740157 | | | | |
| Cattle | 8 | Milk | 4 | Sewage sludge | 2 | 20 | 0.1 | 0.15 | | 87.30 | 1.18110236 | 2.120 | Vreman et al., 1986 | 6 | h,n |
| | | | 4 | | 6 | 21 | 0.2857 | 0.20 | | 87.30 | 1.57480315 | | | | |
| Sheep | 5 | Kidney | | Sludge grown corn silage | | | 0.05 | | | | 5.4 | 7.939 | Heffron et al., 1980 (p.60) | 3 | h,o |
| | 9 | | | | | | 1.7 | | | | 18.5 | | | | |
| Sheep | 5 | Bone | | Sludge grown corn silage | | | 0.05 | | | | 0.01 | 0.006 | Heffron et al., 1980 (p.60) | | h,o |
| | 9 | | | | | | 1.7 | | | | 0.02 | | | | |
| Sheep | 5 | Liver | | Sludge grown corn silage | | | 0.05 | | | | 1.2 | 2.788 | Heffron et al., 1980 (p.60) | 3 | h,o |
| | 9 | | | | | | 1.7 | | | | 5.8 | | | | |
| Sheep | 5 | Muscle | | Sludge grown corn silage | | | 0.05 | | | | 0.005 | 0.003 | Heffron et al., 1980 (p.60) | 3 | h,o |
| | 9 | | | | | | 1.7 | | | | 0.01 | | | | |
| Pig | 10 | Liver | | CdCl(2) | | | 0.23 | 0.07 | | 71.06 | 0.24167975 | 6.316 | Sharma et al., 1979 | 4 | i |
| | | | | | | | 2.41 | 0.4 | | 71.06 | 1.38217001 | | | | |
| | | | | | | | 10.12 | 17 | | 71.06 | 58.7422253 | | | | |
| Swine | 12 | Liver | | CdCl(2) | | | 0.36 | 0 | | 71.06 | 0 | 0.573 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 78.6 | 12.98 | | 71.06 | 44.8514167 | | Experiment 1 | | |
| Swine | 12 | Liver | | Sludge amended diet | | | 0.12 | 0 | | 71.06 | 0 | 0.074 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 147.3 | 3.15 | | 71.06 | 10.8845888 | | Experiment 1 | | |
| Pig | NR | Kidney | | CdCl(2) | | | 0.23 | 0.2 | | 74.73 | 0.59358924 | 16.659 | Sharma et al., 1979 | 4 | i |
| | | | | | | | 2.41 | 10.97 | | 74.73 | 43.4111595 | | | | |
| | | | | | | | 10.12 | 42.30 | | 74.73 | 167.392165 | | | | |
| Swine | 12 | Kidney | | CdCl(2) | | | 0.36 | 0 | | 80.06 | 0 | 3.971 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 78.6 | 61.95 | | 80.06 | 310.682046 | | Experiment 1 | | |
| Swine | 12 | Kidney | | Sludge amended diet | | | 0.12 | 0 | | 80.06 | 0 | 0.800 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 147.3 | 23.49 | | 80.06 | 117.80341 | | Experiment 1 | | |
| Swine | 12 | Muscle | | CdCl(2) | | | 0.36 | 0 | | 71.95 | 0 | 0.001 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 78.6 | 0 | | 71.95 | 0 | | Experiment 1 | | |
| Swine | 12 | Muscle | | Sludge amended diet | | | 0.12 | 0 | | 71.95 | 0 | 0.001 | Osuna et al., 1981 (p.1545) | 4 | e,g |
| | | | | | | | 147.3 | 0 | | 71.95 | 0 | | Experiment 1 | | |
| Chicken | 6 | Kidney | | CdSO(4).8H(2)O | | | 0.18 | | | | 0.39 | 5.052 | Leach et al., 1979 | 5 | g |

## TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Food quantity (kg DW/day) | Food Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [g] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3.18 | | | | 9.27 | | Experiment 1 | | |
| | | | | | | | 12.18 | | | | 49.69 | | | | |
| | | | | | | | 48.18 | | | | 239.07 | | | | |
| Chicken | 5 | Kidney | | CdSO(4).8H(2)O | | | 0.07 | | | | 8.5 | 7.460 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.07 | | | | 30.8 | | Experiment 2 | | |
| | | | | | | | 12.07 | | | | 92.6 | | | | |
| | | | | | | | 48.07 | | | | 365.9 | | | | |
| Chicken | 12–15 | Kidney | | CdSO(4).8H(2)O | | | 0.22 | | | | 17.1 | 7.523 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.22 | | | | 273.9 | | Experiment 3 | | |
| | | | | | | | 12.22 | | | | 708.3 | | | | |
| | | | | | | | 48.22 | | | | 540.7 | | | | |
| Chicken | 6 | Liver | | CdSO(4).8H(2)O | | | 0.18 | | | | 0.23 | 1.837 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.18 | | | | 4.75 | | Experiment 1 | | |
| | | | | | | | 12.18 | | | | 15.13 | | | | |
| | | | | | | | 48.18 | | | | 87.19 | | | | |
| Chicken | 5 | Liver | | CdSO(4).8H(2)O | | | 0.07 | | | | 1.6 | 1.858 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.07 | | | | 9 | | Experiment 2 | | |
| | | | | | | | 12.07 | | | | 26.5 | | | | |
| | | | | | | | 48.07 | | | | 91.8 | | | | |
| Chicken | 12–15 | Liver | | CdSO(4).8H(2)O | | | 0.22 | | | | 2.99 | 4.051 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.22 | | | | 33.47 | | Experiment 3 | | |
| | | | | | | | 12.22 | | | | 41.82 | | | | |
| | | | | | | | 48.22 | | | | 203.54 | | | | |
| Chicken | | Muscle | | CdCl(2) | | | 0.32 | 0.063 | | 75.46 | 0.25672372 | 0.057 | Sharma et al., 1979 | 5 | i |
| | | | | | | | 1.88 | 0.140 | | 75.46 | 0.57049715 | | | | |
| | | | | | | | 13.06 | 0.263 | | 75.46 | 1.07171964 | | | | |
| Chicken | 6 | Muscle | | CdSO(4).8H(2)O | | | 0.18 | | | | 0.07 | 0.014 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.18 | | | | 0.15 | | Experiment 1 | | |
| | | | | | | | 12.18 | | | | 0.26 | | | | |
| | | | | | | | 48.18 | | | | 0.75 | | | | |
| Chicken | 12–15 | Muscle | | CdSO(4).8H(2)O | | | 0.22 | | | | 0.12 | 0.132 | Leach et al., 1979 | 5 | g |
| | | | | | | | 3.22 | | | | 0.57 | | Experiment 3 | | |
| | | | | | | | 12.22 | | | | 1.66 | | | | |
| | | | | | | | 48.22 | | | | 6.46 | | | | |
| Chicken | | Eggs/yolk | | CdCl(2) | | | 0.32 | 0.13 | | 51.10 | 0.26584867 | 0.003 | Sharma et al., 1979 | 7 | i |
| | | | | | | | 1.88 | 0.14 | | 51.10 | 0.28629857 | | | | |
| | | | | | | | 13.06 | 0.15 | | 51.10 | 0.30674847 | | | | |
| Chicken | 5 | Egg | | CdSO(4).8H(2)O | | | 0.07 | | | | 0.05 | 0.001 | Leach et al., 1979 | 7 | g |
| | | | | | | | 3.07 | | | | 0.08 | | Experiment 2 | | |
| | | | | | | | 12.07 | | | | 0.07 | | | | |
| | | | | | | | 48.07 | | | | 0.13 | | | | |
| Chicken | 12–15 | Egg | | CdSO(4).8H(2)O | | | 0.22 | | | | 0.16 | 0.002 | Leach et al., 1979 | 7 | g |

## TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3.22 | | | | 0.13 | | Experiment 3 | | |
| | | | | | | | 12.22 | | | | 0.14 | | | | |
| | | | | | | | 48.22 | | | | 0.22 | | | | |
| Guinea Pig | 4 | Muscle | | [r] | | | 1.2 | | | | 0.1 | 0.001 | Furr et al., 1976b | | h,p |
| | | | | | | | 3.3 | | | | 0.07 | | | | |
| Guinea Pig | 4 | Muscle | | [r] | | | 1.2 | | | | 0.1 | 0.001 | Furr et al., 1976b | | h,q |
| | | | | | | | 4.1 | | | | 0.05 | | | | |
| Guinea Pig | 4 | Liver | | [r] | | | 1.2 | | | | 2.0 | 0.001 | Furr et al., 1976b | | h,p |
| | | | | | | | 3.3 | | | | 1.8 | | | | |
| Guinea Pig | 4 | Liver | | [r] | | | 1.2 | | | | 2.0 | 0.138 | Furr et al., 1976b | | h,q |
| | | | | | | | 4.1 | | | | 2.4 | | | | |
| Guinea Pig | 4 | Kidney | | [r] | | | 1.2 | | | | 6.2 | 0.571 | Furr et al., 1976b | | h,p |
| | | | | | | | 3.3 | | | | 7.4 | | | | |
| Guinea Pig | 4 | Kidney | | [r] | | | 1.2 | | | | 6.2 | 1.517 | Furr et al., 1976b | | h,q |
| | | | | | | | 4.1 | | | | 10.6 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used in" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Cows fed soluble compounds of arsenic pentoxide, cadmium, lead, and mercury acetate.
m Grazing cows
n Cows kept indoors
o Diet consisted of 4/5 corn and 1/5 soybean meal. No concentration for cadmium in soybean meal given, therefore assumed same as corn.
p Soil pH6.5
q Soil pH5.5
r Guinea pigs fed selenium in Swiss chard grown in sewage sludge.

Note: percent moisture data from USDA, 1963

## TABLE D-2. UPTAKE OF MERCURY BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [g] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | 6 | Muscle | | Sludge | | | 0.02 | | | | 0.01 | 0.003876 | Johnson et al., 1981 | 1,3,4,5 | h |
| | | | | | | | 2.6 | | | | 0.02 | | | | |
| Cattle | 12 | Muscle | 12 | [i] | 0.2 | 18 | 0.01111 | 3 | 1 | 70.62 | 10.21102791 | 40.844112 | Vreman et al., 1986 | 1,3,4,5 | h,l,m |
| | | | 12 | | 1.7 | 18 | 0.09444 | 4 | 1 | 70.62 | 13.61470388 | | | | |
| Cattle | 8 | Muscle | 2 | [i] | 0.2 | 20 | 0.01 | 2 | 0 | 70.62 | 6.80735194 | 0.001 | Vreman et al., 1986 | 1,3,4,5 | h,l,n |
| | | | 2 | | 1.7 | 20 | 0.085 | 2 | 1 | 70.62 | 6.80735194 | | | | |
| Cattle | 8 | Muscle | 2 | Harbor sludge | 0.2 | 20 | 0.01 | 2 | 0 | 70.62 | 6.80735194 | 0.001 | Vreman et al., 1986 | 1,3,4,5 | h,n |
| | | | 1 | | 3.1 | 21 | 0.14762 | 1 | | 70.62 | 3.40367597 | | | | |
| Cattle | 8 | Muscle | 2 | Sewage sludge | 0.2 | 20 | 0.01 | 2 | 0 | 70.62 | 6.80735194 | 0.001 | Vreman et al., 1986 | 1,3,4,5 | h,n |
| | | | 2 | | 1.2 | 21 | 0.05714 | 2 | 1 | 70.62 | 6.80735194 | | | | |
| Cattle | 6 | Kidney | | Sludge | | | 0.02 | | | | 0.09 | 0.755814 | Johnson et al., 1981 | 1,3,4,5 | h |
| | | | | | | | 2.6 | | | | 2.04 | | | | |
| Cattle | 12 | Kidney | 4 | [i] | 0.2 | 18 | 0.01111 | 9 | 46* | 77.02 | 39.16449086 | 783.28982 | Vreman et al., 1986 | 1,3,4,5 | h,l,m |
| | | | 4 | | 1.7 | 18 | 0.09444 | 24 | 660 | 77.02 | 104.4386423 | | | | |
| Cattle | 8 | Kidney | 2 | [i] | 0.2 | 20 | 0.01 | 5 | 1 | 77.02 | 21.75805048 | 4293.5886 | Vreman et al., 1986 | 1,3,4,5 | h,l,n |
| | | | 2 | | 1.7 | 20 | 0.085 | 79 | 7 | 77.02 | 343.7771976 | | | | |
| Cattle | 8 | Kidney | 2 | Harbor sludge | 0.2 | 20 | 0.01 | 5 | 1 | 77.02 | 21.75805048 | 1422.9313 | Vreman et al., 1986 | 1,3,4,5 | h,n |
| | | | 1 | | 3.1 | 21 | 0.14762 | 50 | | 77.02 | 217.5805048 | | | | |
| Cattle | 8 | Kidney | 2 | Sewage sludge | 0.2 | 20 | 0.01 | 5 | 1 | 77.02 | 21.75805048 | 2030.7514 | Vreman et al., 1986 | 1,3,4,5 | h,n |
| | | | 2 | | 1.2 | 21 | 0.05714 | 27 | 5 | 77.02 | 117.4934726 | | | | |
| Cattle | 6 | Liver | | Sludge | | | 0.02 | | | | 0.01 | 0.1007752 | Johnson et al., 1981 | 2,3,4,5 | h |
| | | | | | | | 2.6 | | | | 0.27 | | | | |
| Cattle | 12 | Liver | 4 | [i] | 0.2 | 18 | 0.01111 | 7 | 1 | 68.99 | 22.57336343 | 116.09158 | Vreman et al., 1986 | 2,3,4,5 | h,l,m |
| | | | 4 | | 1.7 | 18 | 0.09444 | 10 | 2 | 68.99 | 32.24766204 | | | | |
| Cattle | 8 | Liver | 2 | [i] | 0.2 | 20 | 0.01 | 3 | 1 | 68.99 | 9.674298613 | 988.9283 | Vreman et al., 1986 | 2,3,4,5 | h,l,n |
| | | | 2 | | 1.7 | 20 | 0.085 | 26 | 7 | 68.99 | 83.84392132 | | | | |
| Cattle | 8 | Liver | 2 | Harbor sludge | 0.2 | 20 | 0.01 | 3 | 1 | 68.99 | 9.674298613 | 257.75813 | Vreman et al., 1986 | 2,3,4,5 | h,n |
| | | | 1 | | 3.1 | 21 | 0.14762 | 14 | | 68.99 | 45.14672686 | | | | |
| Cattle | 8 | Liver | 2 | Sewage sludge | 0.2 | 20 | 0.01 | 3 | 1 | 68.99 | 9.674298613 | 410.42479 | Vreman et al., 1986 | 2,3,4,5 | h,n |
| | | | 2 | | 1.2 | 21 | 0.05714 | 9 | 3 | 68.99 | 29.02289584 | | | | |

## TABLE D-2. UPTAKE OF MERCURY BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | 12 | Milk | 12 | [i] | 0.2 | 18 | 0.01111 | 2.3 | 0.03 | 87.3 | 18.11023622 | 0.001 | Vreman et al., 1986 | 6,7 | h,l,m |
| | | | 12 | | 1.7 | 18 | 0.09444 | 0.9 | 0.10 | 87.3 | 7.086614173 | | | | |
| Cattle | 8 | Milk | 4 | [i] | 0.2 | 20 | 0.01 | 0.5 | | 87.3 | 3.937007874 | 10.498688 | Vreman et al., 1986 | 6,7 | h,l,n |
| | | | 4 | | 1.7 | 20 | 0.085 | 0.6 | 0.1 | 87.3 | 4.724409449 | | | | |
| Cattle | 8 | Milk | 4 | Harbor sludge | 0.2 | 20 | 0.01 | 0.5 | | 87.3 | 3.937007874 | 108.71046 | Vreman et al., 1986 | 6,7 | h,n |
| | | | 2 | | 3.1 | 21 | 0.14762 | 2.4 | 0 | 87.3 | 18.8976378 | | | | |
| Cattle | 8 | Milk | 4 | Sewage sludge | 0.2 | 20 | 0.01 | 0.5 | | 87.3 | 3.937007874 | 133.61966 | Vreman et al., 1986 | 6,7 | h,n |
| | | | 4 | | 1.2 | 21 | 0.05714 | 1.3 | 0.5 | 87.3 | 10.23622047 | | | | |
| Guinea Pig | 4 | Muscle | | [o] | | | 1.0 | | | | 0.64 | 7.7142857 | Furr et al., 1976b | 3,4,5 | h,o,p |
| | | | | | | | 0.93 | | | | 0.10 | | | | |
| Guinea Pig | 4 | Muscle | | [o] | | | 1.0 | | | | 0.64 | 0.3913043 | Furr et al., 1976b | 3,4,5 | h,o,q |
| | | | | | | | 0.54 | | | | 0.46 | | | | |
| Guinea Pig | 4 | Liver | | [o] | | | 1.0 | | | | 0.44 | 0.4285714 | Furr et al., 1976b | 3,4,5 | h,o,p |
| | | | | | | | 0.93 | | | | 0.41 | | | | |
| Guinea Pig | 4 | Liver | | [o] | | | 1.0 | | | | 0.44 | 0.1066957 | Furr et al., 1976b | 3,4,5 | h,o,q |
| | | | | | | | 0.54 | | | | 0.39 | | | | |
| Guinea Pig | 4 | Kidney | | [o] | | | 1.0 | | | | 0.10 | 0.001 | Furr et al., 1976b | 3,4,5 | h,o,p |
| | | | | | | | 0.93 | | | | 0.27 | | | | |
| Guinea Pig | 4 | Kidney | | [o] | | | 1.0 | | | | 0.10 | 0.001 | Furr et al., 1976b | 3,4,5 | h,o,q |
| | | | | | | | 0.54 | | | | 0.20 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Cows fed soluble compounds of arsenic pentoxide, cadmium, lead, and mercury acetate. Feed concentration reported as concentration of mercury acetate.
m Grazing cows
n Cows kept indoors

## TABLE D-2. UPTAKE OF MERCURY BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [g] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |

o Guinea pigs fed selenium in Swiss chard grown in sewage sludge.
p Soil pH6.5
q Soil pH5.5

Note: percent moisture data from USDA, 1963

## TABLE D-3. UPTAKE OF SELENIUM BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pig | | Muscle | | Natural diet | | | 0.027 | 0.034 | | 71.95 | 0.12121212 | 3.7257197 | Ky et al., 1973 | 3,4,5,6,7 | h |
| | | | | | | | 0.493 | 0.521 | | 71.95 | 1.8573975 | | as cited in NAS, 1980 (p.339) | | |
| Pig | | Muscle | | Sodium selenite | | | 0.04 | 0.12 | | 71.95 | 0.42760749 | 3.2085561 | Ky et al., 1973 | 3,4,5,6,7 | h |
| | | | | | | | 0.44 | 0.48 | | 71.95 | 1.71122995 | | as cited in NAS, 1980 (p.339) | | |
| Pig | | Liver | | Sodium selenite | | | 0.04 | 0.61 | | 71.06 | 2.10760926 | 1.9668694 | Ky et al., 1973 | 3,4,5,6,7 | h |
| | | | | | | | 0.44 | 0.84 | | 71.06 | 2.90255701 | | as cited in NAS, 1980 (p.339) | | |
| Pig | | Kidney | | Sodium selenite | | | 0.04 | 2.14 | | 60.06 | 10.7321966 | 0.3761284 | Ky et al., 1973 | 3,4,5,6,7 | h |
| | | | | | | | 0.44 | 2.17 | | 60.06 | 10.8826479 | | as cited in NAS, 1980 (p.339) | | |
| Guinea Pig | 4 | Kidney | | [l] | | | 0.06 | | | | 1.61 | 0.001 | Furr et al., 1976b (pp.87-88) | 3,5,6,7 | h,l,m |
| | | | | | | | 0.06 | | | | 1.69 | | | | |
| Guinea Pig | 4 | Muscle | | [l] | | | 0.06 | | | | 0.38 | 0.5 | Furr et al., 1976b (pp.87-88) | 3,5,6,7 | h,l,m |
| | | | | | | | 0.06 | | | | 0.37 | | | | |
| Guinea Pig | 4 | Liver | | [l] | | | 0.06 | | | | 1.12 | 11 | Furr et al., 1976b (pp.87-88) | 3,5,6,7 | h,l,m |
| | | | | | | | 0.06 | | | | 0.90 | | | | |
| Mouse (male) | 5 | Heart | | Sodium selenite | | | 0.06 | 0.22 | | 73 | 0.81481481 | 1.3209877 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g,o |
| | 16 | | | | | | 3.06 | 1.29 | | 73 | 4.77777778 | | | | |
| Mouse (male) | 19 | Heart | | Sodium selenate | | | 0.06 | 0.10 | | 73 | 0.37037037 | 0.6049383 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g,p |
| | 51 | | | | | | 3.06 | 0.59 | | 73 | 2.18518519 | | | | |
| Mouse (female) | 23 | Heart | | Sodium selenite | | | 0.06 | 0.24 | | 73 | 0.88888889 | 1.1851852 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 18 | | | | | | 3.06 | 1.20 | | 73 | 4.44444444 | | | | |
| Mouse (female) | 19 | Heart | | Sodium selenite | | | 0.06 | 0.19 | | 73 | 0.7037037 | 0.3333333 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 43 | | | | | | 3.06 | 0.46 | | 73 | 1.7037037 | | | | |
| Mouse (male) | 5 | Liver | | Sodium selenite | | | 0.06 | 0.55 | | 71 | 1.89655172 | 1.5747126 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 16 | | | | | | 3.06 | 1.92 | | 71 | 6.62068966 | | | | |
| Mouse (male) | 19 | Liver | | Sodium selenite | | | 0.06 | 0.15 | | 71 | 0.51724138 | 1.5977011 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 51 | | | | | | 3.06 | 1.54 | | 71 | 5.31034483 | | | | |
| Mouse (female) | 23 | Liver | | Sodium selenite | | | 0.06 | 0.54 | | 71 | 1.86206897 | 2.3448276 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 18 | | | | | | 3.06 | 2.56 | | 71 | 8.89655172 | | | | |
| Mouse (female) | 19 | Liver | | Sodium selenite | | | 0.06 | 0.22 | | 71 | 0.75862069 | 0.6206897 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 43 | | | | | | 3.06 | 0.76 | | 71 | 2.62068966 | | | | |
| Mouse (male) | 5 | Kidney | | Sodium selenite | | | 0.06 | 0.95 | | 77 | 4.13043478 | 2.0144928 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 16 | | | | | | 3.06 | 2.34 | | 77 | 10.173913 | | | | |
| Mouse (male) | 19 | Kidney | | Sodium selenite | | | 0.06 | 0.44 | | 77 | 1.91304348 | 2.3333333 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 51 | | | | | | 3.06 | 2.05 | | 77 | 8.91304348 | | | | |

## TABLE D-3. UPTAKE OF SELENIUM BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mouse (female) | 23 | Kidney | | Sodium selenite | | | 0.06 | 1.19 | | 77 | 5.17391304 | 1.057971 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 18 | | | | | | 3.06 | 1.92 | | 77 | 8.34782609 | | | | |
| Mouse (female) | 19 | Kidney | | Sodium selenite | | | 0.06 | 0.56 | | 77 | 2.43478261 | 0.4637681 | Schroeder & Mitchener, 1972 (p.62) | 3,5,6,7 | g |
| | 43 | | | | | | 3.06 | 0.88 | | 77 | 3.82608696 | | | | |
| Cattle | 6 | Kidney | | Sludge amended diet | | | 0 | 1.35 | | 77.02 | 5.87487363 | 0.5119541 | Boyer et al., 1961 (p.266) | 3,5,6,7 | h |
| | | | | | | | 1.7 | 1.55 | | 77.02 | 6.74499565 | | | | |
| Cattle | 6 | Liver | | Sludge amended diet | | | 0 | 0.42 | | 68.99 | 1.35440181 | 1.1950904 | Boyer et al., 1961 (p.266) | 3,5,6,7 | h |
| | | | | | | | 1.7 | 1.05 | | 68.99 | 3.38600451 | | | | |
| Cattle | 6 | Muscle | | Sludge amended diet | | | 0 | 0.23 | | 70.62 | 0.78284547 | 0.1401514 | Boyer et al., 1961 (p.266) | 3,5,6,7 | h |
| | | | | | | | 1.7 | 0.30 | | 70.62 | 1.02110279 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used in" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Guinea pigs fed selenium in Swiss chard grown in sewage sludge.
m Soil pH6.5
n Soil pH5.5
o Mice also fed 2 µg/g sodium tellurite.
p Mice also fed 2 µg/g potassium tellurate and 5 µg/g chromium.

Note: percent moisture data from USDA, 1963. Data for mouse tissue approximated from data on other species.

## TABLE D-4. UPTAKE OF ZINC BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | 6 | Kidney | 6 | Sludge | | | 36 | 19.1 | | 77.62 | 85.34405719 | 0.017963 | Boyer et al., 1981 (pp.286-289) | 1,6 | h |
| | | | 6 | | | | 235 | 19.9 | | 77.62 | 88.91867739 | | | | |
| Cattle | 6 | Kidney | 6 | Sludge | | | 26.3 | | | | 93 | 0.014306 | Johnson et al., 1981 (p.112) | 1,6 | h |
| | | | 6 | | | | 236 | | | | 96 | | | | |
| Cattle | 6 | Liver | 6 | Sludge | | | 36 | 35.8 | | 68.99 | 115.4466301 | 0.006482 | Boyer et al., 1981 (pp.286-289) | 2,6 | h |
| | | | 6 | | | | 235 | 36.2 | | 68.99 | 116.7365366 | | | | |
| Cattle | 6 | Liver | 6 | Sludge | | | 26.3 | | | | 143 | 0.001 | Johnson et al., 1981 (p.112) | 2,6 | h |
| | | | 6 | | | | 236 | | | | 132 | | | | |
| Cattle | 6 | Muscle | 6 | Sludge | | | 36 | 66.8 | | 70.62 | 227.3655548 | 0.027368 | Boyer et al., 1981 (pp.286-289) | 1,6 | h |
| | | | 6 | | | | 235 | 68.4 | | 70.62 | 232.8114364 | | | | |
| Cattle | 6 | Muscle | 3 | Sludge | | | 26.3 | | | | 340 | 0.001 | Johnson et al., 1981 (p.112) | 1,6 | h |
| | | | 3 | | | | 236 | | | | 267 | | | | |
| Sheep | 5 | Kidney | | Sludge-grown corn silage | | | 19 | | | | 3271 | 17.63265 | Heffron et al., 1980, 1980 (p.69) | 3 | h,l |
| | 9 | | | | | | 68 | | | | 4135 | | | | |
| Sheep | 5 | Bone | | Sludge-grown corn silage | | | 19 | | | | 625 | 0.755102 | Heffron et al., 1980, 1980 (p.69) | | h,l |
| | 9 | | | | | | 68 | | | | 662 | | | | |
| Sheep | 5 | Liver | | Sludge-grown corn silage | | | 19 | | | | 1523 | 2.122449 | Heffron et al., 1980, 1980 (p.69) | 3 | h,l |
| | 9 | | | | | | 68 | | | | 1627 | | | | |
| Sheep | 5 | Muscle | | Sludge-grown corn silage | | | 19 | | | | 106 | 0.877551 | Heffron et al., 1980, 1980 (p.69) | 3 | h,l |
| | 9 | | | | | | 68 | | | | 151 | | | | |
| Pig | 12 | Kidney | | Sludge-grown corn silage | | | 183.4 | 24.03 | | 80.06 | 120.5115346 | 0.113588 | Osuna et al., 1981 | 4 | e,l |
| | | | | | | | 773.7 | 37.4 | | 80.06 | 187.5626881 | | | | |
| Pig | 12 | Liver | | Sludge-grown corn silage | | | 183.4 | 37.8 | | 71.06 | 130.6150657 | 0.079025 | Osuna et al., 1981 | 4 | e,l |
| | | | | | | | 773.7 | 51.3 | | 71.06 | 177.2633034 | | | | |
| Pig | 12 | Muscle | | Sludge-grown corn silage | | | 183.4 | 13.99 | | 71.95 | 49.87522282 | 0.001 | Osuna et al., 1981 | 4 | e,l |
| | | | | | | | 773.7 | 12.49 | | 71.95 | 44.52762923 | | | | |
| Mallard duck | 6 | Kidney | | ZnCO(3) | | | 0 | 27 | | 74.73 | 106.8480625 | 0.116343 | Gassaway and Buss, 1972 (p.1,115) | 5,7 | l |
| | | | | | | | 3000 | 413 | | 74.73 | 1634.34903 | | | | |
| | | | | | | | 6000 | 453 | | 74.73 | 1792.639493 | | | | |
| | | | | | | | 9000 | 311 | | 74.73 | 1230.70835 | | | | |
| | | | | | | | 12000 | 519 | | 74.73 | 2053.818757 | | | | |
| Mallard duck | 6 | Liver | | ZnCO(3) | | | 0 | 54 | | 73.59 | 204.4680045 | 0.079768 | Gassaway and Buss, 1972 (p.1,115) | 5,7 | l |
| | | | | | | | 3000 | 401 | | 73.59 | 1518.364256 | | | | |
| | | | | | | | 6000 | 483 | | 73.59 | 1828.852707 | | | | |
| | | | | | | | 9000 | 461 | | 73.59 | 1745.550928 | | | | |
| | | | | | | | 12000 | 340 | | 73.59 | 1287.39114 | | | | |
| Mallard duck | 6 | Breast muscle | | ZnCO(3) | | | 0 | 14 | | 75.46 | 57.04971475 | 0.00489 | Gassaway and Buss, 1972 (p.1,115) | 5,7 | l |

TABLE D-4. UPTAKE OF ZINC BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 3000 | 32 | | 75.46 | 130.399348 | | | | |
| | | | | | | | 6000 | 30 | | 75.46 | 122.2493888 | | | | |
| | | | | | | | 9000 | 34 | | 75.46 | 138.5493073 | | | | |
| | | | | | | | 12000 | 31 | | 75.46 | 126.3243684 | | | | |
| Guinea pig | 4 | Kidney | | Sludge-grown chard | | | 159.0 | | | | 19 | 0.003619 | Furr et al., 1976b (pp.87-88) | | h,o |
| | 4 | | | | | | 850 | | | | 22 | | | | m |
| | 2 | | | | | | 1050 | | | | 22 | | | | n |
| Guinea pig | 4 | Liver | | Sludge-grown chard | | | 159.0 | | | | 28 | 0.001 | Furr et al., 1976b (pp.87-88) | | h,o |
| | 4 | | | | | | 850 | | | | 30 | | | | m |
| | 2 | | | | | | 1050 | | | | 27 | | | | n |
| Guinea pig | 4 | Muscle | | Sludge-grown chard | | | 159.0 | | | | 15 | 0.001 | Furr et al., 1976b (pp.87-88) | | h,o |
| | 4 | | | | | | 850 | | | | 13 | | | | m |
| | 2 | | | | | | 1050 | | | | 16 | | | | n |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Diet consisted of 4/5 corn and 1/5 soybean meal. No concentration for zinc in soybean meal given, therefore assumed same as corn.
m Soil pH6.5
n Soil pH5.5
o Tissue samples combined for analysis.

Note: percent moisture data from USDA, 1963. Used chicken data for mallard duck tissue.

## TABLE D-5. UPTAKE OF ALDRIN/DIELDRIN BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [i] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | | Milk fat | | Dieldrin | | | 3.25 | 18 | | 57 | 41.8604651 | 12.8801 | Braund et al.,1969 as cited in Fries, 1982 (p.15) | 4,6 | e,h |
| Cattle | | Fat | | Aldrin | | | 50 | 31 | | 20.21 | 38.8519865 | 0.77704 | Rumsey & Bond, 1947 as cited in Fries, 1982 (p.15) | 1,4 | e,i,l |
| Cattle | | Fat | | Aldrin | | | 10 | | | | 49 | 1.93333 | Claborn, 1956 (pp.18-23) | 1,4 | g |
| | | | | | | | 25 | | | | 78 | | | | |
| Cattle | | Fat | | Tech. Aldrin 60% | | | 2.5 | | | | 5.2 | 5.12 | Claborn, 1956 (pp.18-23) | 1,4 | g |
| | | | | | | | 5 | | | | 18 | | | | |
| Cattle | | Fat | | Dieldrin | | | 1 | | | | 6 | 2.80902 | Claborn, 1956 (pp.18-23) | 1,4 | g |
| | | | | | | | 2.5 | | | | 14.3 | | | | |
| | | | | | | | 10 | | | | 44 | | | | |
| | | | | | | | 25 | | | | 75 | | | | |
| Sheep | | Fat | | Dieldrin | | | 25 | | | | 126 | 2.6 | Davidson, 1970 as cited in Fries, 1982 (p.15) | 3,4 | e,h |
| | | | | | | | 50 | | | | 191 | | | | |
| Sheep | | Fat | | Aldrin | | | 5 | | | | 17 | 1.53333 | Claborn, 1956 (pp.18-23) | 3,4 | g |
| | | | | | | | 10 | | | | 55 | | | | |
| | | | | | | | 25 | | | | 78 | | | | |
| Sheep | | Fat | | Tech. Aldrin 60% | | | 2.5 | | | | 4.7 | 0.52 | Claborn, 1956 (pp.18-23) | 3,4 | g |
| | | | | | | | 5 | | | | 6 | | | | |
| Sheep | | Fat | | Dieldrin | | | 1 | | | | 6 | 2.80902 | Claborn, 1956 (pp.18-23) | 3,4 | g |
| | | | | | | | 2.5 | | | | 14.3 | | | | |
| | | | | | | | 10 | | | | 44 | | | | |
| | | | | | | | 25 | | | | 75 | | | | |
| Rat (male) | | Liver | | Dieldrin | | | 0.1 | 0.0159 | | 71 | 0.05482759 | 0.52925 | Walker et al., 1969 as cited in EPA, 1980a (p.c-14) | 2,5 | i,m |
| | | | | | | | 1 | 0.0155 | | 71 | 0.05344828 | | | | |
| | | | | | | | 10 | 1.476 | | 71 | 5.08965517 | | | | |
| Rat (female) | | Liver | | Dieldrin | | | 0.1 | 0.0348 | | 71 | 0.12 | 1.00069 | Walker et al., 1969 as cited in EPA, 1980a (p.c-14) | 2,5 | i,m |
| | | | | | | | 1 | 0.4295 | | 71 | 1.48103448 | | | | |
| | | | | | | | 10 | 2.965 | | 71 | 10.2241379 | | | | |
| Rat (male) | | Liver | | Dieldrin | | | 0.1 | 0.0259 | | 71 | 0.08931034 | 6.90988 | Walker et al., 1969 as cited in EPA, 1980a (p.c-14) | 2,5 | i,m |
| | | | | | | | 1 | 1.493 | | 71 | 5.14827586 | | | | |
| | | | | | | | 10 | 19.72 | | 71 | 68 | | | | |
| Rat (female) | | Liver | | Dieldrin | | | 0.1 | 0.8974 | | 71 | 3.09448276 | 18.6072 | Walker et al., 1969 as cited in EPA, 1980a (p.c-14) | 2,5 | i,m |
| | | | | | | | 1 | 13.90 | | 71 | 47.9310345 | | | | |
| | | | | | | | 10 | 57.81 | | 71 | 199.344828 | | | | |

## TABLE D-5. UPTAKE OF ALDRIN/DIELDRIN BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barn owl | | Egg | | Dieldrin | | | 0 | 0.31 | | 73.70 | 1.17870722 | 21.5681 | Mendenhall et al., 1983 (p.238) | 7 | g,n,o |
| | | | | | | | 0.58 | 3.6 | | 73.70 | 13.6862129 | | | | |
| Barn owl | | Egg | | Dieldrin | | | | 0.20 | | 73.70 | 0.76045627 | 51.7897 | Mendenhall et al., 1983 (p.238) | 7 | g,n,p |
| | | | | | | | 0.58 | 8.1 | | 73.70 | 30.7984791 | | | | |
| Barn owl (male) | 2 | Carcass | | Dieldrin | | | 0 | 0.33 | | 73.83 | 1.26098586 | 61.0728 | Mendenhall et al., 1983 (p.237) | 5 | g,n |
| | 12 | | | | | | 0.58 | 9.6 | | 73.83 | 36.6832251 | | | | |
| Barn owl (female) | 2 | Carcass | | Dieldrin | | | 0 | 0.15 | | 73.83 | 0.57317539 | 59.6234 | Mendenhall et al., 1983 (p.237) | 5 | g,p |
| | 7 | | | | | | 0.58 | 9.2 | | 73.83 | 35.1547574 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Residue mostly dieldrin
m Control tissue concentration given but no control feed concentration. Control feed data therefore not presented.
n Tissue concentrations are geometric means, reported by authors.
o 1975 data.
p 1976 data.

Note: percent moisture data from USDA, 1963. Data for rat tissue approximated from data on other species. Used chicken data for barn owl tissue, and heavy cream data for milk fat.

## TABLE D-6. UPTAKE OF CHLORDANE BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+\-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle | 1 | Body fat | | [l] | | | 1 | 0.24 | | 20.21 | 0.30078957 | 0.025198 | Dorough and Hemken, 1973 | 1,2,3,4,5 | l,l |
| | | | | | | | 10 | 1.40 | | 20.21 | 1.75460584 | | | | |
| | | | | | | | 100 | 2.65 | | 20.21 | 3.3212182 | | | | |
| Cattle | 1 | Body fat | | [l] | | | 1 | 0.47 | | 20.21 | 0.58904625 | 0.042096 | Dorough and Hemken, 1973 | 1,2,3,4,5 | l,l |
| | | | | | | | 10 | 1.18 | | 20.21 | 1.47888207 | | | | |
| | | | | | | | 100 | 3.97 | | 20.21 | 4.97556085 | | | | |
| Cow | | Fat | | chlordane | | | 10 | | | | 13 | 0.333333 | Claborn, 1956 | 1,2,3,4,5 | g |
| | | | | | | | 25 | | | | 18 | | | | |
| Cattle | 1 | Milk fat | | [l] | | | 1 | 0.19 | | 57 | 0.44186047 | 0.032719 | Dorough and Hemken, 1973 | 6,7 | i,l,m |
| | | | | | | | 10 | 0.87 | | 57 | 2.02325581 | | | | |
| | | | | | | | 100 | 1.82 | | 57 | 4.23255814 | | | | |
| Cattle | 1 | Milk fat | | [l] | | | 1 | 0.32 | | 57 | 0.74418605 | 0.052343 | Dorough and Hemken, 1973 | 6,7 | i,l,n |
| | | | | | | | 10 | 1.53 | | 57 | 3.55813953 | | | | |
| | | | | | | | 100 | 2.98 | | 57 | 6.93023256 | | | | |
| Cattle | 1 | Milk fat | | [l] | | | 1 | 0.33 | | 57 | 0.76744186 | 0.065298 | Dorough and Hemken, 1973 | 6,7 | i,l,o |
| | | | | | | | 10 | 2.1 | | 57 | 4.88372093 | | | | |
| | | | | | | | 100 | 3.76 | | 57 | 8.74418605 | | | | |
| Cattle | 1 | Milk fat | | [l] | | | 1 | 0.43 | | 57 | 1 | 0.07944 | Dorough and Hemken, 1973 | 6,7 | i,l,p |
| | | | | | | | 10 | 2.53 | | 57 | 5.88372093 | | | | |
| | | | | | | | 100 | 4.58 | | 57 | 10.6511628 | | | | |
| Cattle | 1 | Milk fat | | [l] | | | 1 | 0.48 | | 57 | 1.11627907 | 0.084189 | Dorough and Hemken, 1973 | 6,7 | i,l,q |
| | | | | | | | 10 | 2.64 | | 57 | 6.13953488 | | | | |
| | | | | | | | 100 | 4.85 | | 57 | 11.2790698 | | | | |
| Sheep | | Fat | | chlordane | | | 10 | | | | 16 | -0.26667 | Claborn, 1956 | | g |
| | | | | | | | 25 | | | | 12 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).

## TABLE D-6. UPTAKE OF CHLORDANE BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cattle fed HCS 3260 technical grade chlordane in gelatin capsules
m Tissue samples analyzed after 3 days
n Tissue samples analyzed after 7 days
o Tissue samples analyzed after 15 days
p Tissue samples analyzed after 30 days
q Tissue samples analyzed after 60 days

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

## TABLE D-7. UPTAKE OF DDT/DDD/DDE BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+\-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [i] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cow | | Fat | | DDT | | | 10 | | | | 6.8 | 2.346667 | Claborn, 1956 (p.21) | 1,4 | g |
| | | | | | | | 25 | | | | 42 | | | | |
| Cattle | 3 | Body fat | | DDE | | | 0.62 | 1.37 | | 20.21 | 1.71700714 | 3.340422 | Fries and Marrow, 1976 | 1,4 | e,l,l |
| | | | | | | | 3.1 | 7.98 | | 20.21 | 10.0012533 | | | | |
| Cow | | Milk fat | | DDE | | | 1.40 | 6.76 | | 57 | 15.7209302 | 11.22924 | Fries et al., 1969 as cited in Fries 1982 (p.15) | 4,6 | e,h |
| Cow | | Milk fat | | DDT | | | 1.40 | 1.21 | | 57 | 2.81395349 | 2.009967 | Fries et al., 1969 as cited in Fries 1982 (p.15) | 4,6 | e,h |
| Cattle | 3 | Milk fat | | DDE | | | 0.62 | 2.13 | | 57 | 4.95348837 | 7.783196 | Fries and Marrow, 1976 | 4,6 | e,l,l |
| | | | | | | | 3.1 | 10.43 | | 57 | 24.255814 | | | | |
| Sheep | | Fat | | DDE | | | 0.068 | 0.36 | | 22.54 | 0.464756 | 6.834647 | Harrison et al., 1970 as cited in Fries 1982 (p.15) | 3,4 | e,l |
| Sheep | | Fat | | DDT | | | 0.63 | 1.08 | | 22.54 | 1.39426801 | 2.213124 | Harrison et al., 1970 as cited in Fries 1982 (p.15) | 3,4 | e,l |
| Sheep | | Fat | | DDT | | | 10 | | | | 3.1 | 0.793333 | Claborn, 1956 (p.21) | 3,4 | h |
| | | | | | | | 25 | | | | 15 | | | | |
| Barn owl (male) | 2 | Carcass | | | | | 0 | 0.80 | | 73.83 | 3.05693542 | 150.1463 | Mendenhall et al., 1983 (p.237) | 4,5 | g,m,n |
| | 12 | | | | | | 2.83 | 112.0 | | 73.83 | 427.970959 | | | | |
| Hen | | Liver | | DDT | | | 0.004 | 0.17 | | 73.59 | 0.64369557 | 4.09426 | Cummings et al., 1966 &1967 as cited in Bevenue, 1976 (p.87) | 2,5 | e,l,o |
| | | | | | | | 0.05 | 0.25 | | 73.59 | 0.94661113 | | | | |
| | | | | | | | 0.15 | 0.45 | | 73.59 | 1.70390004 | | | | |
| | | | | | | | 0.45 | 0.67 | | 73.59 | 2.53691783 | | | | |
| Hen | | Liver | | DDT | | | 0.0 | 5.8 | | 73.59 | 21.9613783 | 40.58902 | Smith et al., 1970 as cited in Bevenue, 1976 (p.87) | 2,5 | e,l,p |
| | | | | | | | 1.0 | 6.6 | | 73.59 | 24.9905339 | | | | |
| | | | | | | | 2.5 | 9.7 | | 73.59 | 36.7285119 | | | | |
| | | | | | | | 5.0 | 24.4 | | 73.59 | 92.3892465 | | | | |
| | | | | | | | 7.5 | 62.7 | | 73.59 | 237.410072 | | | | |
| | | | | | | | 10.0 | 117.0 | | 73.59 | 443.01401 | | | | |
| Hen | | Egg yolk | | DDT | | | 0.0 | 1.0 | | 51.10 | 2.04498978 | 1.081822 | Smith et al., 1970 as cited in Bevenue, 1976 (p.87) | 7 | e,l,p |
| | | | | | | | 1.0 | 1.6 | | 51.10 | 3.27198364 | | | | |
| | | | | | | | 2.5 | 2.6 | | 51.10 | 5.31697342 | | | | |
| | | | | | | | 5.0 | 4.6 | | 51.10 | 9.40695297 | | | | |
| | | | | | | | 7.5 | 5.7 | | 51.10 | 11.6564417 | | | | |
| | | | | | | | 10.0 | 5.9 | | 51.10 | 12.0654397 | | | | |
| Barn owl | 2 | Eggs | | DDE | | | 0 | 0.25 | | 73.70 | 0.95057034 | 15.78686 | Mendenhall et al., 1983 (p.238) | 7 | g,m,q,t |
| | 12 | | | | | | 2.83 | 12 | | 73.70 | 45.6273764 | | | | |

## TABLE D-7. UPTAKE OF DDT/DDD/DDE BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barn owl | 2 | Eggs | | DDE | | | 0 | 0.40 | | 73.70 | 1.52091255 | 54.54863 | Mendenhall et al., 1983 (p.238) | 7 | g,r,s,u |
| | 12 | | | | | | 2.83 | 41 | | 73.70 | 155.893536 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of hexachlorobenzene. Authors do not believe an interaction occurred.
m Tissue concentrations are geometric means of 9 samples, reported by authors.
n Feed concentrations are geometric means of 2 samples, reported by authors.
o Feed range 0.004-0.035; used lower value to be conservative.
p Lindane and dieldrin also in feed.
q Feed concentrations are geometric means of 13 samples, reported by authors.
r Tissue concentrations are geometric means of 13 samples, reported by authors.
s Feed concentrations are geometric means of 10 samples, reported by authors.
t 1975 data.
u 1976 data.

Note: percent moisture data from USDA, 1963. Used chicken data for barn owl and hen tissue, and heavy cream data for milk fat.

## TABLE D-8. UPTAKE OF HEPTACHLOR BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutan quantity (mg/day | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dairy cow | 2 | Body fat | | Heptachlor epoxide | | | 0.5 | 7.1 | | 20.21 | 8.89835819 | 7.139324034 | Bruce et al., 1965 (p.64) | 1,4,5 | e,i |
| | | | | | | | 1.5 | 14.7 | | 20.21 | 18.42336132 | | | | |
| | | | | | | | 10 | 83.5 | | 20.21 | 104.6497055 | | | | |
| | | | | | | | 50 | 293.4 | | 20.21 | 367.7152525 | | | | |
| Steers | 20 | Body fat | | Heptachlor epoxide | | | 0.19 | 1.24 | | 20.21 | 1.554079459 | 8.179365571 | Bovard et al., 1971., (p.131) | 1,4,5 | e,i,l |
| Cow | | Fat | | Heptachlor | | | 2.5 | | | | 1.4 | 0.88 | Claborn et al., 1960 | 1,4,5 | g |
| | | | | | | | 10 | | | | 8 | | | | |
| Dairy cow | 2 | Milk fat | | Heptachlor epoxide | | | 0.2 | 4.25 | | 57 | 9.88372093 | 21.06101164 | Bruce et al., 1965 (p.64) | 2,4,5,6,7 | e,i |
| | | | | | | | 0.5 | 11.25 | | 57 | 26.1627907 | | | | |
| | | | | | | | 1.5 | 21.7 | | 57 | 50.46511628 | | | | |
| | | | | | | | 10 | 119.7 | | 57 | 278.372093 | | | | |
| | | | | | | | 50 | 460 | | 57 | 1069.767442 | | | | |
| Dairy cow | | Milk fat | | Heptachlor epoxide | | | 0.5 | 0.38 | | 57 | 0.88372093 | 7.255813953 | Bache et al., 1960 | 2,4,5,6,7 | e,i |
| | | | | | | | 1.0 | 1.94 | | 57 | 4.511627907 | | as cited in Bruce et al., 1965 (p.64) | | |
| Sheep | | Fat | | Heptachlor | | | 2.5 | | | | 2.1 | 0.853333333 | Claborn et al., 1960 | 3 | g |
| | | | | | | | 10 | | | | 8.5 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of DDE. Authors do not believe an interaction occurred.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

## TABLE D-9. UPTAKE OF HEXACHLOROBENZENE BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cow | 3 | Body fat | | HCB | | | 0.62 | 1.91 | | 20.21 | 2.393783682 | 3.481922 | Fries and Marrow, 1976 (p.477) | 1,2,4 | e,f,l |
| | | | | | | | 3.1 | 8.60 | | 20.21 | 11.028951 | | | | |
| Cow | 3 | Milk fat | | HCB | | | 0.62 | 2.12 | | 57 | 4.930232558 | 6.46099 | Fries and Marrow, 1976 (p.477) | 2,4,6 | e,f,l |
| | | | | | | | 3.1 | 9.01 | | 57 | 20.95348837 | | | | |
| Sheep | | Body fat | | HCB | | | 0.1 | 0.9 | | 22.54 | 1.161890006 | 8.352516 | Avrahami and Steele, 1972 | 3,4 | e,i |
| | | | | | | | 1 | 7.5 | | 22.54 | 9.682416731 | | as cited in Booth & Mc Dowell, 1975 (p.593) | | |
| | | | | | | | 10 | 75.0 | | 22.54 | 96.82416731 | | | | |
| | | | | | | | 100 | 650.0 | | 22.54 | 839.1427634 | | | | |
| Chicken | | Body fat | | HCB | | | 0.02 | 0.7 | | 28.91 | 0.984667323 | 5.642786 | FAO-WHO, 1969 | 5 | e,i |
| | | | | | | | 0.08 | 0.7 | | 28.91 | 0.984667323 | | as cited in Booth & Mc Dowell, 1975 (p.593) | | |
| | | | | | | | 0.7 | 5 | | 28.91 | 7.033338022 | | | | |
| | | | | | | | 7 | 29 | | 28.91 | 40.79336053 | | | | |
| Chicken, broiler | | Fat | | HCB | | | | | | | | 13 | Dejunckheere et al., as cited in Connor, 1984 (p.48) | 5 | m |
| Chicken, hen | | Fat | | HCB | | | | | | | | 38 | Dejunckheere et al., as cited in Connor, 1984 (p.48) | 5 | n |
| Chicken | | Body fat | | HCB | | | 340 | 528 | | 28.91 | 742.7204951 | 2.184472 | FAO-WHO, 1969 | 5 | e,i |
| | | | | | | | | | | | | | as cited in Booth & Mc Dowell, 1975 (p.593) | | |
| Chicken | | Egg yolks | | HCB | | | 0.02 | 0.2 | | 51.10 | 0.408997955 | 4.312415 | FAO-WHO, 1969 | 7 | e,i |
| | | | | | | | 0.08 | 0.3 | | 51.10 | 0.613496933 | | as cited in Booth & Mc Dowell, 1975 (p.593) | | |
| | | | | | | | 0.7 | 2.0 | | 51.10 | 4.08997955 | | | | |
| | | | | | | | 7 | 15 | | 51.10 | 30.67484663 | | | | |
| Chicken | | Egg yolks | | HCB | | | 340 | 167 | | 51.10 | 341.5132924 | 1.004451 | FAO-WHO, 1969 | 7 | e,i |
| | | | | | | | | | | | | | as cited in Booth & Mc Dowell, 1975 (p.593) | | |
| Chicken | | Egg | | HCB | | | | | | | | 6.5 | Dejunckheere et al., as cited in Connor, 1984 (p.48) | 7 | o |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.

## TABLE D-9. UPTAKE OF HEXACHLOROBENZENE BY ANIMALS (cont.)

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue *concentration*)/(feed *concentration*). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). *Denominator* units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of DDE. Authors do not believe an interaction occurred.
m Dry weight uptake slope range of 11-13 reported. Used higher to be conservative.
n Dry weight uptake slope range of 21-38 reported. Used higher to be conservative.
o Dry weight uptake slope range of 4.5-6.5 reported. Used higher to be conservative.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

## TABLE D-10. UPTAKE OF LINDANE BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cow | | Fat | | Lindane | | | 1 | | | | 2.0 | 1.117267 | Clabom, 1956 (p.26) | 1,2,3,4,5,6,7 | g |
| | | | | | | | 10 | | | | 8.3 | | | | |
| | | | | | | | 100 | | | | 111.0 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.

Note: percent moisture data from USDA, 1963

## TABLE D-11. UPTAKE OF POLYCHLORINATED BIPHENYLS BY ANIMALS

| Species | N [a] | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used In [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cow | | Body fat | | Arochlor 1254 | | | 12.4 | 41.7 | | 20.21 | 52.2621882 | 4.21469 | Fries et al., 1973 (p.119) | 1,2,3,4,5 | e,h,l |
| Cow | | Milk fat | | Arochlor 1254 | | | 12.4 | 60.9 | | 57 | 141.627907 | 11.4216 | Fries et al., 1973 (p.119) | 2,3,4,5,6,7 | e,h,l |
| Cattle | | Milk fat | | Arochlor 1254 | | | 0.22 | 1.0 | | 57 | 2.3255814 | 9.71869 | Willet, 1975 | 2,3,4,5,6,7 | e,h |
| | | | | | | | 0.43 | 1.8 | | 57 | 4.18604651 | | as cited in Fries, 1982 (p.15) | | |
| | | | | | | | 0.87 | 3.7 | | 57 | 8.60465116 | | | | |

Footnotes:

a Number of animals studied.

b Number of samples analyzed.

c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).

d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.

e Not specified whether tissue concentration is wet or dry weight.

f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)

g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.

h Feed concentration dry weight

i Feed concentration not specified. No conversion performed.

j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).

k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.

l Tissue concentration is arithmetic mean reported by authors.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

## TABLE D-12. UPTAKE OF TOXAPHENE BY ANIMALS

| Species | N [a] | | Tissue Analyzed | N [b] | Chemical Form Fed | Pollutant quantity (mg/day) | Feed quantity (kg DW/day) | Feed Conc. (µg/g) [c] | Tissue Concentration (µg/g WW) [d] | range (+/-) | percent moisture (%) | Tissue Conc. (µg/g DW) [f] | Uptake Slope [j] | Reference | Used in [k] | Footnote references |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cow | 2 | | Milk | [g] | | | | 0 | 0 | | 87.30 | 0 | 0.746122294 | Bateman et al., 1953 (p.323-4) | 1,2,3,4,5,6,7 | e,l,l |
| | | | | | | | | 63.18 | 11.6 | | 87.30 | 91.3385827 | | | | |
| | | | | | | | | 132.8 | 13.3 | | 87.30 | 104.724409 | | | | |
| | | | | | | | | 268.18 | 29.2 | | 87.30 | 229.92126 | | | | |
| Cow | 2 | | Liver | [g] | | | | 0 | 0 | | 66.99 | 0 | 0 | Bateman et al., 1953 (p.323-4) | | e,l,l |
| | | | | | | | | 120.7 | 0 | | 66.99 | 0 | | | | |
| | | | | | | | | 252.4 | 0 | | 66.99 | 0 | | | | |
| Cow | 2 | | Kidney | [g] | | | | 0 | 0 | | 77.02 | 0 | 0 | Bateman et al., 1953 (p.323-4) | | e,l,l |
| | | | | | | | | 120.7 | 0 | | 77.02 | 0 | | | | |
| | | | | | | | | 252.4 | 0 | | 77.02 | 0 | | | | |
| Cow | 2 | | Muscle | [g] | | | | 0 | 0 | | 70.62 | 0 | 0 | Bateman et al., 1953 (p.323-4) | | e,l,l |
| | | | | | | | | 120.7 | 0 | | 70.62 | 0 | | | | |
| | | | | | | | | 252.4 | 0 | | 70.62 | 0 | | | | |

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
l Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & l).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows fed Alfalfa sprayed with toxaphene in the field.

Note: percent moisture data from USDA, 1963

# APPENDIX E

## Results of the Plant Phytotoxicity Literature Search

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TABLE E-1. CHROMIUM PHYTOTOXICITY DATA

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Barley | Hordeum vulgare | | leaves | | | |
| Cherry | Prunus cerasus | | fruit | field | | |
| Corn | Zea mays | | leaves,stalks,grain,husks,cobs | | | |
| Mushroom | Cantharellus cibarius | | | | | |
| Oak, English | Quercus robur | | leaves | field | | |
| Oak | Quercus spp. | | leaves | field | | |
| Oats | Avena sativa | | leaves | solution | | |
| | | | leaves,stems | serpentine soil | | |
| Oranges | Citrus sinensis | | leaves | greenhouse | | |
| | | | | field | | |
| | | | | pots | | |
| Pear | Pyrus communis | | fruit,pericarp,peel | field | | |
| Potato | Solanum tuberosum | | tubers | | | |
| Tobacco | Nicotiana tabacum | | leaves,roots | serpentine soil | | |
| Wheat | Triticum spp. | | leaves | | | |
| Corn | Zea mays | | | greenhouse | 6.8 | Warsaw sandy loam limed |
| Rye | Seceale cereal | | | greenhouse | 6.8 | Warsaw sandy loam limed |
| Corn | Zea mays | | | greenhouse | 6.5 | Warsaw sandy loam |
| Rye | Seceale cereal | | | greenhouse | 6.5 | Warsaw sandy loam |
| Corn | Zea mays | | grain | field | 6.3 | Sable silty clay loam |
| | | | | | 6.8 | Cisne silt loam |
| | | | | | 6.0-6.3 | Ipava silt loam |
| | | | | | 6.2-6.3 | Drummer silty clay loam |
| | | | | | 6 | Muscatine silt loam |
| | | | | | 6.2 | Hartsburg silty clay loam |
| | | | tops | greenhouse | 5.5 | Hartsell fine sandy loam |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| Barley | | | | | 7.60 ppm | |
| Cherry | | | | | .032ppm | |
| Corn | | | | | .44-2.07 | 4.0-8.0 |
| Mushroom | | | | | .058-.135 | |
| Oak, English | | | | | 3 | |
| Oak | | | | | 4 | |
| Oats | | | | | 0.4-3.0 | 252 |
| | | | | | 3.0-11.0 | |
| Oranges | | | | | .20-1.00 | |
| | | | | | <10 | |
| | | | | | .20-<1.00 | |
| Pear | | | | | .03-.85 | |
| Potato | | | | | 0.002 | |
| Tobacco | | | | | 4-14 | 18-34 |
| Wheat | | | | | 4.5-14.8 | |
| Corn | fertilized | | | | <.4 | |
| | plain sludge | 58ppm | | | .7-1.6 | |
| | Cr sludge | 404-1444 | | | 2.3-7.2 | |
| Rye | fertilized | | | | 0.8 | |
| | plain sludge | | 58 | | 1.3 | |
| | Cr sludge | 404-1444 | | | 3.2-5.1 | |
| Corn | fertilized | | | | <3 | |
| | sludge | | 58 | | <3 | |
| | Cr sludge | 358-697 | | | 3-8.0 | |
| | inorganic | 350-700 | | | | 46 |
| Rye | fertilized | | | | <3 | |
| | sludge | | 58 | | <3 | |
| | Cr sludge | 358-697 | | | 4.8-9.5 | |
| | inorganic | 350-700 | | | | 25.1-58.1 |
| Corn | | | | | .094 ug/g | |
| | | | | | 0.11ug/g | |
| | | | | | .059-.193ug/g | |
| | | | | | .059-.118ug/g | |
| | | | | | 0.068 ug/g | |
| | | | | | .094 ug/g | |
| | sludge A | | 68-1360 | | 1.2-5.4 | |
| | sludge B | | 3-50 | | .6-3.5 | |
| | compost | | 3-50 | | .7-2.8 | |
| | NaCrO | | 1-320 | | 1.4-1.6 | 2.5-29.0 |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| Barley | | | | | 35 |
| Cherry | | | | | 35 |
| Corn | visual | stunted,leave · roll & ·urple | | | 35 |
| Mushroon | | | | | 35 |
| Oak, English | | | | | 35 |
| Oak | | | | | 35 |
| Oats | visual | stunted,brownish-red leaves | | | 35 |
| | | | | | 35 |
| Oranges | | | | | 35 |
| | | | | | 35 |
| | | | | | 35 |
| Pear | | | | | 35 |
| Potato | | | | | 35 |
| Tobacco | | | visual | stem retarded,no inflorescence | 35 |
| Wheat | | | | | 35 |
| Corn | | | | | 44 |
| | | | | | 44 |
| | | | yield | reduction was attributed to others | 44 |
| Rye | | | | | 44 |
| | | | | | 44 |
| | | | yield | reduction was attributed to others | 44 |
| Corn | | | | | 45 |
| | | | | | 45 |
| | | | | | 45 |
| | | | yield | reduction,lowest yield in crop #1 | 45 |
| Rye | | | | | 45 |
| | | | | | 45 |
| | | | | | 45 |
| | | | yield | reduction | 45 |
| Corn | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 169 |
| | | | | | 169 |
| | | | | | 169 |
| | | | yield | reduction from 55 to 1 g/pot | 169 |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| | | Jubilee | leaves, kernels | field | 5.8-7.1 | Willamette silt loam |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 5.6-5.9 | Chalmers silty clay loam and Russel silt loam |
| Rye grass | Lolium perenne | | | greenhouse | 5.6-5.9 | Chalmers silty clay loam and Russel silt loam |
| Soybean | Glycine max | Corsoy | seedling tissue | pot | 5.9 | Nicollet loam soil |
| Sorghum | sorghum bicolor | Moench | leaves,root,grain,stem | field | 5.8-7.2 | Haynie fine sand loam |
| | | | | | 6.9-7.7 | Haynie fine sand loam |
| Winter wheat | Triticum aestivum | | roots,grain | field | 5.8-7.2 | Haynie fine sand loam |
| | | | | | 6.9-7.7 | Haynie fine sand loam |
| Oat | | Harmon | root,seed,stem | field | | |
| Lucerne | Medicago sativa | Wairau | whole | pot | 5 | Waitarere sand |
| | | | | | 5.1-5.6 | Waitarere sand |
| | | | | | 6.6 | Waitarere sand |
| | | | | | 5.2 | Levin silt loam |
| | | | | | 5.4-6.0 | Levin silt loam |
| | | | | | 6.8 | Levin silt loam |
| Tomato | Lycopersicon esculentum | Money maker | leaves,fruit,root | pot | 4.6-6.9 | |
| Soybean | Glycine max | | stem,leaves,seeds,pods | pot | | Ritzville silt loam |
| Grass | | timothy,brown top sweet vernal,blue | | field | 6.05 | clay & sandy loam |
| | | | | | 6.2 | clay & sandy loam |
| Alfalfa & red clover | | | | field | 6.05 | clay & sandy loam |
| | | | | | 6.2 | clay & sandy loam |
| Various | | | shoots | field | | serpentine soil |
| Wheat | Triticum aestivum | HDM 1553 | stem | field | 8 | clay |
| | | | tops | pot | 5.0-5.5 | Orentano histosol |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | CrSO$ | | 5-320 | | 1.3-1.4 | 2.4-2.8 |
| | control | | 0 | | 1.3-2.1 | |
| | control | .87-1.0 mmol/kg | | | .18-.19mmol/kg | |
| | tannery waste | 1.23-13.7mmol/kg | | | .12-.22mmol/kg | |
| Swiss chard | control | 12 mg/kg | | | 8.9 | |
| | drilling fluid | 96-402 mg/kg | | | 8.0-12.2 | |
| Rye grass | control | 12 mg/kg | | | 7.5 | |
| | drilling fluid | 96-402 mg/kg | | | 8.3-10.9 | |
| Soybean | Na2Cr2O | | 0-40 mg/kg | | .7-1.1 | |
| | sludge | | 0-432 mg/kg | | .7-.9 | |
| Sorghum | fertilized | 29.34 | | | 0.398 | |
| | sludge | 47.7 | | | 0.2 | |
| Winter wheat | fertilized | 29.34 | | | 15.47 | |
| | sludge | 47.7 | | | 17.26 | |
| Oat | control | .8.1-9.6 | | | 43 | |
| | 25% sludge | 20.3 | | | 72 | |
| | 50% sludge | 27.5 | | | 56 | |
| Lucerne | 0 | 15 | | | .75-9.1 | |
| | 5-40% sludge | 19.25-49 | | | .1-6.5 | |
| | 100% sludge | 100 | | | .1-2.6 | |
| | 0 | 30 | | | .1-.9 | |
| | 5-40% sludge | 33.5-58 | | | .1-4.7 | |
| | 100% sludge | 100 | | | .1-1.0 | |
| Tomato | sludge | 470 | 0-459 kg/ha | | 15 | |
| Soybean | control | 59 | | | 0.095 | |
| | Cr solution | | 2.5 ug/g | | 0.15 | |
| Grass | control | .18-.78 | | | .13-1.63 | |
| | sludge | .30-.94 | 1.39-5.84 kg/ha | | .11-2.07 | |
| Alfalfa & red clover | control | .18-.78 | | | .47-3.96 | |
| | sludge | .30-.94 | 1.39-5.84 kg/ha | | .38-7.93 | |
| Various | natural | 92-737 | | | 0-70 | |
| Wheat | control | 17 | 0 | | 7.94 | |
| | 50% sludge | 41.8 | | | 9.52 | |
| | 66% sludge | 46.6 | | | 10.6 | |
| | 100% sludge | 55 | | | 12.16 | |
| | 10 ton/ha sludge | 27 | .45 kg/ha | | 11.08 | |
| | 20 ton/ha sludge | 31 | .90 kg/ha | | 20.76 | |
| | control | 27.8 | | | 5 | |
| | fly ash 2% | 25.6 | | | 4.1 | |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | yield | reduction from 56 to 25 g/pot | 169 |
| | | | | | 169 |
| | | | | | 226 |
| | | | | | 226 |
| Swiss chard | | | | | 176 |
| | | | | | 176 |
| Rye grass | | | | | 176 |
| | | | | | 176 |
| Soybean | | | | | 57 |
| | | | | | 57 |
| Sorghum | | | | | 127 |
| | | | | | 127 |
| Winter wheat | | | | | 127 |
| | | | | | 127 |
| Oat | | | | | 73 |
| | | | | | 73 |
| | | | | | 73 |
| Lucerne | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| Tomato | | | | | 262 |
| Soybean | | | | | 27 |
| | | | | | 27 |
| Grass | | | | | 147 |
| | | | | | 147 |
| Alfalfa & red clover | | | | | 147 |
| | | | | | 147 |
| Various | | | | | 5 |
| Wheat | | | | | 29 |
| | | | | | 29 |
| | | | | | 29 |
| | | | | | 29 |
| | | | | | 29 |
| | | | | | 29 |
| | | | | | 186 |
| | | | | | 186 |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| | | | | | 6.1-8.3 | Lamporecchio fluvisol |
| | | | | | 7.5-8.0 | Guardia regosol |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | fly ash 5% | 20.3 | | | 4.3 | |
| | control | 25.7 | | | 3.2 | |
| | fly ash 2% | 21.8 | | | 3.1 | |
| | fly ash 5% | 18.2 | | | 2.8 | |
| | control | 13.9 | | | 4.9 | |
| | fly ash 2% | 14.4 | | | 3.2 | |
| | fly ash 5% | 21.1 | | | 4.1 | |

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |

TABLE E-2. COPPER PHYTOTOXICITY DATA

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Alfalfa | Medicago sativa | | steams,leaves,tops | field | |
| | | | tops | control | |
| Apple | Malus spp. | | leaves | field | |
| Avocado | Persea americana | | leaves | field | |
| Barley | Hordeum vulgare | | grain | field | |
| Cacao | Theobroma cacao | | leaves | field | |
| Cauliflower | Brassica oleracea botrytis | | leaves | field | |
| Cherry | Prunus cerasus | | leaves | field | |
| Lemon | Citrus limon | | leaves | field | |
| Orange | Citrus sinensis | | leaves, Valencia and Navel leaves | field | |
| | | | | culture | |
| | | | | control | |
| Clover,red | Trifolium pratense | | tops | field | |
| Clover,subterranean | Trifolium subterraneum | | leaves,tops | field | |
| Coffee | Coffea spp. | | beans | | |
| Currant,black | Ribes nigrum | | leaves | field | |
| Grapes | Vitis spp. | | leaves | field | |
| Oats | Avena sativa | | leaves,straw,tops,grain, | field | |
| | | | | solution | |
| Peach | Prunus persica | | leaves | field | |
| Pear | Pyrus communis | | leaves,wood,bark | field | |
| Pecan | Carya illinoensis | | leaves | field | |
| Pineapple | Ananas comosus | | leaves | field | |
| Plum | Prunus domestica | | apical leaves | field | |
| Potato | Solanum tuberosum | | tubers | field | |
| Rye | Secale cereale | | grain | field | |
| Timothy | Phleum pratense | | tops | field | |
| Tomato | Lycopersicon esculentum | | leaves | greenhouse | |
| | | | fruit | control | |
| | | | fruit | field | |
| Tung | Aleurites fordi | | leaves | field | |
| Wheat | Triticum spp. | | straw,grain,wheat germ | field | |
| Corn | Zea mays | | earleaf | controled | 5.8-6.2 |
| | | | | | 5.7-6.0 |
| | | | | | 5.7-6.0 |
| | | | earleaf,grain,stover | field | 6.6 |
| Barley | Hordeum vulgare | Henry | silage | field | 6.6 |
| Reed canarygrass | Phalaris arundinacea | | | field | 5.9-6.6 |
| Corn | Zea mays | | | field | 5.9-6.6 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Alfalfa | | | | |
| Apple | | | | |
| Avocado | | | | |
| Barley | | | | |
| Cacao | | | | |
| Cauliflower | | | | |
| Cherry | | | | |
| Lemon | | | | |
| Orange | | | | |
| Clover,red | | | | |
| Clover,subterranean | | | | |
| Coffee | | | | |
| Currant,black | | | | |
| Grapes | | | | |
| Oats | | | | |
| Peach | | | | |
| Pear | | | | |
| Pecan | | | | |
| Pineapple | | | | |
| Plum | | | | |
| Potato | | | | |
| Rye | | | | |
| Timothy | | | | |
| Tomato | | | | |
| Tung | | | | |
| Wheat | | | | |
| Corn | Bojac loamy sand | | | |
| | Davidson clay loam | | | |
| | Groseclose silt loam | | | |
| | Acredale silt loam | | | 304 kg/ha |
| Barley | Acredale silt loam | | | 304 kg/ha |
| Reed canarygrass | Hublersburg clay loam | | | 36.6 kg/ha |
| Corn | Hublersburg ckay loam | | | 7.6 kg/ha |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Alfalfa | | 5.10-11.5 | | | |
| | | 6-16.4 | | | |
| Apple | 1.0-4.0 | 3.2-23.0 | | visual | necrotic spots,shoots die |
| Avocado | | 4-11 | | | |
| Barley | | 6.2-11.9 | | | |
| Cacao | | 11-15 | | | |
| Cauliflower | | 4.8-5.4 | | | |
| Cherry | | 5-200 | | | |
| Lemon | 3.9 | 8.4-8.6 | | visual | multiple budding,gum pockets |
| Orange | <4.00 | 5-20 | >20.00 | visual | dark greeen leaves,bumpy fruit |
| | <4.00 | 4-20 | | visual | dark greeen leaves,bumpy fruit |
| | .70-1.60 | 3.20-15 | | visual | dark greeen leaves,bumpy fruit |
| Clover,red | | 7.6-16.4 | | | |
| Clover,subterranean | <3.00 | 3-32 | | visual | become light, no center markings |
| Coffee | | 8.0-20.0 | | | |
| Currant,black | 2-4 | 7.5-10.00 | | visual | leaves turn pale & mottled |
| Grapes | 1.0-5.4 | 2.6-30.0 | | visual | |
| Oats | <3.0 | 7-8 | | visual | leaves roll& yellow-gray spots |
| | 1-2.5 | 1.1-8.8 | | visual | leaves roll& yellow-gray spots |
| Peach | | 7-16 | | | |
| Pear | 1.2-6.7 | 5-100 | | visual | stunted,terminal leaves die,unfruit |
| Pecan | | 21-28 | | | |
| Pineapple | | 8.6-11.5 | | | |
| Plum | 3.0-4.0 | 7.0-9.0 | | visual | terminal buds die,leaves go yellow |
| Potato | | 2.5-5.5 | | | |
| Rye | <.5 | <2.0 | | visual | |
| Timothy | | 6.4 | | | |
| Tomato | | 3.1-12.3 | | | |
| | | 13.0-37.0 | | | |
| | | 15.0-25.0 | | | |
| Tung | 2.6-3.1 | 4.8-5.7 | | visual | foliage is chlorotic & dwarfed |
| Wheat | 1.5 (grain) | 3-16.7 (gr) | | visual | Leaves roll,yellow,die,dry to gray |
| Corn | | 6.1-9.6mg/kg | | | |
| | | 6.1-9.1mg/kg | | | |
| | | 8.8-10.5mg/k | | | |
| | | 4.9-8.2mg/kg | | | |
| Barley | | 1.0-2.8mg/kg | | | |
| Reed canarygrass | | 8.9-32.3ug/g | | | |
| Corn | | 4.2-6.2ug/g | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Alfalfa | | | 35 |
| | | | 35 |
| Apple | | | 35 |
| Avocado | | | 35 |
| Barley | | | 35 |
| Cacao | | | 35 |
| Cauliflower | | | 35 |
| Cherry | | | 35 |
| Lemon | | | 35 |
| Orange | visual | chlorosis of the foliage,yellow | 35 |
| | | | 35 |
| | | | 35 |
| Clover,red | | | 35 |
| Clover,subterranean | | | 35 |
| Coffee | | | 35 |
| Currant,black | | | 35 |
| Grapes | | | 35 |
| Oats | | | 35 |
| | | | 35 |
| Peach | | | 35 |
| Pear | | | 35 |
| Pecan | | | 35 |
| Pineapple | | | 35 |
| Plum | | | 35 |
| Potato | | | 35 |
| Rye | | | 35 |
| Timothy | | | 35 |
| Tomato | | | 35 |
| | | | 35 |
| | | | 35 |
| Tung | | | 35 |
| Wheat | | | 35 |
| Corn | | | 197 |
| | | | 197 |
| | | | 197 |
| | | | 196 |
| Barley | | | 196 |
| Reed canarygrass | | none reported | 213 |
| Corn | | none reported | 213 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | greenhouse | 6.8 |
| Rye | Seceale cereal | | | greenhouse | 6.8 |
| Corn | Zea mays | | | greenhouse | 6.5 |
| Rye | Seceale cereal | | | greenhouse | 6.5 |
| Bermuda grass | Cynodon dactylon | | | field | 5.7-6.6 |
| | | | | | 5.4-6.2 |
| | | | | | 4.2-5.3 |
| Corn | Zea mays | | grain | field | 6.3 |
| | | | | | 6.8 |
| | | | | | 6.0-6.3 |
| | | | | | 6.2-6.3 |
| | | | | | 6 |
| | | | | | 6.2 |
| Tall Fescue | Festuca arundinacea | | tops | pots | 7.1-7.5 |
| | | | | | 6.1-7.5 |
| | | | | | 5.5-6.0 |
| Alfalfa | Medicago sativa | | tops | pots | 7.1-7.7 |
| | | | | | 6.1-7.5 |
| | | | | | 5.5-6.0 |
| Lettuce | Lactuca sativa | longifolia | shoots | greenhouse | 7.5 |
| | | | | | 5.7 |
| Wheat | Triticum aestivum | Inia | leaves,grain | greenhouse | 7.5 |
| | | | | | 5.7 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | limed Warsaw sandy loam | fertilized | | |
| | | sludge | 46 ppm | |
| | | Cu sludge | 120-343 ppm | |
| Rye | limed Warsaw sandy loam | fertilized | | |
| | | sludge | 46 ppm | |
| | | Cu sludge | 120-343 ppm | |
| Corn | Warsaw sandy loam | fertilized | | |
| | | sludge | 46 | |
| | | Cu sludge | 88-160 | |
| | | inorganic | 75-150 | |
| Rye | Warsaw sandy loam | fertilized | | |
| | | sludge | 46 | |
| | | Cu sludge | 88-160 | |
| | | inorganic | 75-160 | |
| Bermuda grass | Cecil sandy clay loam | control | 1 | |
| | Cecil sandy clay loam | fertilized | 1 | |
| | Cecil sandy clay loam | sludge | 1-4 | |
| Corn | Sable silty clay loam | | | |
| | Cisne silt loam | | | |
| | Ipava silt loam | | | |
| | Drummer silty clay loam | | | |
| | Muscatine silt loam | | | |
| | Hartsburg silty clay loam | | | |
| Tall Fescue | fine silty | | 3.9 | |
| | fine silty | sludge | 19.2 | |
| | stripped mind | sludge | 25.2 | |
| Alfalfa | fine silty | | 3.9 | |
| | fine silty | sludge | 19.2 | |
| | stripped mind | sludge | 25.2 | |
| Lettuce | Domino silt loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| | Redding fine sandy loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| Wheat | Domino silt loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| | Redding fine sandy loam | | 0-10 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 4.4-10.4 | | | |
| | | 6.5-24.3 | | | |
| | | | >30 | | |
| Rye | | 7.5 | | | |
| | | 12.1 | | | |
| | | | >42 | | |
| Corn | | 4.4-10.4 | | | |
| | | 6.5-24.3 | | | |
| | | | 16.7-22.8 | | |
| | | | 12.7-41.0 | | |
| Rye | | 7.5 | | | |
| | | 12.1 | | | |
| | | 14.7-17.4 | | | |
| | | | 23.9-37.9 | | |
| Bermuda grass | | 12 | | | |
| | | 7 | | | |
| | | 6-8 | | | |
| Corn | | 2.69 ug/g | | | |
| | | 2.68 ug/g | | | |
| | | 2.6-4.41ug/g | | | |
| | | 2.18-3.22ug/g | | | |
| | | 2.49 ug/g | | | |
| | | 1.67 ug/g | | | |
| Tall Fescue | | 9.7 | | | |
| | | 9.6-15.0 | | | |
| | | 8.6-11.6 | | | |
| Alfalfa | | 16 | | | |
| | | 19.1-20.5 | | | |
| | | 15.1-17.8 | | | |
| Lettuce | | 6.2-6.4 ug/g | | | |
| | | 6.6-7.9 ug/g | | | |
| | | | 8.2-9.3 ug/g | | |
| | | 6.8-7.3 ug/g | | | |
| | | 6.1-8.9 ug/g | | | |
| | | 7.6-10.7 ug/g | 10.7-18.3ug/g | | |
| Wheat | | 10.7-11.6ug/g | | | |
| | | 11.9-14.8ug/g | | | |
| | | 13.9-15.4ug/g | 15.4-21.0ug/g | | |
| | | 10.1-10.7ug/g | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 44 |
| | | | 44 |
| | yield | reduction | 44 |
| Rye | | | 44 |
| | | | 44 |
| | yield | reduction | 44 |
| Corn | | | 45 |
| | | | 45 |
| | yield | reduction | 45 |
| | yield | reduction | 45 |
| Rye | | | 45 |
| | | | 45 |
| | | | 45 |
| | yield | reduction | 45 |
| Bermuda grass. | | | 240 |
| | | | 240 |
| | | | 240 |
| Corn | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| Tall Fescue | | | 230 |
| | | | 230 |
| | | | 230 |
| Alfalfa | | | 230 |
| | | | 230 |
| | | | 230 |
| Lettuce | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| Wheat | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| | | | 167 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Snap bean | Phaseolus vulgaris | Tendergreen | beans,leaves | field | 5.3 |
| | | | leaves, edible tissue | field | 5.3 |
| Carrots | Daucus carota sativa | Scarlet Nantes | tubers | field | 5.3 |
| Lettuce | Lactuca sativa | Grand Rapids | leaves | field | 5.3 |
| Peas | Pisum sativum | Wando | fruit,vines,pods | field | 5.3 |
| Potatoes | Solanum tuberosum | Norland | tubers | field | 5.3 |
| Radishes | Raphanus sativus | Sparkler | tubers | field | 5.3 |
| Sweet corn | Zea mays | NK-199 | grain,leaves | field | 5.3 |
| Tomatoes | Lycopersicon esculentum | Fantastic | fruit | field | 5.3 |
| Wheat | Triticum aestivum | Centurk | grain | field | |
| Pearl Millet | Pennisetum americanum | | leaves | field | 5.3-6.9 |
| Red Oak | Quercus ruba | | leaves | field | 5.3-6.9 |
| Black Walnut | Juglans nigra | | leaves | field | 5.3-6.9 |
| Wheat | Triticum aestivum | | | pots | 5.2 |
| | | | | | >6.5 |
| | | | shoots,roots | greenhouse | |
| Little bluestem | Andropogon scoparius | | shoots,roots,whole | greenhouse | 4.8 |
| | | | | | 7.82 |
| Black-eyed Susan | Rudbeckia hirta | | shoots,roots,whole | greenhouse | 4.8 |
| Corn | Zea mays | Dekalb XL-43 | seedlings,grain,stover | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Oats | Avena sativa | Norline | grain | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Wheat | Triticum aestivum | Arthur | grain | field | 5.6 |
| | | | | | 6 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | | 20-80 | |
| | | | 160-640 | |
| Snap bean | Hubbard coarse sand | | | |
| | Hubbard coarse sand | control | | 0 |
| | | single | | 26.3-105kg/ha |
| | | anual | | 66.0-263kg/ha |
| Carrots | Hubbard coarse sand | | | |
| Lettuce | Hubbard coarse sand | | | |
| Peas | Hubbard coarse sand | | | |
| Potatoes | Hubbard coarse sand | | | |
| Radishes | Hubbard coarse sand | | | |
| Sweet corn | Hubbard coarse sand | | | |
| Tomatoes | Hubbard coarse sand | | | |
| Wheat | Truckton loamy sand | | | |
| Pearl Millet | Downer sand | fertilized | | |
| | | unfertilized | | |
| | | sludge | | 517ug/g sludge |
| Red Oak | Downer sand | fertilized | | |
| | | unfertilized | | |
| | | sludge | | 517ug/g sludge |
| Black Walnut | Downer sand | fertilized | | |
| | | unfertilized | | |
| | | sludge | | 517ug/g sludge |
| Wheat | Redding fine sandy loam | | | 100-200 ug/g |
| | Redding fine sandy loam | | | 100-200 ug/g |
| | clay loam | control | | |
| | | 0-2 cm depth | | |
| | | 18-20cm depth | | |
| Little bluestem | rural Plainfield sand | | 37.73-47.11 | |
| | urban Oakville sand | | 47.25 | 100 ug/g |
| Black-eyed Susan | rural Plainfield sand | | 84.88 | 200 ug/g |
| Corn | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |
| | sandy | 112metric tons | 58-66 | |
| Oats | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |
| | sandy | 112metric tons | 58-66 | |
| Wheat | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 10.6-10.9ug/g | | | |
| | | | 11.8-42.0ug/g | | |
| Snap bean | | 11 ug/g | | | |
| | | 8.2-10.0 ug/g | | | |
| | | 11.8-12.2 ug/g | | | |
| | | 10.8-12.0 ug/g | | | |
| Carrots | | <.3-1.5 | | | |
| Lettuce | | 1.6-11.9 | | | |
| Peas | | 5.9-22.8 | | | |
| Potatoes | | 8.6-19.0 | | | |
| Radishes | | <.3 | | | |
| Sweet corn | | 8.5-15.8 | | | |
| Tomatoes | | <.3 | | | |
| Wheat | | 3.50-5.96 ug/g | | | |
| Pearl Millet | | 5.8-7.8 ug/g | | | |
| | | 5.2-6.6 ug/g | | | |
| | | 5.4-10.3 ug/g | | | |
| Red Oak | | 5.8 ug/g | | | |
| | | 6.2 ug/g | | | |
| | | 6.0-6.6 ug/g | | | |
| Black Walnut | | 5.6 ug/g | | | |
| | | 5.1 ug/g | | | |
| | | 6.4-7.8 ug/g | | | |
| Wheat | | | ** | | |
| | | | ** | | |
| | | 6.5 | | | |
| | | 8.4 | | | |
| | | 7.2 | | | |
| Little bluestem | | | ** | | |
| | | 50.59 | 209.5 | | |
| Black-eyed Susan | | | ** | | |
| Corn | | 3.6-7.2 | | | |
| | | 10.5-14.2 | | | |
| | | 11.6-16.8 | | | |
| Oats | | 1.5 | | | |
| | | 2.6 | | | |
| | | 2.5 | | | |
| Wheat | | 2.1 | | | |
| | | 3.2 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| Snap bean | | | 58 |
| | | | 138 |
| | | | 138 |
| | | | 138 |
| Carrots | | | 56 |
| Lettuce | | | 56 |
| Peas | | | 56 |
| Potatoes | | | 56 |
| Radishes | | | 56 |
| Sweet corn | | | 56 |
| Tomatoes | | | 56 |
| Wheat | | | 206 |
| Pearl Millet | | | 128 |
| | | | 128 |
| | | | 128 |
| Red Oak | | | 128 |
| | | | 128 |
| | | | 128 |
| Black Walnut | | | 128 |
| | | | 128 |
| | | | 128 |
| Wheat | yield | reduction | 15 |
| | yield | reduction | 15 |
| | | | 126 |
| | | | 126 |
| | | | 126 |
| Little bluestem | yield | 25% yield reduction | 164 |
| | yield | reduction of up to 68% | 164 |
| Black-eyed Susan | yield | total mortality | 164 |
| Corn | | | 212 |
| | | | 212 |
| | | | 212 |
| Oats | | | 212 |
| | | | 212 |
| | | | 212 |
| Wheat | | | 212 |
| | | | 212 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.3 |
| Rye | Secale cereale | Balboa | grain | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Crimson clover | Trifolium incarnatum | Auburn | whole | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Arrowleaf clover | Trifolium vesiculosum | Yuchi | whole | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Carrots | Daucus carota | Danvers | tubers,shoots | field | 5.5-5.8 |
| Radishes | Raphanus sativus | Cherry belle | tubers,shoots | field | 5.5-5.8 |
| Tomato | Lycopersicon esculentum | New Yorker | fruit | field | 5.5-5.8 |
| Lettuce | Lactuca sativa | Salad Bowl | leaves | field | 5.5-5.8 |
| Bromegrass | Bromus inermis | Leyess | | field | 6.7-7.9 |
| Corn | Zea mays | | stover | field | 6.7-7.9 |
| | | Pioneer 3369A | leaves,grain | field | low |
| Grain sorghum | Sorghum bicolor | Funk G-522 | leaves,grain | field | low |
| Soybeans | Glycine max | Centennial | seedlings leaves seeds | field | low |
| Winter wheat | Triticum spp. | Anza | straw | field | 7.6 |
| Swiss chard | Beta vulgaris | Ford Hook Giant | | greenhouse | 7.7 |
| | | | | | 7 |
| | | | | | 5.5 |
| Sweet corn | Zea mays | Jubilee | plant, seeds | field | |
| Alfalfa | Medicago sativa | Ranger | leaves,stems | field | |
| Wheat | Triticum vulgare | Fremont | plant, seeds | field | |
| Fodder rape | Brassica napus | Kenton | | greenhouse | 5.6 |
| | | | | | 6 |
| | | | | | 7.5 |
| Barley | Hordeum vulgare | Larker | | greenhouse | 4.0-6.4 |
| Rye Grass | Lolium multiflorum | Westerwool | | greenhouse | 4.0-6.4 |
| Corn | Zea mays | Pioneer 3517 | leaves, grain | field | 7.6-8.1 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | sandy | 112metric tons | 58-66 | |
| Rye | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |
| | sandy | 112metric tons | 58-66 | |
| Crimson clover | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |
| | sandy | 112metric tons | 58-66 | |
| Arrowleaf clover | sandy | no sludge | .6-1.0 | |
| | sandy | 56 metric tons | 29-35 | |
| | sandy | 112metric tons | 58-66 | |
| Carrots | Bridgehampton silt loam | | 1.6-13.8 | |
| Radishes | Bridgehampton silt loam | | 1.6-13.8 | |
| Tomato | Bridgehampton silt loam | | 1.6-13.8 | |
| Lettuce | Bridgehampton silt loam | | 1.6-13.8 | |
| Bromegrass | Conestoga loam | NH4NO3 | | |
| | | sludge low | | |
| | | sludge high | | |
| Corn | Conestoga loam | No N | | |
| | | NH4NO3 | | |
| | | Ca sludge | | 6-13 kg/ha |
| | | Al sludge | | 9-18 kg/ha |
| | | Fe sludge | | 13-18 kg/ha |
| | fine sandy loam | | | |
| Grain sorghum | fine sandy loam | | | |
| Soybeans | fine sandy loam | | | |
| Winter wheat | Omni silty clay | | 40-62 | 86.2 kg/ha |
| Swiss chard | Domino silt loam | | .1-.4 | 6.0-40.0 |
| | Hanford sandy loam | | .2-.6 | 6.0-40.0 |
| | Redding fine sand | | .05-.4 | 6.0-40.0 |
| Sweet corn | fine silt | | 8-25 | |
| Alfalfa | fine silt | | 8-25 | |
| Wheat | fine silt | | 8-25 | |
| Fodder rape | sandy | | | 687 mg/kg |
| | sandy | | | |
| | sandy | | | |
| Barley | marginally productive soil | dredged material | | |
| Rye Grass | marginally productive soil | dredged material | | |
| Corn | calcareous strip-mined spoil | control | 2.3-6.8 mg/kg | |
| | | sludge | 2.7-39.6mg/kg | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 3.7 | | | |
| Rye | | 4.5 | | | |
| | | 6.6 | | | |
| | | 6.7 | | | |
| Crimson clover | | 7.1 | | | |
| | | 8.4 | | | |
| | | 9.4 | | | |
| Arrowleaf clover | | 7.3 | | | |
| | | 10.1 | | | |
| | | 13.9 | | | |
| Carrots | | 3-11 | | | |
| Radishes | | 9-22 | | | |
| Tomato | | 10-13 | | | |
| Lettuce | | 11-17 | | | |
| Bromegrass | | 5.9-11 | | | |
| | | 7.3-10.1 | | | |
| | | 9.3-14.4 | | | |
| Corn | | 4.3-8.0 | | | |
| | | 6.1-9.4 | | | |
| | | 6.0-9.6 | | | |
| | | 6.7-11.6 | | | |
| | | 6.3-9.6 | | | |
| | | 11.3-13.5 | | | |
| Grain sorghum | | 8.5-11.0 | | | |
| Soybeans | | 10.5-29.5 | | | |
| Winter wheat | | 2.0-3.2 | | | |
| Swiss chard | | 12-19 mg/kg | | | |
| | | 4-14 mg/kg | | | |
| | | 12-23 mg/kg | | | |
| Sweet corn | | 8.5-9.5 | | | |
| Alfalfa | | 8.-12 | | | |
| Wheat | | 8.0-9.5 | | | |
| Fodder rape | | 6.95-25.75 | | | |
| | | 7.02-17.71 | | | |
| | | 6.88-14.47 | | | |
| Barley | | 6-21 | | | |
| Rye Grass | | 9-39 | | | |
| Corn | | 9-16 | | | |
| | | 10-15 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 212 |
| Rye | | | 212 |
| | | | 212 |
| | | | 212 |
| Crimson clover | | | 212 |
| | | | 212 |
| | | | 212 |
| Arrowleaf clover | | | 212 |
| | | | 212 |
| | | | 212 |
| Carrots | | | 211 |
| Radishes | | | 211 |
| Tomato | | | 211 |
| Lettuce | | | 211 |
| Bromegrass | | | 224 |
| | | | 224 |
| | | | 224 |
| Corn | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 143 |
| Grain sorghum | | | 143 |
| Soybeans | | | 143 |
| Winter wheat | | | 32 |
| Swiss chard | | | 242 |
| | | | 242 |
| | | | 242 |
| Sweet corn | | | 24 |
| Alfalfa | | | 24 |
| Wheat | | | 24 |
| Fodder rape | | | 173 |
| | | | 173 |
| | | | 173 |
| Barley | | | 41 |
| Rye Grass | | | 41 |
| Corn | | | 188 |
| | | | 188 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | Jubilee | leaves, kernels | field | 5.8-7.1 |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 5.6-5.9 |
| Rye Grass | Lolium perenne | | | greenhouse | 5.6-5.9 |
| Upland cotton | Gossypium hirsutum | | leaves, seeds | field | 8.2 |
| Timothy | Phleum pratense | | | field | 6.3 |
| | | | | | 6.1 |
| Corn | Zea mays | | leaves,grain | field | 7 |
| | | Pioneer 3192 | leaves, grain | field | >6.5 |
| | | | | | >6.5 |
| | | | | | >6.5 |
| Soybean | Glycine max | Corsoy | seeding tissue | pot | 5.9 |
| Sorghum | Sorghum bicolor | Moench | root,leaves,stems,grain | field | 6.9-7.2 |
| | | | | | 5.8-7.2 |
| Winter wheat | Triticum | | root, grain | field | 6.9-7.7 |
| | | | | | 5.8-7.2 |
| Splash pine | Pinus elliottii | | pine needles | field | 4.8-5.1 |
| | | | | | 4.9-5.3 |
| | | | | | 4.8-5.2 |
| Wheat | Triticum aestivum | Vergina | whole | field | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Willamette silt loam | control | 8-11umol/kg | |
| | | tannery waste | 8-13 umol/kg | |
| Swiss chard | Chalmers silt clay loam and | control | 13 mg/kg | |
| | Russel silt loam | drilling fluid | 10-163 mg/kg | |
| Rye Grass | Chalmers silt clay loam and | control | 13 mg/kg | |
| | Russel silt loam | drilling fluid | 10-163 mg/kg | |
| Upland cotton | Pima clay loam | control | | |
| | | fertilized | | |
| | | sludge | | |
| Timothy | Dalhousie clay loam | control | | |
| | | fertilized | | |
| | | pig manure | | |
| | | sludge | | |
| | St. Bernard sandy loam | control | | |
| | | fertilized | | |
| | | pig manure | | |
| | | sludge | | |
| Corn | Davidson silty clay | CuSO4 | | 334-415 kg/ha |
| | Guernsey silt loam | control | | |
| | | pig manure | | |
| | | sludge | | |
| | Bertie fine sandy loam | control | | |
| | | pig manure | | |
| | | sludge | | |
| | Starr-Dyke clay loam | control | | |
| | | pig manure | | |
| | | sludge | | |
| Soybean | Nicollet loam soil | CuSO4 | | 0-40 mg/kg |
| | | sludge | | 0-107 mg/kg |
| Sorghum | Hynie fine sandy loam | fertilized | 0.6 | |
| | Hynie fine sandy loam | sludge | 2.9 | |
| Winter wheat | Hynie fine sandy loam | fertilized | 0.6 | |
| | Hynie fine sandy loam | sludge | 2.9 | |
| Splash pine | Troup fine sandy loam | control | 0.5 | 0 |
| | Troup fine sandy loam | low sludge | 1.2-2.4 | 11-34 kg/ha |
| | Troup fine sandy loam | high sludge | 1.7-2.6 | 45-56 kg/ha |
| Wheat | | control | 50-80 mg/kg | |
| | | low Zn polution | 100-300 | |
| | | med Zn polution | 300-600 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | .07-.08 mmol/kg | | | |
| | | .06-.09 mmol/kg | | | |
| Swiss chard | | 7.7 mg/kg | | | |
| | | 7.6-21.4 mg/kg | | | |
| Rye Grass | | 6.1 mg/kg | | | |
| | | 7.7-15.5mg/kg | | | |
| Upland cotton | | 8.1 mg/kg | | | |
| | | 10.7 mg/kg | | | |
| | | 9.2-10.1 mg/kg | | | |
| Timothy | | 3.9-5.1mg/kg | | | |
| | | 4.4-5.8 mg/kg | | | |
| | | 2.7-5.0 mg/kg | | | |
| | | 3.4-5.2 mg/kg | | | |
| | | 3.8-5.2 mg/kg | | | |
| | | 3.6-5.1 mg/kg | | | |
| | | 3.7-5.1 mg/kg | | | |
| | | 3.8-5.9 mg/kg | | | |
| Corn | | 9.7-10.4 mg/kg | | | |
| | | 8.9-9.3 mg/kg | | | |
| | | 10.1-10.7mg/kg | | | |
| | | 9.5-10.7 mg/kg | | | |
| | | 6.5-9.1mg/kg | | | |
| | | 7.6-10.1 mg/kg | | | |
| | | 7.6-10.0 mg/kg | | | |
| | | 8.8-10.5 mg/kg | | | |
| | | 9.2-10.2 mg/kg | | | |
| | | 9.0-11.1 mg/kg | | | |
| Soybean | | 3.2-4.0 | | | |
| | | 3.3-9.4 | | | |
| Sorghum | | 12.8 | | | |
| | | 27.5 | | | |
| Winter wheat | | 8 | | | |
| | | 13 | | | |
| Splash pine | | 3.6 | | | |
| | | 4.1-4.5 | | | |
| | | 4.1-4.3 | | | |
| Wheat | | ** | | | |
| | | | ** | | |
| | | | ** | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 226 |
| | | | 226 |
| Swiss chard | | | 176 |
| | | | 176 |
| Rye Grass | | | 176 |
| | | | 176 |
| Upland cotton | | | 259 |
| | | | 259 |
| | | | 259 |
| Timothy | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| Corn | | | 183 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| Soybean | | | 57 |
| | | | 57 |
| Sorghum | | | 127 |
| | | | 127 |
| Winter wheat | | | 127 |
| | | | 127 |
| Splash pine | | | 144 |
| | | | 144 |
| | | | 144 |
| Wheat | | | 61 |
| | visual | reduced growth | 61 |
| | visual | reduced growth,chlorotic,stunted | 61 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Oat | | Harmon | root,seed,stem | field | |
| Sudangrass | Sorghum bicolor | Piper | whole | field | 5.23 |
| | | | | | 5.18 |
| | | | | | 5.77-6.38 |
| Corn | Zea mays | | leaves,roots,stems,husks | field | 6.2 |
| Perennial ryegrass | Loluim perenne | | | pot | 4.3-5.26 |
| | | | | | 4.76-5.72 |
| | | | | | 6.16-7.11 |
| Wheat | | | straw,kernels | greenhouse | 8.1 |
| | | | | | 6.5 |
| | | | | field | 8.1 |
| Brome-alfalfa | | | whole | greenhouse | 8.1 |
| | | | | | 6.5 |
| Soybean | Glycine max | Bragg | seed,pod wall, stem | greenhouse | 6.2 |
| | | Ransom | seed,pod wall,stem | greenhouse | 6.2 |
| Maize | Zea mays | | whole | pot | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | high Zn polution | 800-1200 | |
| Oat | | control | 5.2-8.7 | |
| | | 25 % sludge | 16.6 | |
| | | 50% sludge | 10.3 | |
| Sudangrass | Wahiawa silty clay | control | | |
| | Wahiawa silty clay | fertilized | | |
| | Wahiawa silty clay | sludge | | |
| Corn | Warsaw silt loam | control | 51 | |
| | | sludge | 843 | 1075 tons/ha |
| Perennial ryegrass | acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| | acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| | acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| Wheat | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 12.15-121.5 kg/ha |
| | Red River noncalcareous fine | control | | 0 |
| | | sludge | | 12.15-121.5 kg/ha |
| | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 198-396 kg/ha |
| Brome-alfalfa | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 12.15-121.5 kg/ha |
| | Red River noncalcareous fine | control | | 0 |
| | | sludge | | 12.15-121.5 kg/ha |
| Soybean | Enon sandy loam | control | | 0 |
| | | low sludge | | 10-20 kg/ha |
| | | high sludge | | 30 kg/ha |
| | Enon sandy loam | control | | 0 |
| | | low sludge | | 10-20 kg/ha |
| | | high sludge | | 30 kg/ha |
| Maize | sand | control | 2.5 | |
| | | low saturatrion sludge | 5.1-10.2 | |
| | | low saturatrion sludge | 20.3-40.7 | |
| | | high saturation sludge | 5.1-10.2 | |
| | | high saturation sludge | 20.3-40.7 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Oat | | 8 | | | |
| | | 27 | | | |
| | | 22 | | | |
| Sudangrass | | 24 | | | |
| | | 20 | | | |
| | | 17-20 | | | |
| Corn | | 10 | | | |
| | | 40 | | | |
| Perennial ryegrass | | 15 | | | |
| | | 20-30 | | | |
| | | 30 | | | |
| | | 10 | | | |
| | | 20-30 | | | |
| | | 35 | | | |
| | | 10 | | | |
| | | 15-20 | | | |
| | | 30 | | | |
| Wheat | | 1.78 | | | |
| | | 1.83-3.13 | | | |
| | | 2.4 | | | |
| | | 1.68-3.38 | | | |
| | | 1.7-2.7 | | | |
| | | 2.5-8.3 | | | |
| Brome-alfalfa | | 7.9 | | | |
| | | 7.9-15.0 | | | |
| | | 5.2 | | | |
| | | 5.9-12.9 | | | |
| Soybean | | 5.66 | | | |
| | | 7.93-8.96 | | | |
| | | 10.66 | | | |
| | | 3.8 | | | |
| | | 5.73-6.33 | | | |
| | | 7.16 | | | |
| Maize | | 6-9.0 | | | |
| | | 7-9.0 | | | |
| | | 8-13.0 | | | |
| | | 9-13.0 | | | |
| | | | 15-36.0 | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | visual | 1/6natural size,few reach maturity | 61 |
| Oat | | | 73 |
| | | | 73 |
| | | | 73 |
| Sudangrass | | | 104 |
| | | | 104 |
| | | | 104 |
| Corn | | | 125 |
| | | | 125 |
| Perennial ryegrass | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| Wheat | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| Brome-alfalfa | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| Soybean | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| Maize | | | 79 |
| | | | 79 |
| | | | 79 |
| | | | 79 |
| | yield | significant reduction | 79 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Lettuce | | Imperial 847 | tops | pot | |
| Onions | | Early flat Baretta | bulbs | pot | |
| | | | | field | |
| Lettuce | | Imperial 847 | tops | greenhouse | |
| Lucerne | Medicago satuva | Wairau | whole | pot | 5 |
| | | | | | 5.1-5.6 |
| | | | | | 6.6 |
| | | | | | 5.2 |
| | | | | | 5.4-6.0 |
| | | | | | 6.8 |
| Tomato | Lycopersicon esculentum | Money maker | Leaves,fruit,root | pot | 4.6-6.9 |
| | | | fruit | pot | 4.6-6.6 |
| | | | | | 6.6-6.9 |
| | | | | | 6.6-6.7 |
| Sweet corn | Zea mays | Jubilee | leaves,kernels | field | 5.4 |
| | | | | | 4.7-5.1 |
| | | | | | 5.1-5.2 |
| | | | | | 5.1-5.3 |
| | | | | | 5.1 |
| Soybean | Glycine max | | stem,leaves,seeds,pods | pot | |
| Barley | Hordeum vulgare | Julia | tops | sand | |
| Ryegrass | Lolium perenne | S24 | tops | greenhouse | 6 |
| | | | | | 7.6 |
| Lettuce | Lactuca sativa | Grand rapids | leaves | pots | 6.7 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | | Concentration in soil | Loading rate |
|---|---|---|---|---|---|
| Lettuce | loamy, fine sand | control | | | 0 |
| | | low sludge | | | 1.31-6.55 kg/ha |
| | | high sludge | | | 6.55-11.79 kg/ha |
| Onions | loamy, fine sand | control | | | 0 |
| | | low sludge | | | 1.31-6.55 kg/ha |
| | | high sludge | | | 6.55-11.79 kg/ha |
| | loamy fine sand | control | | | 0 |
| | | sludge | | | 1.31-23.58kg/ha |
| Lettuce | sandy loam | control | | | 0 |
| | | sludge | | | 1.31-106.11 kg/ha |
| | | heated sludge | | | 3.93-11.79 kg/ha |
| Lucerne | Waitarere sand | | 0 | 12 | |
| | Waitarere sand | 5-40% sludge | | 26.9-131.2 | |
| | Waitarere sand | 100% sludge | | 310 | |
| | Levin silt loam | | 0 | 28 | |
| | Levin silt loam | 5-40% sludge | | 42.1-140.8 | |
| | Levin silt loam | 100% sludge | | 310 | |
| Tomato | | sludge | | 380 | 0-388.8 kg/ha |
| | | | 0 | | 0 |
| | | 25-75% sludge | | | 97.2-291.6 kg/ha |
| | | 100% sludge | | | 388.8 kg/ha |
| Sweet corn | Willamette silt loam | control | | | |
| | Willamette silt loam | fertilized | | | |
| | Willamette silt loam | Portland sudge | | | 28-55 lb/acre |
| | Willamette silt loam | Rock Creek sludge | | | 27-54 lb/acre |
| | Willamette silt loam | Salem sludge | | | 11-21 lb/acre |
| Soybean | Ritzville silt loam | control | | 31 | |
| | | Cu solution | | | 2.5 ug/g |
| Barley | washed silver sand | CuSO4 | | 3.1-13.6 | |
| | | CuSO4 | | 34-100 | |
| Ryegrass | sandy soil | control | | | 0 |
| | | salt | | | 13.7-110 mg/kg |
| | | sludge | | | 13.7-110 mg/kg |
| | heavy clay soil | control | | | 0 |
| | | salt | | | 13.7-110 mg/kg |
| | | sludge | | | 13.7-110 mg/kg |
| Lettuce | very fine non-calcareous | control | | 31 | 0 |
| | | low sludge | | | 43.45-86.9 kg/ha |
| | | high sludge | | | 173.8 kg/ha |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Lettuce | | 6 | | | |
| | | 9-12.5 | | | |
| | | 12.5-14 | | | |
| Onions | | 4.5 | | | |
| | | 6-6.5 | | | |
| | | 6.5-7 | | | |
| | | 4.5 | | | |
| | | 4.25-4.5 | | | |
| Lettuce | | 6.9 | | | |
| | | 8.7-18.7 | | | |
| | | 8.1-10.8 | | | |
| Lucerne | | 15 | | | |
| | | 16-22 | | | |
| | | 15 | | | |
| | | 9-24.0 | | | |
| | | 8.5-35 | | | |
| | | 12-20.0 | | | |
| Tomato | | 28 | | | |
| | | 13 | | | |
| | | 18-20 | | | |
| | | 22 | | | |
| Sweet corn | | 9 | | | |
| | | 6-7.0 | | | |
| | | 12-13.0 | | | |
| | | 11-12.0 | | | |
| | | 10-11.0 | | | |
| Soybean | | 3.9 | | | |
| | | 1.7 | | | |
| Barley | | 18.2-20.3 | | | |
| | | | 36-100 | | |
| Ryegrass | | 12.4 | | | |
| | | 14.2-20.9 | | | |
| | | 14.8-19.9 | | | |
| | | 9.2 | | | |
| | | 12.6-21.3 | | | |
| | | 9.3-18.0 | | | |
| Lettuce | | 5.6 | | | |
| | | 7.8-8.7 | | | |
| | | 12.8 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Lettuce | | | 54 |
| | | | 54 |
| | | | 54 |
| Onions | | | 54 |
| | | | 54 |
| | | | 54 |
| | | | 54 |
| | | | 54 |
| Lettuce | | | 53 |
| | | | 53 |
| | | | 53 |
| Lucerne | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| Tomato | | | 262 |
| | | | 262 |
| | | | 262 |
| | | | 262 |
| Sweet corn | | | 121 |
| | | | 121 |
| | | | 121 |
| | | | 121 |
| | | | 121 |
| Soybean | | | 27 |
| | | | 27 |
| Barley | | | 6 |
| | visual' | death | 6 |
| Ryegrass | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| Lettuce | | | 271 |
| | | | 271 |
| | | | 271 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Carrots | Daucus carota | Amstel | tubers | pots | 6.7 |
| Peas | Pisum sativum | Thomas Laxton | fruit | pots | 6.7 |
| Tomato | Lycopersicon esculentum | | shoots | greenhouse | 5.33<br>7.96-8.09<br>8.01-8.11 |
| Grass | | timothy,brown top<br>sweet vernal,blue | | field | 6.05<br>6.2 |
| Alfalfa & red clover | | | | field | 6.05<br>6.2 |
| Duckweed | | | whole | solution | 4<br>4.5<br>5 |
| Various | | | shoots | field | |
| Oats | Avena sativa | Selma | leaves | pot | 6.6<br>6.2<br>7.5 |
| Highbush blueberry | Vaccinium corymbosum | Blueray | | pot | 3.9-7.1 |
| Subterranean clover | Trifolium subterraneum | | tops | field | |
| | Arctotheca calendula | | tops | field | |
| | Holcus lanatus | | tops | field | |
| | Lolium perenne | | tops | field | |
| | Plantago lanceolata | | tops | field | |
| Subterranean clover | Trifolium subterraneum | Mt. Barker | tops | greenhouse | 5.6-6.3 |
| Silver beat | Beat vulgaris | Fordhook Giant | tops | greenhouse | 5.6-6.3 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Carrots | very fine non-calcareous | control | 31 | 0 |
| | | low sludge | | 43.45-86.9 kg/ha |
| | | high sludge | | 173.8 kg/ha |
| Peas | very fine non-calcareou: | control | 31 | 0 |
| | | low sludge | | 43.45-86.9 kg/ha |
| | | high sludge | | 173.8 kg/ha |
| Tomato | Elkton silt loam | control | 72.4 | |
| | Elkton silt loam | low 2-6% sludge | 73.46-75.58 | |
| | Elkton silt loam | high 8-10% sludge | 76.64-77.70 | |
| Grass | clay and sandy loam | control | .81-8.39 | |
| | clay and sandy loam | sludge | .66-11.06 | 17.87-30.44 kg/ha |
| Alfalfa & red clover | clay and sandy loam | control | .81-8.39 | |
| | clay and sandy loam | sludge | .66-11.06 | 17.87-30.44 kg/ha |
| Duckweed | Huther's medium | | 1.0-10 | |
| | Huther's medium | | 1.0-10 | |
| | Huther's medium | | 1.0-10 | |
| Various | serpentine soil | natural | 37-144 | |
| Oats | sandy loam | control | 10.6 | |
| | | nitrate compound | 28.7 | |
| | sandy soil | control | 21.5 | |
| | | nitrate compound | 30.1 | |
| | organic soil | control | 28 | |
| | | nitrate compound | 49.5 | |
| Highbush blueberry | peat | control | | |
| | | low CuSO4 | | 2 g/pot |
| | | high CuSO4 | | 4 g/pot |
| Subterranean clover | orchard soil | | 155 mg/kg | |
| | orchard soil | | 155 mg/kg | |
| | orchard soil | | 155 mg/kg | |
| | orchard soil | | 155 mg/kg | |
| | orchard soil | | 155 mg/kg | |
| Subterranean clover | orchard | 12 degrees | 195 mg/kg | |
| | | 22 degrees | 195 mg/kg | |
| | ore mineralized | 12 degrees | 9 mg/kg | |
| | | 22 degrees | 9 mg/kg | |
| Silver beat | orchard | 12 degrees | 195 mg/kg | |
| | | 22 degrees | 195 mg/kg | |
| | ore mineralized | 12 degrees | 9 mg/kg | |
| | | 22 degrees | 9 mg/kg | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Carrots | | 3.6 | | | |
| | | 5.5-6.7 | | | |
| | | 7.5 | | | |
| Peas | | 5.3 | | | |
| | | 8.4-8.9 | | | |
| | | 9.5 | | | |
| Tomato | | 41 | | | |
| | | 24.6-27.1 | | | |
| | | 30.9-33.8 | | | |
| Grass | | 5.2-17.4 | | | |
| | | 6.7-19.2 | | | |
| Alfalfa & red clover | | 7.2-14.2 | | | |
| | | 8.6-15.2 | | | |
| Duckweed | | 31.8 prop. metal uptak | 34.6-42.2 PMUT | | |
| | | 18.2 PMUT | 32.5-37.1 PMUT | | |
| | | 5.5 PMUT | 30.4-33.2 PMUT | | |
| Various | | 2.0-30 | | | |
| Oats | | 4.04-5.93 | | | |
| | | 3.15-6.36 | | | |
| | | 1.83-8.58 | | | |
| | | 3.05-10.48 | | | |
| | | 2.97-9.24 | | | |
| | | 4.82-12.87 | | | |
| Highbush blueberry | | 1.0-7 | | | |
| | | 4-8.9 | | | |
| | | 5.5-9.9 | | | |
| Subterranean clover | | | 22-30 | | |
| | | | 27-36 | | |
| | | | 35-40 | | |
| | | | 12.0-43 | | |
| | | | 12.0-34 | | |
| Subterranean clover | | 21 | | | |
| | | 30 | | | |
| | | 9.5 | | | |
| | | 13.7 | | | |
| Silver beat | | 77 | | | |
| | | 134 | | | |
| | | 6.9 | | | |
| | | 9.2 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Carrots | | | 271 |
| | | | 271 |
| | | | 271 |
| Peas | | | 271 |
| | | | 271 |
| | | | 271 |
| Tomato | | | 62 |
| | | | 62 |
| | | | 62 |
| Grass | | | 147 |
| | | | 147 |
| Alfalfa & red clover | | | 147 |
| | | | 147 |
| Duckweed | visual | became pale and dark green | 168 |
| | visual | became pale and dark green | 168 |
| | visual | became pale and dark green | 168 |
| Various | | | 5 |
| Oats | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| Highbush blueberry | | | 87 |
| | | | 87 |
| | | | 87 |
| Subterranean clover | yield | probable yield reduction | 161 |
| | yield | probable yield reduction | 161 |
| | yield | probable yield reduction | 161 |
| | yield | probable yield reduction | 161 |
| | yield | probable yield reduction | 161 |
| Subterranean clover | | | 161 |
| | | | 161 |
| | | | 161 |
| | | | 161 |
| Silver beat | | | 161 |
| | | | 161 |
| | | | 161 |
| | | | 161 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Radishes | Rhaphanus sativus | Long Scarlet | tops | greenhouse | 5.6-6.3 |
| Silver beat | Beta vulgaris | Fordhook Giant | tops | greenhouse | 4.77-6.57<br>3.6-4.83<br>5.6-8.00<br>4.9-6.9<br>4.8-6.75<br>3.6-5.05<br>4.3-5.95<br>5.35-7.75<br>4.8-6.65 |
| Radishes | Rhaphanus sativus | Long scarlet | tops | greenhouse | |
| Corn | Zea mays | Asgrow UH7 | whole | greenhouse | 6.3 |
| Lettuce | Lactuca sativa | Grand Rapids Forcing | whole | greenhouse | 5.9<br>6.5<br>6.3<br>5.9<br>6.5 |
| Oats | Avena sativa | Garry | straw | field | 5.09<br>5.84 |
| Soybean | Glycine max | Clark | shoots | field | 6<br>6.9<br>6.6<br>6.4<br>5.9-7.4<br>7.0-7.7<br>6.9-7.6<br>5.8-7.1<br>5.7-6.0<br>5.1-5.3<br>6.4-6.6<br>5.7-5.9 |
| Sunflower | Helianthus annuus | 894A | whole | field | 7.2-7.4 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Radishes | orchard | 12 degrees | 195 mg/kg | |
| | | 22 degrees | 195 mg/kg | |
| | ore mineralized | 12 degrees | 9 mg/kg | |
| | | 22 degrees | 9 mg/kg | |
| | various | control | 43-295 | |
| | various | sulfure | 43-295 | |
| | various | CaCO3 | 43-295 | |
| | various | waterlogging | 43-295 | |
| Silver beat | various | control | 43-295 | |
| | various | Sulfure | 43-295 | |
| | various | Gypsum | 43-295 | |
| | various | CaCO3 | 43-295 | |
| | various | waterlogging | 43-295 | |
| | Dystric Xeropsamment | sulfate | | 250 mg/kg |
| Radishes | Dystric Xeropsamment | sulfate | | 250 mg/kg |
| Corn | Grenville loam | control | | 0-480 |
| | | fertilized | | 0-480 |
| | | sludge | | 0-480 + 12 |
| | Rideau clay | sludge | | 0-480 + 12 |
| | Rideau clay | sludge + lime | | 0-480 + 12 |
| Lettuce | Grenville loam | sludge | | 0-480 + 12 |
| | Rideau clay | sludge | | 0-480 + 12 |
| | Rideau clay | sludge + lime | | 0-480 + 12 |
| Oats | peat | CuSO4 | 22-1177 | 13-1659 ug/g |
| | muck | CuSO4 | 152-1187 | 135-1745 ug/g |
| | mucky peat | CuSO4 | 158-583 | 81-1063 ug/g |
| Soybean | Sassafras fine sandy loam | control | | 0 |
| | Sassafras fine sandy loam | sludge | | 123.2 kg/ha |
| | Sassafras fine sandy loam | sludge | | 246.4 kg/ha |
| | Christiana fine sandy loam | control | | 0 |
| | Christiana fine sandy loam | limed-digested | | 14.5-116 kg/ha |
| | Christiana fine sandy loam | limed-raw | | 15.5-62.0 kg/ha |
| | Christiana fine sandy loam | limed-composted | | 15.3-184.1 kg/ha |
| | Christiana fine sandy loam | heated | | 22.6-90.5 kg/ha |
| | Christiana fine sandy loam | heated | | 22.6-90.5 kg/ha |
| | Christiana fine sandy loam | Nu-earth | | 58-116 kg/ha |
| | Christiana fine sandy loam | Nu-earth | | 58-116 kg/ha |
| Sunflower | irrigated loamy fine sand | control | | 0 |
| | | Cu Sulfate | | 3.0 kg/ha |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Radishes | | 19 | | | |
| | | 26 | | | |
| | | 6.5 | | | |
| | | 6.8 | | | |
| | | 16 | | | |
| | | 39 | | | |
| | | 13 | | | |
| | | 20 | | | |
| Silver beat | | 63 | | | |
| | | 63 | | | |
| | | 68 | | | |
| | | 35 | | | |
| | | 74 | | | |
| | | | ** | | |
| Radishes | | | ** | | |
| Corn | | 4.5 | 5.7-8.6 | | |
| | | 2.4-3.1 | 4.9-5.5 | | |
| | | 4.3-5.0 | | | |
| | | 4.6-5.5 | | | |
| | | 3.1-5.4 | | | |
| Lettuce | | 12.8 | 13.8-22.0 | | |
| | | 11.3-15.7 | | | |
| | | 11.0-12.9 | | | |
| Oats | | 8.0-9.6 | | | |
| | | 4.8-5.4 | | | |
| | | 6.0-7.4 | | | |
| Soybean | | 8.1-8.7 | | | |
| | | 8.6-8.9 | | | |
| | | 9.0-9.5 | | | |
| | | 7.4-8.1 | | | |
| | | 7.9-8.5 | | | |
| | | 7.4-8.0 | | | |
| | | 7.0-7.6 | | | |
| | | 7.0-7.9 | | | |
| | | 6.6-8.3 | | | |
| | | 7.6-8.2 | | | |
| | | 7.1-7.5 | | | |
| Sunflower | | 9.8 | | | |
| | | 10.5 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Radishes | | | 161 |
| | | | 161 |
| | | | 161 |
| | | | 161 |
| | | | 162 |
| | | | 162 |
| | | | 162 |
| | | | 162 |
| Silver beat | | | 162 |
| | | | 162 |
| | | | 162 |
| | | | 162 |
| | | | 162 |
| | yield | death of all plants | 162 |
| Radishes | yield | death of all plants | 162 |
| Corn | yield | 23-50% reduction in yield | 146 |
| | yield | 25-49.6% reduction in yield | 146 |
| | | | 146 |
| | | | 146 |
| | | | 146 |
| Lettuce | yield | 20.7-58.6% reduction in yield | 146 |
| | | | 146 |
| | | | 146 |
| Oats | | | 7 |
| | | | 7 |
| | | | 7 |
| Soybean | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| Sunflower | | | 93 |
| | | | 93 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.0-6.3 |
| | | | | | 8.4 |
| | | | | | 6.0-6.2 |
| Barley | Hordeum vulgare | M ariout | grain | field | 5.3 |
| | | | | | 4.7-4.9 |
| | | | | | 4.4-4.5 |
| | | | | | 5.3 |
| | | | | | 6.4-6.5 |
| | | | | | 6.5-6.6 |
| Oats | Avena sativa | Clintford | stover | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Wheat | Triticum aestivum | Potomac | stover | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Chard | Beta vulgaris | Fordhook Giant Swiss | whole | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Carrots | Daucus carota | Gold Pak 128 | leaves | field | 5.11 |
| | | | | | 5.08 |
| | | | | | 5.11 |
| | | | | | 5.05 |
| | | | | | 5.89 |
| | | | | | 5.79 |
| | | | | | 5.89 |
| | | | | | 5.79 |
| Beans | Phaleolus vulgaris | Tender crop | fruit | pot | 5 |
| | | | | | 5.3 |
| Cabbage | Brassica oleracea | Golden Acre | leaves | pot | 5 |
| | | | | | 5.3 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | dry loamy fine sand | control | | 0 |
| | | Cu Sulfate | | 3.0 kg/ha |
| | dry fine sandy loam | control | | 0 |
| | | Cu Sulfate | | 3.0 kg/ha |
| | irrigated fine sandy loam | control | | 0 |
| | | Cu Sulfate | | 3.0 kg/ha |
| Barley | Dublin loam | Oakland sludge control | | 0 |
| | Dublin loam | low sludge | | 27-54 kg/ha |
| | Dublin loam | high sludge | | 81-108 kg/ha |
| | Dublin loam | Pacheo sludge control | | 0 |
| | Dublin loam | low sludge | | 8.1-16.2 kg/ha |
| | Dublin loam | high sludge | | 24.3-40.5 kg/ha |
| Oats | Galestown Evesboro loamy sand | control | DTPA: 3.1 | |
| | Galestown Evesboro loamy sand | control + lime | 1.9 | |
| | Galestown Evesboro loamy sand | lime raw | 3.4 | |
| | Galestown Evesboro loamy sand | digested | 6.3 | |
| | Galestown Evesboro loamy sand | limed + digested | 7.4 | |
| Wheat | Galestown Evesboro loamy sand | control | DTPA: 3.1 | |
| | Galestown Evesboro loamy sand | control + lime | 1.9 | |
| | Galestown Evesboro loamy sand | lime raw | 3.4 | |
| | Galestown Evesboro loamy sand | digested | 6.3 | |
| | Galestown Evesboro loamy sand | limed + digested | 7.4 | |
| Chard | Galestown Evesboro loamy sand | control | DTPA: 3.1 | |
| | Galestown Evesboro loamy sand | control + lime | 1.9 | |
| | Galestown Evesboro loamy sand | lime raw | 3.4 | |
| | Galestown Evesboro loamy sand | digested | 6.3 | |
| | Galestown Evesboro loamy sand | limed + digested | 7.4 | |
| Carrots | peat | control | 12.6-30.8 | |
| | peat | low CuSO4 | 83.0-209.5 | |
| | peat | med CuSO4 | 113.4-669.0 | |
| | peat | high CuSO4 | 338.0-1659 | |
| | muck | control | 135.4-170.7 | |
| | muck | low CuSO4 | 244.1-292.7 | |
| | muck | med CuSO4 | 311.8-610.3 | |
| | muck | high CuSO4 | 746.4-1745.0 | |
| Beans | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Cabbage | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 8.8 | | | |
| | | 8.8 | | | |
| | | 18.2 | | | |
| | | 17.9 | | | |
| | | 8.8 | | | |
| | | 8 | | | |
| Barley | | 10 | | | |
| | | 11.0-12 | | | |
| | | 10.0-13.0 | | | |
| | | 10 | | | |
| | | 12.0-13.0 | | | |
| | | 13.0-14.0 | | | |
| Oats | | 2.6 | | | |
| | | 3.1 | | | |
| | | 2.7 | | | |
| | | 3.5 | | | |
| | | 3.3 | | | |
| Wheat | | 2.1 | | | |
| | | 2.1 | | | |
| | | 2.4 | | | |
| | | 3.2 | | | |
| | | 2.8 | | | |
| Chard | | 14 | | | |
| | | 19.2 | | | |
| | | 23 | | | |
| | | 27.2 | | | |
| | | 25.8 | | | |
| Carrots | | 3.77 | | | |
| | | 4.95 | | | |
| | | 5.74 | | | |
| | | 6.82 | | | |
| | | 17.26 | | | |
| | | 16.08 | | | |
| | | 11.55 | | | |
| | | 7.62 | | | |
| Beans | | 3.2 | | | |
| | | 3.6 | | | |
| Cabbage | | .6-3.0 | | | |
| | | 1.8-2.9 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| Barley | | | 246 |
| | | | 246 |
| | | | 246 |
| | | | 246 |
| | | | 246 |
| | | | 246 |
| Oats | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Wheat | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Chard | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Carrots | | | 157 |
| | | | 157 |
| | | | 157 |
| | | | 157 |
| | | | 157 |
| | | | 157 |
| | | | 157 |
| | | | 157 |
| Beans | | | 68 |
| | | | 68 |
| Cabbage | | | 68 |
| | | | 68 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Carrots | Daucus carota | Scarlet Nantes | tubers | pot | 5<br>5.3 |
| Millet | Echinochloa crusgalli | Japanese | edilbe tissue | pot | 5<br>5.3 |
| Onions | Allium cepa | Downing Yellow Sweet<br>Spanish | fruit | pot | 5<br>5.3 |
| Potatoes | Solanum tuberosum | Katahidin | tubers | pot | 5<br>5.3 |
| Tomatoes | Lycopersicon esculentum | Vendor | fruit | pot | 5<br>5.3 |
| Celery | Apium graveolens | Utah 52-70 | leaves | field | 6.88<br>5.68<br>6.91 |
| Ryegrass<br>Timothy<br>Meadow grass | lolium perenne<br>Phleum pratense<br>Poa annua | | whole | field | 5.4<br><br><br>5.9 |
| Perennial ryegrass | Lolium perenne | Melle | leaves | pot | 7 |
| Wheat | Triticum aestivum | HDM 1553 | stem | field | 8 |
| Cabbage | Brassica Parachinensis | Flowering Chinese | leaves | pot | 6.35<br>5.8-6.32<br>5.82-6.27<br>6.55-7.32<br>6.18-7.33 |
| Tomatoes | Lycopersicon esculentum | Fireball | leaves | sand | |
| Wheat | Triticum aestivum | | tops | pot | 5.0-5.5 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Carrots | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Millet | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Onions | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Potatoes | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Tomatoes | Arkport fine sandy loam | peat | 42.35 | |
| | Arkport fine sandy loam | sludge | 107 | |
| Celery | muck soil | control | 46 | |
| | muck soil | high metal soil | 657 | |
| | muck soil | limed high metal soil | 575 | |
| Ryegrass | Devon sandy clay | control | | 0 |
| Timothy | | pig slurry low | | 50-100 m3/ha |
| Meadow grass | | pig slurry high | | 200 m3/ha |
| | Devon clay | control | | 0 |
| | | pig slurry low | | 50-100 m3/ha |
| | | pig slurry high | | 200 m3/ha |
| Perennial ryegrass | Sutton sandy loam | control | 39 | 0 |
| | | low sludg | 229 | |
| | | medium sludge | 409 | 132 kg/ha |
| | | high sludge | 715 | |
| Wheat | clay | control | 23.4 | 0 |
| | | 50% sludge | 38.2 | |
| | | 66% sludge | 63.8 | |
| | | 100% sludge | 77.2 | |
| | | 10 tons/ha sludge | 40.1 | 4.28 kg/ha |
| | | 20 tons/ha sludge | 72.8 | 8.56 kg/ha |
| Cabbage | redyellow podzol soil | control | 22.33 | |
| | redyellow podzol soil | activated sludge | 32.5-50.0 | |
| | redyellow podzol soil | digested sludge | 14.25-86.75 | |
| | redyellow podzol soil | chicken manure | 18.5-37.5 | |
| | redyellow podzol soil | pig manure | 52.5-75.0 | |
| Tomatoes | Hoagland solution | control | | 0 |
| | | CuSO4 | | 3 |
| | | CuSO4 | | 6 |
| Wheat | Orentano histosol | control | 44.5 | |
| | | fly ash 2% | 46.2 | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Carrots | | 2 | | | |
| | | 2 | | | |
| Millet | | 2.4 | | | |
| | | 2.6 | | | |
| Onions | | 3.4 | | | |
| | | 1.2 | | | |
| Potatoes | | 3.1 | | | |
| | | 4.6 | | | |
| Tomatoes | | 2.2 | | | |
| | | 1.7 | | | |
| Celery | | 15 | | | |
| | | 12 | | | |
| | | 15 | | | |
| Ryegrass | | 3.5 | | | |
| Timothy | | 6.0-8.1 | | | |
| Meadow grass | | 16.7 | | | |
| | | 6.6 | | | |
| | | 8.1-9.7 | | | |
| | | 21.7 | | | |
| Perennial ryegrass | | 19.8 | | | |
| | | 22 | 32.4 | | |
| | | | 34.9 | | |
| | | | 39.6 | | |
| Wheat | | 6.14 | | | |
| | | 6.84 | | | |
| | | 7.78 | | | |
| | | 10.94 | | | |
| | | 8.12 | | | |
| | | 9.96 | | | |
| Cabbage | | | | | |
| | | | 100-250 | | |
| | | 30 | 100-150 | | |
| | | 25-30 | | | |
| | | 10.0-30 | | | |
| Tomatoes | | ** | | | |
| | | | ** | | |
| | | | ** | | |
| Wheat | | 19.4 | | | |
| | | 18.6 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Carrots | | | 68 |
| | | | 68 |
| Millet | | | 68 |
| | | | 68 |
| Onions | | | 68 |
| | | | 68 |
| Potatoes | | | 68 |
| | | | 68 |
| Tomatoes | | | 68 |
| | | | 68 |
| Celery | | | 16 |
| | | | 16 |
| | | | 16 |
| Ryegrass | | | 182 |
| Timothy | | | 182 |
| Meadow grass | | | 182 |
| | | | 182 |
| | | | 182 |
| | | | 182 |
| Perennial ryegrass | | | 50 |
| | yield | 28% reduciton | 50 |
| | yield | 43% reduction | 50 |
| | yield | 57% reduciton | 50 |
| Wheat | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| Cabbage | | | 36 |
| | visual | small,short,young budding stage | 36 |
| | visual | opaque granulate deposits | 36 |
| | | | 36 |
| | | | 36 |
| Tomatoes | | | 193 |
| | yield | 33% reduced dry weight | 193 |
| | yield | 62% reduced dry weight | 193 |
| Wheat | | | 186 |
| | | | 186 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.1-8.3 |
| | | | | | 7.5-8.0 |
| Bush bean | Phaseolus vulgaris | improved Tendergreen | trifoliate leaves | solution | 4 |
| | | | | | 8 |
| | | | | | 4 |
| | | | | | 8 |
| Soybean | Glycine max | Coker 237 | leaves | field | 6 |
| Spinach | Spinacia oleracea | Symphony | leaves | field | 6 |
| | | | | | 5.09 |
| Bush bean | Phaseolus vulgaris | Bulgarian | leaves | field | 6.33 |
| Corn | Zea mays | Pioneer 3369A | whole | pot | 6.4 |
| | | | | | 6.3 |
| | | | | | 6.2 |
| Highbush blueberry | Vaccinium corymbosium | Blueray | whole | pot | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | fly ash 5% | 47.9 | |
| | Lamporecchio fluvisol | control | 55.3 | |
| | | fly ash 2% | 46.9 | |
| | | fly ash 5% | 42.4 | |
| | Guardia regosol | control | 28.2 | |
| | | fly ash 2% | 34.4 | |
| | | fly ash 5% | 42 | |
| Bush bean | solution | control | | 0 |
| | | CuSO4 | | 0.0001 |
| | | CuSO4 | | 0.00025 |
| | solution | control | | 0 |
| | | CuSO4 | | 0.0001 |
| | | CuSO4 | | 0.00025 |
| | N-deficient solution | control | | 0 |
| | | CuSO4 | | 0.0001 |
| | | CuSO4 | | 0.00025 |
| | N-deficient solution | control | | 0 |
| | | CuSO4 | | 0.0001 |
| | | CuSO4 | | 0.00025 |
| Soybean | loamy sand | control | | 0 |
| | | CuSO4 | | 5.6 kg/ha |
| | | Cu-EDTA | | .4-.7 kg/ha |
| | | Cu-heptogluconate | | .2-.5 kg/ha |
| Spinach | muck peat | control | 158.1 | 0 |
| | | Cu solution | 212.6 | 81 ug/g |
| | | Cu solution | 316.9 | |
| | | Cu solution | 582.5 | 1063 ug/g |
| | peat | control | 22.4 | 0 |
| | | Cu solution | 125.7 | 13 ug/g |
| | | Cu solution | 359.8 | |
| | | Cu solution | 1177.1 | 1659 ug/g |
| Bush bean | sand,loam,clay | control | .69 umol/kg | |
| | | sewage sludge | 22.4 umol/kg | |
| Corn | various | control | | 0 |
| | various | CuSO4 | | 169-183 kg/ha |
| | various | sludge | | 169-183 kg/ha |
| Highbush blueberry | Tempelton silt loam | control | | |
| | Tempelton silt loam | control | | |
| | Tempelton silt loam | control | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 17.8 | | | |
| | | 17.5 | | | |
| | | 13.5 | | | |
| | | 11.9 | | | |
| | | 21.5 | | | |
| | | 16.4 | | | |
| | | 16.2 | | | |
| Bush bean | | 5.9 | | | |
| | | | 17.9 | | |
| | | | 49.8 | | |
| | | 3.2 | | | |
| | | 14.2 | | | |
| | | 16.7 | | | |
| | | 6.5 | | | |
| | | | 45.4 | | |
| | | | 26 | | |
| | | 6.2 | | | |
| | | 9.7 | | | |
| | | 13.9 | | | |
| Soybean | | 10 | | | |
| | | 12 | | | |
| | | 11 | | | |
| | | 10.0-15 | | | |
| Spinach | | 16.03 | | | |
| | | 14.73 | | | |
| | | 15.32 | | | |
| | | 15.9 | | | |
| | | 9.85 | | | |
| | | 11.58 | | | |
| | | 15.76 | | | |
| | | 19.3 | | | |
| Bush bean | | | | | |
| | | | 495.0 nmol/g | | |
| Corn | | 4.0-6.0 | | | |
| | | 6.0-14.0 | | | |
| | | 5.0-9.0 | | | |
| Highbush blueberry | | 7.5-8.0 | | | |
| | | 7.0-9.0 | | | |
| | | 3.0-6.0 | | | |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| Bush bean | | | 253 |
| | yield | 17% reduced by dry weight of leaf | 253 |
| | yield | 73% reduced dry weight of leaf | 253 |
| | | | 253 |
| | | | 253 |
| | | | 253 |
| | | | 253 |
| | yield | 21% reduced dry weight of leaves | 253 |
| | yield | 84% reduced dry weight of leaves | 253 |
| | | | 253 |
| | | | 253 |
| | | | 253 |
| Soybean | | | 114 |
| | | | 114 |
| | | | 114 |
| | | | 114 |
| Spinach | | | 165 |
| | | | 165 |
| | | | 165 |
| | | | 165 |
| | | | 165 |
| | | | 165 |
| | | | 165 |
| | | | 165 |
| Bush bean | | | 82 |
| | | possible yield reduction | 82 |
| Corn | | | 129 |
| | | | 129 |
| | | | 129 |
| Highbush blueberry | | | 86 |
| | | | 86 |
| | | | 86 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |
| | | | | | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |
| Barley | Hordeum vulgare | Conquest | | greenhouse | 6.1 |
| Oats | Avena sativa | Hudson | | greenhouse | 6.1 |
| Wheat | Triticum aestivum | Neepawa | | greenhouse | 6.1 |
| Flax | Linum usitatissimum | Dufferin | | greenhouse | 6.1 |
| Canola | Brassica campestris | Torch | | greenhouse | 6.1 |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Tempelton silt loam | CuSO4 | | 2 g/m3 |
| | Tempelton silt loam | CuSO4 | | 2 g/m3 |
| | Tempelton silt loam | CuSO4 | | 2 g/m3 |
| | Tempelton silt loam | CuSO4 | | 4 g/m3 |
| | Tempelton silt loam | CuSO4 | | 4 g/m3 |
| | Tempelton silt loam | CuSO4 | | 4 g/m3 |
| Barley | Cu deficient soil | CuSO4 | | 0-5.8 ug/g |
| Oats | Cu deficient soil | CuSO4 | | 0-5.8 ug/g |
| Wheat | Cu deficient soil | CuSO4 | | 0-11.5 ug/g |
| Flax | Cu deficient soil | CuSO4 | | 0-64 ug/g |
| Canola | Cu deficient soil | CuSO4 | | 0-16 ug/g |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 10.0-11.0 | | | |
| | | 9.0-10.0 | | | |
| | | 3.5-7.5 | | | |
| | | 12.5-13.5 | | | |
| | | 10.0-12.0 | | | |
| | | 4.0-9.0 | | | |
| Barley | 1.3-2.3 | 2.3-3.7 | | visual | bending,gray leaf margins,necrotic |
| Oats | 1.1-1.7 | 1.7-2.5 | | visual | bending,whitish margins,necrotic |
| Wheat | 1.4-3.0 | 3.0-4.9 | | visual | bending,grayish margins,necrotic |
| Flax | 1.0-2.4 | 2.4-3.5 | | visual | interveinal chlorosis,obtuse stem |
| Canola | 1.2-1.7 | 1.7-2.7 | | visual | interveinal chlorosis,large leaves |

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| Barley | | | 159 |
| Oats | | | 159 |
| Wheat | | | 159 |
| Flax | | | 159 |
| Canola | | | 159 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Alfalfa | Medicago sativa | | tops | field | | |
| Alyssum | Alyssum berthollnii | | leaves,seeds | field | | |
| Apricot | Prunus armeniaca | | fruit | field | | |
| Barley | Hordeum vulgare | | leaves | field | | |
| Bean | Phaseolus spp. | | seeds | field | | |
| Bog asphodel | Narthecium spp. | | leaves,stems | field | | |
| Buckwheat | Fagopyrum spp. | | seeds | field | | |
| Bulrush | Scirpus caespitosus | | leaves,stems | field | | |
| Cabbage | Brassica oleracea capitala | | tops | field | | |
| Carrot | Daucus carota sativa | | roots,leaves | field | | |
| Cherry | Prunus cerasus | | fruit | field | | |
| Citrus fruits | citrus spp. | | leaves | greenhouse | | |
| | | | | field | | |
| | | | | pots | | |
| Clover,bur | Medicago hispida | | tops | field | | |
| Clover,red | Trifolium pratense | | tops | field | | |
| Coffee | Coffea spp. | | beans | field | | |
| Corn | Zea mays | | grain | field | | |
| Cress,water | Rorippa nasturtium-aquaticum | | tops,leaves | field | | |
| Fig | Ficus carica | | fruit | field | | |
| Grasses | Anthoxanthum odoratum | sweet vernal | tops | field | | |
| | | various spp. | tops | field | | |
| Heather Heath | Calluna vulgaris | | tops | field | | |
| | Erica cinerea | | tops | field | | |
| | Erica tetralix | | tops | field | | |
| Mushroom | Cantharellus cibarius | | buttons | field | | |
| Oats | Avena sativa | | leaves,grain,tops | field | | |
| | | | | pots | | |
| Onion | Allium cepa | | bulbs | field | | |
| Pea | Pisum sativum | | seeds | field | | |
| Pear | Pyrus communis | | fruit | field | | |
| Potato | Solanum tuberosum | | tubers | field | | |
| Rice | Oryza sativa | | grain | field | | |
| Sedge | Carex spp. | | tops | field | | |
| Soybean | Glycine soja | | seeds | field | | |
| Spinach | Spinacia oleracea | | tops | field | | |
| Squash | Cucurbita spp. | | fruit | field | | |
| Tea | Camillia sinensis | | leaves | field | | |
| Timothy | Phleum pratense | | tops | field | | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| Alfalfa | | | | | 1-4 | |
| Alyssum | | | | | 4000 | |
| Apricot | | | | | 0.65 | |
| Barley | | | | | 4-6 | |
| Bean | | | | | 0.59 | |
| Bog asphodel | | | | | .4-5.3 | |
| Buckwheat | | | | | 1.34 | |
| Bulrush | | | | | .3-3.0 | |
| Cabbage | | | | | 3.3 | |
| Carrot | | | | | 1.8 | |
| Cherry | | | | | 0.5 | |
| Citrus fruits | | | | | .4-1.0 | 55-140 |
| | | | | | .4-4.0 | |
| | | | | | .7-1.8 | |
| Clover,bur | | | | | 1.0-2.0 | |
| Clover,red | | | | | 1.9 | |
| Coffee | | | | | 0.4 | |
| Corn | | | | | 0.14 | |
| Cress,water | | | | | 0.13 | |
| Fig | | | | | 1.2 | |
| Grasses | | | | | .7-1.7 | |
| | | | | | .2-56.0 | |
| Heather Heath | | | | | .6-2.6 | |
| | | | | | 1.5-1.7 | |
| | | | | | 1.1-1.5 | |
| Mushroom | | | | | 3.5 | |
| Oats | | | | | 7-134 | |
| | | | | | 84-340 | |
| Onion | | | | | 0.16 | |
| Pea | | | | | 2 | |
| Pear | | | | | 1.3 | |
| Potato | | | | | .08-.37 | |
| Rice | | | | | 0.02 | |
| Sedge | | | | | .20-3.2 | |
| Soybean | | | | | 3.9 | |
| Spinach | | | | | 2.4 | |
| Squash | | | | | 4.6 | |
| Tea | | | | | 3.0-5.0 | |
| Timothy | | | | | 0.46 | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| Alfalfa | | | | | 35 |
| Alyssum | | | | | 35 |
| Apricot | | | | | 35 |
| Barley | | | | | 35 |
| Bean | | | | | 35 |
| Bog asphodel | | | | | 35 |
| Buckwheat | | | | | 35 |
| Bulrush | | | | | 35 |
| Cabbage | | | | | 35 |
| Carrot | | | | | 35 |
| Cherry | | | | | 35 |
| Citrus fruits | | | Visual | Chlorosis,necrosis,death | 35 |
| | | | | | 35 |
| | | | | | 35 |
| Clover,bur | | | | | 35 |
| Clover,red | | | | | 35 |
| Coffee | | | | | 35 |
| Corn | | | | | 35 |
| Cress,water | | | | | 35 |
| Fig | | | | | 35 |
| Grasses | | | | | 35 |
| | | | | | 35 |
| Heather Heath | | | | | 35 |
| | | | | | 35 |
| | | | | | 35 |
| Mushroom | | | | | 35 |
| Oats | | | | | 35 |
| | | | | | 35 |
| Onion | | | | | 35 |
| Pea | | | | | 35 |
| Pear | | | | | 35 |
| Potato | | | | | 35 |
| Rice | | | | | 35 |
| Sedge | | | | | 35 |
| Soybean | | | | | 35 |
| Spinach | | | | | 35 |
| Squash | | | | | 35 |
| Tea | | | | | 35 |
| Timothy | | | | | 35 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Tomato | Lycopersicon esculentum | | fruit | field | | |
| Walnut | Juglans regia | | leaves,meats | field | | |
| Wheat | Triticum spp. | | grain | field | | |
| Corn | Zea mays | | earleafs,grain | field | 5.8-6.2 | Bojac loamy sand |
| | | | | | 5.7-6.0 | Davidson clay loam |
| | | | | | 5.7-6.0 | Groseclose silt loam |
| | | | earleafs,grain,stover | field | 6.6 | Acredale silt loam |
| Barley | Hordeum vulgare | Henry | silage | field | 6.6 | Acredale silt loam |
| Corn | Zea mays | | | greenhouse | 6.8 | limed Warsaw sandy loam |
| Rye | Seceale cereal | | | greenhouse | 6.8 | limed Warsaw sandy loam |
| Corn | Zea mays | | | greenhouse | 6.5 | Warsaw sandy loam |
| Rye | Seceale cereal | | | greenhouse | 6.5 | Warsaw sandy loam |
| Tall fescue | Festuca arundinacea | | tops | pots | 7.1-7.7 | fine silty |
| | | | | | 6.1-7.5 | fine silty |
| | | | | | 5.5-6.0 | stripped mined |
| Alfalfa | Medicago sativa | | tops | pots | 7.1-7.7 | fine silty |
| | | | | | 6.1-7.5 | fine silty |
| | | | | | 5.5-6.0 | stripped mined |
| Lettuce | Lactuca sativa | longifolia | shoots | greenhouse | 7.5 | Domino silt loam |
| | | | | | 5.7 | Redding fine sandy loam |
| Wheat | Triticum aestivum | Inia | leaves grain | greenhouse | 7.5 | Domino silt loam |
| | | | | | 5.7 | Redding fine sandy loam |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| Tomato | | | | | .01-.15 | |
| Walnut | | | | | .9-5.0 | |
| Wheat | | | | | .35-35.0 | |
| Corn | | | | | .54-1.0mg/kg | |
| | | | | | .2-.41mg/kg | |
| | | | | | .28-.46mg/kg | |
| | | | 17.2 kg/ha | | .23-1.3mg/kg | |
| Barley | | | 17.2 kg/ha | | .51-.92mg/kg | |
| Corn | fertilized | | | | <4.5 | |
| | sludge | 22 ppm | | | <4.5 | |
| | Ni sludged | 37-81ppm | | | 5.7-15.5 | |
| Rye | fertilized | | | | <4.5 | |
| | sludge | 22 ppm | | | 5 | |
| | Ni sludge | 37-81 ppm | | | 15.4-34.1 | |
| Corn | fertilized | | | | <4.5 | |
| | sludge | 22 | | | <4.5 | |
| | Ni sludge | 22-36 | | | 4.6-6.5 | |
| | inorganic | 15-30 | | | 4.5-5.5 | |
| Rye | fertilized | | | | 4.5 | |
| | sludge | 22 | | | 5 | |
| | Ni sludge | 22-36 | | | 10.1-15.3 | >20.9 |
| | inorganic | 15-30 | | | 5.5-14.1 | |
| Tall fescue | | 1.3 | | | 4.1 | |
| | sludge | 7.9 | | | 2.8-3.8 | |
| | sludge | 12.2 | | | 4.2-9.0 | |
| Alfalfa | | 1.3 | | | 5.7 | |
| | sludge | 7.9 | | | 5.5-6.1 | |
| | sludge | 12.2 | | | 5.6-14.8 | |
| Lettuce | | 0-10 | | | 4.5-6.8 ug/g | |
| | | 20-80 | | | 9.5-23 ug/g | |
| | | 160-640 | | | 29-61 ug/g | 61-166ug/g |
| | | 0-10 | | | 3.5-9.9 ug/g | |
| | | 20-80 | | | 19-41 ug/g | 41-241 ug/g |
| | | 160-640 | | | | 345-1150ug/g |
| Wheat | | 0-10 | | | 3.2-3.4 ug/g | |
| | | 20-80 | | | 3.6-4.3 ug/g | |
| | | 160-640 | | | 6.8-18 ug/g | 18-41 ug/g |
| | | 0-10 | | | 2.3-4.3 ug/g | |
| | | 20-80 | | | 5.7-46 ug/g | >46 ug/g |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| Tomato | | | | | 35 |
| Walnut | | | | | 35 |
| Wheat | | | | | 35 |
| Corn | | | | | 197 |
| | | | | | 197 |
| | | | | | 197 |
| | | | | | 196 |
| Barley | | | | | 196 |
| Corn | | | | | 44 |
| | | | | | 44 |
| | | | yield | reduction attributed to other | 44 |
| Rye | | | | | 44 |
| | | | | | 44 |
| | | | yield | reduction attributed to other | 44 |
| Corn | | | | | 45 |
| | | | | | 45 |
| | | | | | 45 |
| | | | | | 45 |
| Rye | | | | | 45 |
| | | | | | 45 |
| | | | yield | reduction | 45 |
| | | | | | 45 |
| Tall fescue | | | | | 230 |
| | | | | | 230 |
| | | | | | 230 |
| Alfalfa | | | | | 230 |
| | | | | | 230 |
| | | | | | 230 |
| Lettuce | | | | | 167 |
| | | | | | 167 |
| | | | yield | significant yield reduction | 167 |
| | | | | | 167 |
| | | | yield | significant yield reduction | 167 |
| | | | yield | significant yield reduction | 167 |
| Wheat | | | | | 167 |
| | | | | | 167 |
| | | | yield | significant yield reduction | 167 |
| | | | | | 167 |
| | | | yield | significant yield reduction | 167 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Corn | Zea mays | | grain | field | 6.3 | Sable silty clay loam |
| | | | | | 6.8 | Cisne silt loam |
| | | | | | 6.0-6.3 | Ipava silt loam |
| | | | | | 6.2-6.3 | Drummer silty clay loam |
| | | | | | 6 | Muscatine silt loam |
| | | | | | 6.2 | Hartsburg silty clay loam |
| | | | Forage,grain | field | 5.4 | Sango sil |
| Bush Bean | Phaseolus vulgaris | | vines,pods | field | 5.4 | Sango sil |
| Pearl Millet | Pennisetum americanum | | leaves | field | 5.3-6.9 | Downer sand |
| Red Oak | Queracus ruba | | leaves | field | 5.3-6.9 | Downer sand |
| Black Walnut | Juglans nigra | | leaves | field | 5.3-6.9 | Downer sand |
| Wheat | Triticum aestivum | | | pots | 5.2 | Redding fine sandy loam |
| | | | | | <6.5 | Redding fine sandy loam |
| Corn | Zea mays | Dekalb XL-43 | seedlings,grain,stover | field | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Oats | Avena sativa | Norline | grain | field | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Rye | Secale cereale | Balboa | grain | field | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Wheat | Triticum aestivum | Arthur | grain | field | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Crimson clover | Trifolium incarnatum | Auburn | whole | field | 5.6 | sandy |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | | 160-640 | | | | 125-294 ug/g |
| Corn | | | | | 0.91ug/g | |
| | | | | | 0.78 ug/g | |
| | | | | | .49-.58ug/g | |
| | | | | | .79-1.43ug/g | |
| | | | | | 0.78 ug/g | |
| | | | | | 1.03 ug/g | |
| | control | 1.1 | | | 4.4 | |
| | ZnSO4 | 1.3-1.9 | | | 3.0-3.6 | |
| | compost | 1.3-2.1 | | | 2.4-4.6 | |
| | sludge | 1.4-2.1 | | | 2.6-4.5 | |
| Bush Bean | control | 1.1 | | | 5 | |
| | ZnSO4 | 1.3-1.9 | | | 4.1-4.6 | |
| | compost | 1.3-2.1 | | | 3.7-4.8 | |
| | sludge | 1.4-2.1 | | | .9-5.8 | |
| Pearl Millet | fertilized | | | | .4-4.9 | |
| | unfertilized | | | | .2-7.5 | |
| | sludge | | 69 ug/g sludge | | .9-5.9 | |
| Red Oak | fertilized | | | | 1.1 | |
| | unfertilized | | | | 1.5 | |
| | sludge | | 69 ug/g sludge | | 1.3-2.0 | |
| Black Walnut | fertilized | | | | 1.3 | |
| | unfertilized | | | | 1.1 | |
| | sludge | | 69 ug/g sludge | | 1.2-1.8 | |
| Wheat | | | 20-80 ug/g | | | ** |
| | | | 20-80 ug/g | | ** | |
| Corn | no sludge | .2-.4 | | | 1.2 | |
| | 56 metric tons | 1.3-1.7 | | | 1.6 | |
| | 112metric tons | 2.5-2.8 | | | 2.1 | |
| Oats | no sludge | .2-.4 | | | 0.7 | |
| | 56 metric tons | 1.3-1.7 | | | 5.3 | |
| | 112metric tons | 2.5-2.8 | | | 6.9 | |
| Rye | no sludge | .2-.4 | | | 0.4 | |
| | 56 metric tons | 1.3-1.7 | | | 1.1 | |
| | 112metric tons | 2.5-2.8 | | | 1.9 | |
| Wheat | no sludge | .2-.4 | | | 0.4 | |
| | 56 metric tons | 1.3-1.7 | | | 1.3 | |
| | 112metric tons | 2.5-2.8 | | | 2.2 | |
| Crimson clover | no sludge | .2-.4 | | | 1.4 | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | yield | significant yield reduction | 167 |
| Corn | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 187 |
| | | | | | 74 |
| | | | | | 74 |
| | | | | | 74 |
| | | | | | 74 |
| Bush Bean | | | | | 74 |
| | | | | | 74 |
| | | | | | 74 |
| | | | | | 74 |
| Pearl Millet | | | | | 128 |
| | | | | | 128 |
| | | | | | 128 |
| Red Oak | | | | | 128 |
| | | | | | 128 |
| | | | | | 128 |
| Black Walnut | | | | | 128 |
| | | | | | 128 |
| | | | | | 128 |
| Wheat | | | yield | reduction | 15 |
| | | | | | 15 |
| Corn | | | | | 212 |
| | | | | | 212 |
| | | | | | 212 |
| Oats | | | | | 212 |
| | | | | | 212 |
| | | | | | 212 |
| Rye | | | | | 212 |
| | | | | | 212 |
| | | | | | 212 |
| Wheat | | | | | 212 |
| | | | | | 212 |
| | | | | | 212 |
| Crimson clover | | | | | 212 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Arrowleaf clover | Trifolium vesiculosum | Yuchi | whole | field | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 6.3 | sandy |
| Carrots | Daucus carota | Danvers | tubers,shoots | field | 5.5-5.8 | Bridgehampton silt loam |
| Radishes | Raphanus sativus | Cherry belle | tubers,shoots | field | 5.5-5.8 | Bridgehampton silt loam |
| Tomato | Lycopersicon esculentum | New Yorker | fruit | field | 5.5-5.8 | Bridgehampton silt loam |
| Lettuce | Lactuca sativa | Salad Bowl | leaves | field | 5.5-5.8 | Bridgehampton silt loam |
| Bromegrass | Bromus inermis | Leyess | | field | 6.7-7.9 | Conestoga loam |
| Corn | Zea mays | | stover | field | 6.7-7.9 | Conestoga loam |
| Fescue grass | Fertuca arundinacea | | | pot | 6.5 | Norfolk fine loamy |
| | | | | | | Cecil sandy clay loam |
| | | | | | | Norfolk fine loamy |
| | | | | | | Norfolk fine loamy |
| Winter wheat | Triticum spp. | Anza | straw | field | 7.6 | Omni silty clay |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 7.7 | Domino silt loam |
| | | | | | 7 | Hanford sandy loam |
| | | | | | 5.5 | Redding fine sandy loam |
| Fodder rape | Brassica napus | Kenton | | greenhouse | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 7.5 | sandy |
| Barley | Hordeum vulgare | Larker | | greenhouse | 4.0-6.4 | marginally productive soil |
| Rye grass | Lolium multiflorum | Westerwool | | greenhouse | 4.0-6.4 | marginally productive soil |
| Corn | Zea mays | Pioneer 3517 | leaves, grain | field | 7.6-8.1 | calcareous strip-mined spoil |
| Fodder rape | Brassica napus | Kenton | | greenhouse | 5.6 | sandy |
| | | | | | 6 | sandy |
| | | | | | 7.5 | sandy |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 5.6-5.9 | Chalmers silty clay loam and Russel silt loam |
| Rye grass | Lolium perenne | | | greenhouse | 5.6-5.9 | Chalmers silty clay loam and |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | 56 metric tons | 1.3-1.7 | | | 2.9 | |
| | 112metric tons | 2.5-2.8 | | | 3.5 | |
| Arrowleaf clover | no sludge | .2-.4 | | | 2.3 | |
| | 56 metric tons | 1.3-1.7 | | | 6.5 | |
| | 112metric tons | 2.5-2.8 | | | 10.7 | |
| Carrots | | .3-3.2 | | | 5-11 | |
| Radishes | | .3-3.2 | | | 4-22 | |
| Tomato | | .3-3.2 | | | 1.6-6.9 | |
| Lettuce | | .3-3.2 | | | 5.2-9.6 | |
| Bromegrass | $NH_4NO_3$ | .7-1.3 | | | .7-.8 | |
| | Ca sludge | .6-44.5 | | | 2.6-6.0 | |
| | Al sludge | 4.5-5.2 | | | .8-1.7 | |
| | Fe sludge | 1.2-3.0 | | | .6-1.1 | |
| Corn | no N | | | | 0.8 | |
| | Ca sludge | .6-27.8 | | | 2.3 | |
| Fescue grass | | | | | 6.5-18 | |
| | | | | | 5-10 | |
| | surface | | | | 11.2-31.6 | |
| | incorporated | | | | 5.4-8.2 | |
| Winter wheat | | 93-106 | 20.6 kg/ha | | <5.0 | |
| Swiss chard | | .6-6.6 | .4-200.0 | | 5-39 mg/kg | |
| | | 1.4-32.0 | .4-200.0 | | | 100-410mg/kg |
| | | .6-43.0 | .4-200.0 | | | 100-340 mg/kg |
| Fodder rape | | | 46 mg/kg | | .46-3.75 | |
| | | | | | .24-1.30 | |
| | | | | | .11-.49 | |
| Barley | dredged material | | | | .37-2.9 | |
| Rye grass | dredged material | | | | 1.4-10.8 | |
| Corn | control | 4.4-5.7 | | | .4-2.6 | |
| | sludge | 3.9-11.3 | | | .5-2.6 | |
| Fodder rape | control | | 20.4 mg/pot | | 39.6 ug/pot | |
| | sludge | | 26.2-31.9mg/pot | | 35.2-51.4ug/pot | |
| | control | | 20.4 mg/pot | | 24.9 ug/pot | |
| | sludge | | 26.2-31.9mg/pot | | 18.1-24.0ug/pot | |
| | control | | 20.4 mg/pot | | 9.2 ug/pot | |
| | sludge | | 26.2-31.9mg/pot | | 12.8-18.3 ug/pot | |
| Swiss chard | control | 15 mg/kg | | | 4.4 mg/kg | |
| | drilling fluids | 9-18 mg/kg | | | 4.4-13.0 mg/kg | |
| Rye grass | control | 15 mg/kg | | | 4.4 mg/kg | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | | | 212 |
| | | | | | 212 |
| Arrowleaf clover | | | | | 212 |
| | | | | | 212 |
| | | | | | 212 |
| Carrots | | | | | 211 |
| Radishes | | | | | 211 |
| Tomato | | | | | 211 |
| Lettuce | | | | | 211 |
| Bromegrass | | | | | 224 |
| | | | | | 224 |
| | | | | | 224 |
| | | | | | 224 |
| Corn | | | | | 224 |
| | | | | | 224 |
| Fescue grass | | | | | 123 |
| | | | | | 123 |
| | | | | | 123 |
| | | | | | 123 |
| Winter wheat | | | | | 32 |
| Swiss chard | | | | | 242 |
| | | | yield | reduction | 242 |
| | | | yield | reduction | 242 |
| Fodder rape | | | | | 173 |
| | | | | | 173 |
| | | | | | 173 |
| Barley | | | | | 41 |
| Rye grass | | | | | 41 |
| Corn | | | | | 188 |
| | | | | | 188 |
| Fodder rape | | | | | 215 |
| | | | | | 215 |
| | | | | | 215 |
| | | | | | 215 |
| | | | | | 215 |
| | | | | | 215 |
| Swiss chard | | | | | 176 |
| | | | | | 176 |
| Rye grass | | | | | 176 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| | | | | | | Russel silt loam |
| Upland cotton | Gossypium hirsutum | | seeds | field | 8.2 | Pima clay loam |
| Soybean | Glycine max | Corsoy | seedling tissue | pot | 5.9 | Nicollet loam soil |
| Sorghum | Sorghum bicolor | Moench | root,leaves,stem,grain | field | 6.9-7.7 | Haynie fine sand loam |
| | | | | | 5.8-7.2 | Haynie fine sand loam |
| Winter wheat | Triticum aestivum | | root,grain | field | 6.9-7.7 | Haynie fine sand loam |
| | | | | | 5.8-7.2 | Haynie fine sand loam |
| Oat | | Harmon | root,seed,stem | field | | |
| Corn | Zea mays | | leaves,roots,stems,husks | field | 6.2 | Warsaw silt loam |
| Perennial ryegrass | Loluim perenne | | | pot | 4.3-5.26 | acid clay loam |
| | | | | | 4.76-5.72 | acid clay loam |
| | | | | | 6.16-7.11 | acid clay loam |
| Soybean | Glycine max | Bragg | seed,pod wall,stem | greenhouse | 6.2 | Enon sandy loam |
| | | Ransom | seed,pod walls,stem | greenhouse | 6.2 | Enon sandy loam |
| Oat | Avena sativa | Victory | roots | greenhouse | 5.2-7.0 | solution |
| Lettuce | | Imperial 847 | tops | pot | | loamy fine sand |
| Onions | | Early flat Baretta | bulbs | pot | | loamy fine sand |
| Lettuce | | Imperial 847 | tops | field | | loamy fine sand |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | drilling fluids | 9-18 mg/kg | | | 4.1-6.3 mg/kg | |
| Upland cotton | control | | | | 1.05 mg/kg | |
| | fertilized | | | | 1.38 mg/kg | |
| | sludge | | | | .70-1.08mg/kg | |
| Soybean | NiCl2 | | 0-40 mg/kg | | 2.8-10.6 | |
| Sorghum | fertilized | 12.31-15.96 | | | 0.053 | |
| | sludge | 11.90-18.58 | | | 0.059 | |
| Winter wheat | fertilized | 12.31-15.96 | | | 3.18 | |
| | sludge | 11.90-18.58 | | | 4.53 | |
| Oat | control | 5.7-10.4 | | | 14 | |
| | 25% sludge | 7.5 | | | 21 | |
| | 50% sludge | 8.6 | | | 17 | |
| Corn | control | 71.5 | | | 2 | |
| | sludge | 147 | 1990 ton /ha | | 2 | |
| Perennial ryegrass | control | 0 | | | 20 | |
| | sludge | 4-8% | | | | 225-300 |
| | sludge | 0.12 | | | | 350 |
| | control | 0 | | | 15 | |
| | sludge | 4-8% | | | | 200-280 |
| | sludge | 0.12 | | | | 300 |
| | control | 0 | | | 10 | |
| | sludge | 4-8% | | | 115-200 | |
| | sludge | 0.12 | | | | 250 |
| Soybean | control | | 0 | | 8.1 | |
| | low sludge | | 2.8-5.6 kg/ha | | 11.83-13.83 | |
| | high sludge | | 8.4 kg/ha | | 15.93 | |
| | control | | 0 | | 3.3 | |
| | low sludge | | 2.8-5.6 kg/ha | | 9.30-14.5 | |
| | high sludge | | 8.4 kg/ha | | 20.26 | |
| Oat | | 0uM | | | .2-.4umol/gDWh | |
| | | 5-15 uM | | | .7-1.3 umol/gDWh | |
| | | 20-30 uM | | | 1.8 umol | |
| Lettuce | control | | 0 | | 1.5 | |
| | low sludge | | .34-1.7 | | 2.0-4 | |
| | high sludge | | 1.7-3.06 | | 4.0-6 | |
| Onions | control | | 0 | | 4.5 | |
| | low sludge | | .34-1.7 | | 5.5-7.5 | |
| | high sludge | | 1.07-3.06 | | 7.5-10 | |
| Lettuce | control | | 0 | | 1 | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | | | 176 |
| Upland cotton | | | | | 259 |
| | | | | | 259 |
| | | | | | 259 |
| Soybean | | | | | 57 |
| Sorghum | | | | | 127 |
| | | | | | 127 |
| Winter wheat | | | | | 127 |
| | | | | | 127 |
| Oat | | | | | 73 |
| | | | | | 73 |
| | | | | | 73 |
| Corn | | | | | 125 |
| | | | | | 125 |
| Perennial ryegrass | | | | | 19 |
| | | | yield | decreases yield | 19 |
| | | | yield | reduction in yield | 19 |
| | | | | | 19 |
| | | | yield | decreases yield | 19 |
| | | | yield | reduction in yield | 19 |
| | | | | | 19 |
| | | | | | 19 |
| | | | yield | reduction in yield | 19 |
| Soybean | | | | | 202 |
| | | | | | 202 |
| | | | | | 202 |
| | | | | | 202 |
| | | | | | 202 |
| | | | | | 202 |
| Oat | | | | | 4 |
| | | | | | 4 |
| | | | | | 4 |
| Lettuce | | | | | 54 |
| | | | | | 54 |
| | | | | | 54 |
| Onions | | | | | 54 |
| | | | | | 54 |
| | | | | | 54 |
| Lettuce | | | | | 54 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Onion | | Early flat Baretta | bulbs | field | | loamy fine sand |
| Lettuce | | Imperial 847 | tops | greenhouse | | sandy loam |
| Lucerne | Medicago sativa | Wairau | whole | pot | 5 | Waitarere sand |
| | | | | | 5.1-5.6 | Waitarere sand |
| | | | | | 6.6 | Waitarere sand |
| | | | | | 5.2 | Levin silt loam |
| | | | | | 5.4-6.0 | Levin silt loam |
| | | | | | 6.8 | Levin silt loam |
| Tomato | Lycopersicon escuientum | Money maker | leaves,fruit,root | pot | 4.6-6.9 | |
| | | | fruit | pot | 4.6-6.6 | |
| | | | | | 6.6-6.9 | |
| | | | | | 6.6-6.7 | |
| Soybean | Glycine max | | stem,leaves,seeds,pods | pot | | Ritzville silt loam |
| Barley | Hordeum vulgare | Julia | tops | sand | | washed Silver sand |
| Ryegrass | Lolium perenne | S24 | tops | pot | 6 | sandy soil |
| | | | | | 7.6 | heavy clay soil |
| Tomato | Lycopersicon esculentum | | shoots | greenhouse | 5.33 | Elkton silt loam |
| | | | | | 7.96-8.09 | Elkton silt loam |
| | | | | | 8.01-8.11 | Elkton silt loam |
| Grass | | timothy,brown top | | field | 6.05 | clay & sandy loams |
| | | sweet vernal,blue | | | 6.2 | clay & sandy loams |
| Alfalfa & red clover | | | | field | 6.05 | clay & sandy loams |
| | | | | | 6.2 | clay & sandy loams |
| Barley | Hordeum vulgare | Onda | shoots | solution | | solution |
| | Alyssum murale | | leaves | field | | serpentine soil |
| | Rumex scutatus | | leaves | field | | serpentine soil |
| Corn | Zea mays | Asgrow UH7 | whole | greenhouse | 6.3 | Grenville loam |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | sludge | | .34-6.12 | | 1.0-2 | |
| Onion | control | | 0 | | 0.5 | |
| | sludge | | .34-6.12 | | 0.75 | |
| Lettuce | control | | 0 | | 1.46 | |
| | sludge | | .34-27.54 kg/ha | | 1.78-44.8 | |
| | heated | | 1.02-3.06 kg/ha | | 1.79-2.69 | |
| Lucerne | 0 | 7 | | | 3.5 | |
| | 5-40% sludge | 8.25-17.0 | | | 2.1-3.5 | |
| | 100% sludge | 32 | | | 1.8 | |
| | 0 | 12 | | | .5-2 | |
| | 5-40% sludge | 13.0-20 | | | .5-3.25 | |
| | 100% sludge | 32 | | | .1-2 | |
| Tomato | sludge | 210 | 0-189 kg/ha | | 3.4 | |
| | 0 | | 0 | | 0.7 | |
| | 25-75% sludge | | 47.25-141.75 kg/ha | | .95-1.9 | |
| | 100% sludge | | 189 kg/ha | | 2.4 | |
| Soybean | Control | 28 | | | 0.62 | |
| | Ni solution | | 2.5 ug/g | | 14.3 | |
| Barley | NiCl2 | 2-8.9 | | | 10.8-13.0 | |
| | NiCl2 | 24-90 | | | | 250-850 |
| Ryegrass | control | | 0 | | 2.47 | |
| | salt | | 2.5-20 mg/kg | | 4.65-54.4 | |
| | sludge | | 2.5-20 mg/kg | | 4.17-11.3 | |
| | control | | 0 | | 2.3 | |
| | salt | | 2.5-20 mg/kg | | 2.7-13.9 | |
| | sludge | | 2.5-20 mg/kg | | 2.8-4.9 | |
| Tomato | control | 154.6 | | | 14.91 | |
| | low 2-6% sludge | 157.6-163.7 | | | 8.81-8.84 | |
| | high 8-10% sludge | 166.8-169.8 | | | 9.82-10.68 | |
| Grass | control | .26-2.5 | | | .64-4.10 | |
| | sludge | .49-3.05 | 1.26-2.51 kg/ha | | .57-5.89 | |
| Alfalfa & red clover | control | .26-2.5 | | | 2.24-5.71 | |
| | sludge | .49-3.05 | 1.26-2.51 kg/ha | | 2.55-5.92 | |
| Barley | | 0 Ni | | 0-100 ppb | | |
| | | 1.0 uM Ni | | | 100-400 ppb | |
| | natural | 728-2093 | | | | 10317 |
| | natural | 728-2093 | | | <252 ppm | |
| Corn | control | | 0-480 | | 0.6 | 1.6-78.1 |
| | fertilized | | 0-480 | | 0.6 | 1.5-166.1 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | | | 54 |
| Onion | | | | | 54 |
| | | | | | 54 |
| Lettuce | | | | | 53 |
| | | | | | 53 |
| | | | | | 53 |
| Lucerne | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| | | | | | 261 |
| Tomato | | | | | 262 |
| | | | | | 262 |
| | | | | | 262 |
| | | | | | 262 |
| Soybean | | | | | 27 |
| | | | | | 27 |
| Barley | | | | | 6 |
| | | | visual | death | 6 |
| Ryegrass | | | | | 43 |
| | | | | | 43 |
| | | | | | 43 |
| | | | | | 43 |
| | | | | | 43 |
| | | | | | 43 |
| Tomato | | | | | 62 |
| | | | | | 62 |
| | | | | | 62 |
| Grass | | | | | 147 |
| | | | | | 147 |
| Alfalfa & red clover | | | | | 147 |
| | | | | | 147 |
| Barley | yield/visual | 30% less/less green,smaller | | | 21 |
| | | | | | 21 |
| | | | | none mentioned | 5 |
| | | | | | 5 |
| Corn | | | yield | 32-91% reduction in yield | 146 |
| | | | yield | 22-97.6% reduction in yield | 146 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| | | | | | 5.9 | Rideau clay |
| | | | | | 6.5 | Rideau clay |
| Lettuce | Lactuca sativa | Grand Rapilds Forcing | whole | greenhouse | 6.3 | Grenville loam |
| | | | | | 5.9 | Rideau clay |
| | | | | | 6.5 | Rideau clay |
| Soybean | Glycine max | Clark | shoots | field | 6.9 | Sassafras sandy loam |
| | | | | | 6.6 | Sassafras sandy loam |
| | | | | | 6.4 | Sassafras sandy loam |
| | | | | | 5.9-7.4 | Christiana fine sandy loam |
| | | | | | 7.0-7.7 | Christiana fine sandy loam |
| | | | | | 6.9-7.6 | Christiana fine sandy loam |
| | | | | | 5.8-7.1 | Christiana fine sandy loam |
| | | | | | 5.7-6.0 | Christiana fine sandy loam |
| | | | | | 5.1-5.3 | Christiana fine sandy loam |
| | | | | | 6.4-6.6 | Christiana fine sandy loam |
| | | | | | 5.7-5.9 | Christiana fine sandy loam |
| Beans | Phaseolus vulgaris | Tender crop | fruit | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Cabbage | Brassica oleracea | Golden Acre | leaves | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Carrots | Daucus carota | Scarlet Nantes | tubers | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Millet | Echinochloa crusgalli | Japanese | edible tissue | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Onions | Allium cepa | Downing Yellow Sweet Spanish | fruit | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Potatoes | Solanum tuberosum | Katahdin | tubers | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Tomatoes | Lycopersicon esculentum | Vendor | fruit | pots | 5 | Arkport fine sandy loam |
| | | | | | 5.3 | Arkport fine sandy loam |
| Celery | Apium graveolens | Utah 52-70 | leaves | field | 6.88 | muck soil |
| | | | | | 5.68 | muck soil |
| | | | | | 6.91 | muck soil |
| Perennial ryegrass | Lolium perenne | Melle | leaves | pot | 7 | Sutton sandy loam |
| Lettuce | Lactuca sativa | Climax | | solution | 6.2 | Hoagland solution |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| | sludge | | 0-480+1 | | 0.5 | 1.5-19.1 |
| | sludge | | 0-480+1 | | .6-1.4 | 21.9-637.8 |
| | sludge+lime | | 0-480+1 | | 0.4 | 1.2-6.8 |
| Lettuce | sludge | | 0-480+1 | | 1.3 | 6.1-133.1 |
| | sludge | | 0-480+1 | | 1.3-51.0 | 3619 |
| | sludge+lime | | 0-480+1 | | 1.6-31.8 | |
| Soybean | control | | 0 | | 2.5-2.8 | |
| | sludge | | 9.52 kg/ha | | 3.8-4.6 | |
| | sludge | | 19.04 kg/ha | | 5.1-6.1 | |
| | control | | 0 | | 5.8-8.2 | |
| | limed-digested | | .84-6.72 kg/ha | | 3.7-6.9 | |
| | limed-raw | | .95-3.81 kg/ha | | 3.2-4.4 | |
| | limed-compost | | 11.26-135 kg/ha | | 2.5-7.8 | |
| | heated sludge | | 2.07-8.29 kg/ha | | 4.4-7.7 | |
| | heated sludge | | 2.07-8.29 kg/ha | | 7.9-12.6 | |
| | Nu-Earth | | 15.1-30.2 kg/ha | | 7.6-7.7 | |
| | Nu-Earth | | 15.1-30.2 kg/ha | | 9.6-11.3 | |
| Beans | peat | 15.31 | | | 3.9 | |
| | sludge | 28.9 | | | 11.3 | |
| Cabbage | peat | 15.31 | | | 1.9-2.1 | |
| | sludge | 28.9 | | | 3.3-10.0 | |
| Carrots | peat | 15.31 | | | 2.7 | |
| | sludge | 28.9 | | | 3.8 | |
| Millet | peat | 15.31 | | | 1.4 | |
| | sludge | 28.9 | | | 1.9 | |
| Onions | peat | 15.31 | | | 2.2 | |
| | sludge | 28.9 | | | 3 | |
| Potatoes | peat | 15.31 | | | 0.6 | |
| | sludge | 28.9 | | | 1.6 | |
| Tomatoes | peat | 15.31 | | | 0.5 | |
| | sludge | 28.9 | | | 1.3 | |
| Celery | control | 54 | | | 5 | |
| | high metal soil | 6000 | | | | 78 |
| | limed high metal soil | 5550 | | | 66 | |
| Perennial ryegrass | control | 43 | 0 | | 11 | |
| | low sludge | 86-129 | | | 46-79 | |
| | medium sludge | 210-372 | 356 kg/ha | | 90 | 126-222 |
| | high sludge | 537 | | | | 305 |
| Lettuce | | | | | 20 ueg/l | 20-45 ueg/l |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| | | | yield | 19.6-88% reduction in yield | 146 |
| | | | yield | 71.4-88.9% reduction in yield | 146 |
| | | | yield | 15.3-42% reduction in yield | 146 |
| Lettuce | | | yield | 31-41% reduction in yield | 146 |
| | | | yield | 20.9% reduction in yield | 146 |
| | | | | | 146 |
| Soybean | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| | | | | | 89 |
| Beans | | | | | 68 |
| | | | | | 68 |
| Cabbage | | | | | 68 |
| | | | | | 68 |
| Carrots | | | | | 68 |
| | | | | | 68 |
| Millet | | | | | 68 |
| | | | | | 68 |
| Onions | | | | | 68 |
| | | | | | 68 |
| Potatoes | | | | | 68 |
| | | | | | 68 |
| Tomatoes | | | | | 68 |
| | | | | | 68 |
| Celery | | | | | 16 |
| | | | visual | stunting,cupping,& foliar necrosis | 16 |
| | | | | | 16 |
| Perennial ryegrass | | | | | 50 |
| | | | | | 50 |
| | | | yield | 28% reduction | 50 |
| | | | yield | 57% reduction | 50 |
| Lettuce | | | yield | 70% reduced root length | 10 |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH | Soil Type |
|---|---|---|---|---|---|---|
| Tomato | Lycopersicon esculentum | Fireball | leaves | sand | | Hoagland solution |
| Soybean | Glycine max | Harcor | leaves | sand | | Hoagland solution |
| Wheat | Triticum aestivum | | tops | pot | 5.0-5.5 | Orentano histosol |
| | | | | | 6.1-8.3 | Lamporecchio fluvisol |
| | | | | | 7.5-8.0 | Guardia regosol |
| Peas | Pisum sativum | Dark Skin Prefection | | perlite | | Hoaglands solutions |
| | | Laxton's Progress | | perlite | | Hoaglands solution |
| Corn | Zea mays | Pioneer 3369A | whole | pot | 6.4 | various |
| | | | | | 6.3 | various |
| | | | | | 6.2 | various |
| | | | | pot | 7.3-8.1 | various |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | Treatment | Concentration in soil | Loading rate | plant tissue concentration | | |
|---|---|---|---|---|---|---|
| | | | | deficiency | normal | toxic |
| Tomato | control | | 0 | | ** | |
| | NiSO4 | | 1.5 | | | ** |
| | NiSO4 | | 7.5 | | | ** |
| | NiSO4 | | 37.5 | | | ** |
| Soybean | control | | 0 | | ** | |
| | NiSO4 | | 0.3 | | ** | |
| | NiSO4 | | 0.9 | | ** | |
| | NiSO4 | | 1.5 | | ** | |
| Wheat | control | 24.1 | | | 6.7 | |
| | fly ash 2% | 29 | | | 7.7 | |
| | fly ash 5% | 30.2 | | | 6.8 | |
| | control | 53.8 | | | 11.7 | |
| | fly ash 2% | 42.7 | | | 9.6 | |
| | fly ash 5% | 38.4 | | | 7.7 | |
| | control | 23.1 | | | 16.4 | |
| | fly ash 2% | 26.6 | | | 12.2 | |
| | fly ash 5% | 28.8 | | | 9.1 | |
| Peas | control | | 0 | | 0 | |
| | NiSO4 | | 10-100 umol | | 8.5-40.1 | |
| | NiSO4 | | 1000 umol | | | ** |
| | control | | 0 | | 0 | |
| | NiSO4 | | 10-100 umol | | 9.9-53.7 | |
| | NiSO4 | | 1000 umol | | | ** |
| Corn | control | | 0 | | <.1-2.7 | |
| | NiSO4 | | 14.5-16.4 kg/ha | | <.1-2.7 | |
| | sludge | | 14.5-16.4 kg/ha | | <.1-2.7 | |
| | Ni(NO3)2 | 20.0-44.0 | | | 3.0-5.5 | |
| | Ni(NO3)2 | 53.0-54.0 | | | 4.2-6.4 | |
| | Ni(NO3)2 | 74.0-90.0 | | | 4.5-7.1 | |

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity deficiency | | phytotoxicity | | reference |
|---|---|---|---|---|---|
| | type | symptoms | type | symptoms | |
| Tomato | | | | | 193 |
| | | | visual | 44.3% leaf area injury--necrosis | 193 |
| | | | visual | 57.9% leaf area injury--necrosis | 193 |
| | | | visual | death 91% yield reduction | 193 |
| Soybean | | | | | 193 |
| | | | | | 193 |
| | | | | | 193 |
| | | | | | 193 |
| Wheat | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| | | | | | 186 |
| Peas | | | | | 179 |
| | | | | | 179 |
| | | | visual | extreme leaf necrosis & abscission | 179 |
| | | | | | 179 |
| | | | | | 179 |
| | | | visual | extreme leaf necrosis & abscission | 179 |
| Corn | | | | | 129 |
| | | | | | 129 |
| | | | | | 129 |
| | | | | | 207 |
| | | | | | 207 |
| | | | | | 207 |

TABLE E-4. ZINC PHYTOTOXICITY DATA

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Alfalfa | Medicago sativa | | tops,top half of shoots | field | |
| | | | | control | |
| Apple | Malus spp. | | leaves,stems | field | |
| Apricot | Prunus armeniaca | | leaves,stems | field | |
| Avocado | Persea americana | | leaves | field | |
| Clover,Subter. | Trifolium subterraneum | | leaves | field | |
| | | | tops | solution | |
| Corn | Zea mays | | leaves | field | |
| Flax | Linum usitatissimum | | tops | pots | |
| Oats | Avena sativa | | leaves,plant | sand | |
| Orange | Citrus sinensis | | leaves | field | |
| Peach | Prunus persica | | leaves,stems | field | |
| Pear | Pyrus communis | | leaves | field | |
| Pecan | Carya illinoensis | | leaves,leaflets,petioles,shoots | field | |
| Pineapple | Ananas comosus | | leaves,stems | field | |
| Potato | Solanum tuberosum | | leaves | field | |
| Tomato | Lycopersicon esculentum | | leaves | field | |
| | | | | sand | |
| | | | | solution | |
| Tung | Aleurites fordi | | leaves,petioles | field | |
| | | | | sand | |
| Walnut | Juglans regia | | leaves,stems | field | |
| Corn | Zea mays | | earleaf,grain | controled | 5.8-6.2 |
| | | | | | 5.7-6.0 |
| | | | | | 5.7-6.0 |
| | | | earleaf,grain,stover | field | 6.6 |
| Barley | Hordeum vulgare | Henry | silage | field | 6.6 |
| Reed canarygrass | Phalaris arundinacea | | | field | 5.9-6.6 |
| Corn | Zea mays | | | field | 5.9-6.6 |
| Radish | Raphanus sativus | Cherry Belle | leaf,tuber | field | |
| Swiss Chard | Beta vulgare | Fordhook | | field | |
| Corn | Zea mays | | stover,grain | field | 6.2 |
| | | | | greenhouse | 6.8 |
| Rye | Seceale cereal | | | greenhouse | 6.8 |
| Corn | Zea mays | | | greenhouse | 6.5 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Alfalfa | | | | |
| Apple | | | | |
| Apricot | | | | |
| Avocado | | | | |
| Clover,Subter. | | | | |
| Corn | | | | |
| Flax | | | | |
| Oats | | | | |
| Orange | | | | |
| Peach | | | | |
| Pear | | | | |
| Pecan | | | | |
| Pineapple | | | | |
| Potato | | | | |
| Tomato | | | | |
| Turg | | | | |
| Walnut | | | | |
| Corn | Bojac loamy sand | | | |
| | Davidson clay loam | | | |
| | Groseclose silt loam | | | |
| | Acredale silt loam | | | 248 kg/ha |
| Barley | Acredale silt loam | | | 248 kg/ha |
| Reed canarygrass | Hublersburg clay loam | | | 73.0 kg/ha |
| Corn | Hublersburg clay loam | | | 30.6 kg/ha |
| Radish | Ramona sandy loam | | 950 mg/kg | |
| Swiss Chard | Ramona sandy loam | | 950 mg/kg | |
| Corn | Waukegan fine silty over loam | | | 106-384 kg/ha |
| | limed Warsaw sandy loam | fertilized | | |
| | | sludge | 113 | |
| | | Zn sludge | 410-1302 | |
| Rye | limed Warsaw sandy loam | fertilized | | |
| | | sludge | 113 | |
| | | Zn sludge | 410-1302 | |
| Corn | Warsaw sandy loam | fertilized | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Alfalfa | 8 | 13.8 | | visual | |
| | 13 | 39-48 | | visual | |
| Apple | 1.2-54 | 4-80 | | visual | small stiff and mottled leaves |
| Apricot | 24-30 | 19-31 | | visual | |
| Avocado | 4-15 | 50 | | visual | |
| Clover,Subter. | <15 | | | visual | |
| | 24-25 | 76-90 | | visual | |
| Corn | 9-15.1 | 15-36 | | visual | light yellow streaks,chlorotic strip |
| Flax | 18 | 32-83 | | visual | grayish-brown spots,turns white |
| Oats | <20 | 20 | 1700-7500 | visual | turn pale green,collapsed areas,gray |
| Orange | 3.8-26 | 7.8-200 | 200-300 | visual | leaves become chlorotic,mottled |
| Peach | 3.5-25.4 | 66.0-140 | | visual | mottling,narrow crinkled leaves |
| Pear | 9.9 | 16 | | visual | |
| Pecan | trace-7.0 | 66-202 | | visual | yellow mottling,rosettes |
| Pineapple | 4-26 | 4-44 | | visual | |
| Potato | | 30-87 | | | |
| Tomato | 6.0-8.7 | 13 | | visual | slow growth,brownish chlorosis,curl |
| | 14.4 | 26.9 | | visual | slow growth,brownish chlorosis,curl |
| | 9-15 | 65-198 | 526-1489 | visual | slow growth,brownish chlorosis,curl |
| Tung | 3.6-26 | 15.7-229 | | visual | leaf bronzing,necrosis,spotting |
| | | | 485 | | |
| Walnut | 11-22 | 16-30 | | visual | |
| Corn | 56-71mg/kg | | | | |
| | 21-28mg/kg | | | | |
| | 22-48mg/kg | | | | |
| | 10-53mg/kg | | | | |
| Barley | 12-35mg/kg | | | | |
| Reed canarygrass | | 41.14-90.19ug/g | | | |
| Corn | | 18.32-45.15ug/g | | | |
| Radish | | 425 mg/kg | | | |
| Swiss Chard | | 610 mg/kg | | | |
| Corn | | 18.5-154 mg/kg | | | |
| | | 26-42 ppm | | | |
| | | 164-225 ppm | | | |
| | | | 296-959 ppm | | |
| Rye | | 45 | | | |
| | | 125 | | | |
| | | | 396-948ppm | | |
| Corn | | 26-42 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Alfalfa | | | 35 |
| | | | 35 |
| Apple | | | 35 |
| Apricot | | | 35 |
| Avocado | | | 35 |
| Clover,Subter. | | | 35 |
| | | | 35 |
| Corn | | | 35 |
| Flax | | | 35 |
| Oats | visual | leaves show iron chlorosis | 35 |
| Orange | visual | leaves show iron chlorosis | 35 |
| Peach | | | 35 |
| Pear | | | 35 |
| Pecan | | | 35 |
| Pineapple | | | 35 |
| Potato | | | 35 |
| Tomato | | | 35 |
| | | | 35 |
| | visual | | 35 |
| Tung | | | 35 |
| | visual | | 35 |
| Walnut | | | 35 |
| Corn | | | 197 |
| | | | 197 |
| | | | 197 |
| | | | 196 |
| Barley | | | 196 |
| Reed canarygrass | | none reported | 213 |
| Corn | | none reported | 213 |
| Radish | | none reported | 34 |
| Swiss Chard | | none reported | 34 |
| Corn | | no significant differences | 12 |
| | | | 44 |
| | | | 44 |
| | yield | up to 78% reduction | 44 |
| Rye | | | 44 |
| | | | 44 |
| | yield | up to 57% reduction | 44 |
| Corn | | | 45 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Rye | Seceale cereal | | | greenhouse | 6.5 |
| Corn | Zea mays | | leaf,grain | field | 5.0-5.9 |
| | | | | | 6.8-7.7 |
| | | | | | 6.7-7.6 |
| Bermuda grass | Cynodon dactylon | | | field | 5.7-6.0 |
| | | | | | 5.4-6.0 |
| | | | | | 4.2-5.3 |
| | | | | | 6.1-6.6 |
| | | | | | 5.8-6.2 |
| | | | | | 4.8-5.2 |
| Tall fescue | Festuca arundinacea | | tops | pots | 7.1-7.7 |
| | | | | | 6.1-7.5 |
| | | | | | 5.5-6.0 |
| Alfalfa | Medicago sativa | | tops | pots | 7.1-7.7 |
| | | | | | 6.1-7.5 |
| | | | | | 5.5-6.0 |
| Corn | Zea mays | | grain | field | 6.3 |
| | | | | | 6.8 |
| | | | | | 6.0-6.3 |
| | | | | | 6.2-6.3 |
| | | | | | 6 |
| | | | | | 6.2 |
| Lettuce | Lactuca sativa | longifolia | shoots | greenhouse | 7.5 |
| | | | | | 5.7 |
| Wheat | Triticum aestivum | Inia | leaves, grain | greenhouse | 7.5 |
| | | | | | 5.7 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | sludge | 113 | |
| | | Zn sludge | 327-618 | |
| | | inorganic | 300-600 | |
| Rye | Warsaw sandy loam | fertilized | | |
| | | sludge | 113 | |
| | | Zn sludge | 327-618 | |
| | | inorganic | 300-600 | |
| Corn | Blount silt loam | | 12.1-277.2 | |
| | Blount silt loam | | 5.99-227 | |
| | Blount silt loam | | 4.82-140 | |
| Bermuda grass | nonlimed Cecil sandy clay loam | control | 1-4 | |
| | nonlimed Cecil sandy clay loam | fertilized | 1-4 | |
| | nonlimed Cecil sandy clay loam | sludge | 34-54 | |
| | limed Cecil sandy clay loam | control | 1-6 | |
| | limed Cecil sandy clay loam | fertilized | 1-8 | |
| | limed Cecil sandy clay loam | sludge | 26-43 | |
| Tall fescue | fine silty | | 7.5 | |
| | fine silty | sludge | 506.7 | |
| | stripped mined | sludge | 543.4 | |
| Alfalfa | fine silty | | 7.5 | |
| | fine silty | sludge | 506.7 | |
| | stripped mined | sludge | 543.4 | |
| Corn | Sable silty clay loam | | | |
| | Cisne silt loam | | | |
| | Ipava silt loam | | | |
| | Drummer silty clay loam | | | |
| | Muscatine silt loam | | | |
| | Hartsburg silty clay loam | | | |
| Lettuce | Domino silt loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| | Redding fine sandy loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| Wheat | Domino silt loam | | 0-10 | |
| | | | 20-80 | |
| | | | 160-640 | |
| | Redding fine sandy loam | | 0-10 | |
| | | | 20-80 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 164-225 | | | |
| | | | 280-520 | | |
| | | | 273-591 | | |
| Rye | | 45 | | | |
| | | 125 | | | |
| | | | 317-833 | | |
| | | | 564-1031 | | |
| Corn | | 28.3-381 | | | |
| | | 23-145 | | | |
| | | 18.3-115 | | | |
| Bermuda grass | | 33 | | | |
| | | 19 | | | |
| | | 34-285 | | | |
| | | 27 | | | |
| | | 19 | | | |
| | | 34-192 | | | |
| Tall fescue | | 50.3 | | | |
| | | 52.4-54.2 | | | |
| | | 51.6-62.7 | | | |
| Alfalfa | | 103.5 | | | |
| | | 92.6-108.3 | | | |
| | | 141.8-237.9 | | | |
| Corn | | 16.4 ug/g | | | |
| | | 18.8 ug/g | | | |
| | | 15.7-20.1 ug/g | | | |
| | | 18.6-20.7 ug/g | | | |
| | | 16.9 ug/g | | | |
| | | 17.1 ug/g | | | |
| Lettuce | | 78-98ug/g | | | |
| | | 105-146ug/g | | | |
| | | 190-380ug/g | 380-1265ug/g | | |
| | | 139-172ug/g | | | |
| | | 195-520ug/g | | | |
| | | | 1058-1973ug/g | | |
| Wheat | | 63-67 ug/g | | | |
| | | 68-87 ug/g | | | |
| | | 108-189 ug/g | 189-412 ug/g | | |
| | | 58-70 ug/g | | | |
| | | 76-131 ug/g | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 45 |
| | yield | reduction | 45 |
| | yield | reduction | 45 |
| Rye | | | 45 |
| | | | 45 |
| | yield | reduction | 45 |
| | yield | reduction | 45 |
| Corn | | no significant differences | 111 |
| | | no significant differences | 111 |
| | | no significant differences | 111 |
| Bermuda grass | | | 240 |
| | | | 240 |
| | | | 240 |
| | | | 240 |
| | | | 240 |
| | | | 240 |
| Tall fescue | | | 230 |
| | | | 230 |
| | | | 230 |
| Alfalfa | | | 230 |
| | | | 230 |
| | | | 230 |
| Corn | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| | | | 187 |
| Lettuce | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| Wheat | | | 167 |
| | | | 167 |
| | yield | significant yield reduction | 167 |
| | | | 167 |
| | | | 167 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Snap bean | Phaseolus vulgaria | Tendergreen | beans,leaves | field | 5.3 |
| | | | leaves,edible tissue | field | 5.3 |
| Barley | Hordeum vulgare | Liberty | | greenhouse | 7.2 |
| Corn | Zea mays | | forage,grain | field | 5.4 |
| Bush beans | Phaseolus vulgaris | | vines,pods | field | 5.4 |
| Corn | Zea mays | | forage,grain | field | 5.4 |
| Bush beans | Phaseolus vulgaris | | vines, pods | field | 5.4 |
| Carrots | Daucus carota sotiva | Scarlet Nantes | tubers | field | 5.3 |
| Lettuce | Lactuca sativa | Grand Rapids | leaves | field | 5.3 |
| Peas | Pisum sativum | Wando | fruit,vines,pods | field | 5.3 |
| Potatoes | Solanum tuberosum | Norland | tubers | field | 5.3 |
| Radishes | Raphanus sativus | Sparkler | tubers | field | 5.3 |
| Sweet corn | Zea mays | NK-199 | grain,leaves | field | 5.3 |
| Tomatoes | Lycopersicon esculentum | Fantastic | fruit | field | 5.3 |
| Wheat | Triticum aestivum | Centurk | grain | field | 5.3 |
| Corn | Zea mays | | tops | greenhouse | 5.5 |
| | | | leaves,grain | field | nuetral |
| Pearl millet | Pennisetum Americanum | | leaves | field | 5.3-6.9 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | | 160-640 | |
| Snap bean | Hubbard coarse sand | | | 1520 kg/ha |
| | Hubbard coarse sand | control | | 0 |
| | | single | | 149-597 kg/ha |
| | | anual | | 379-1518kg/ha |
| Barley | Humus loam coarse sand | | | |
| Corn | Sango sil | control | 4 | 0 |
| | | ZnSo4 | 28-106 | 40-160 ppm |
| | | Compost | 32-80 | 40-160 |
| | | Sludge | 29-93 | 40-160 |
| Bush beans | Sango sil | control | 4 | 0 |
| | | ZnSO4 | 28-106 | 40-160 |
| | | Compost | 32-80 | 40-160 |
| | | Sludge | 29-93 | 40-160 |
| Corn | Sango sil | control | 6 | 0 |
| | | ZnSo4 | 53-164 | 80-320 |
| | | Compost | 70-156 | 80-320 |
| | | Sludge | 68-206 | 80-320 |
| Bush beans | Sango sil | control | 6 | 0 |
| | | ZnSO4 | 53-164 | 80-320 |
| | | Compost | 70-156 | 80-320 |
| | | Sludge | 68-206 | 80-320 |
| Carrots | Hubbard coarse sand | | | |
| Lettuce | Hubbard coarse sand | | | |
| Peas | Hubbard coarse sand | | | |
| Potatoes | Hubbard coarse sand | | | |
| Radishes | Hubbard coarse sand | | | |
| Sweet corn | Hubbard coarse sand | | | |
| Tomatoes | Hubbard coarse sand | | | |
| Wheat | Truckton loamy sand | | | |
| Corn | Hartsell fine sandy loam | Sludge A | | 70-1400 |
| | | Sludge B | | 11-210 |
| | | Compost | | 6-120 |
| | | ZnSO4 | | 12-1400 |
| | | control | | 0 |
| | Blount silt loam | none | 72-83 | |
| | | middle | 124-270 | |
| | | maximum | 257-451 | |
| Pearl millet | Downer sand | fertilized | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 224-655ug/g | >655 ug/g | | |
| Snap bean | | 112-115 ug/g | | | |
| | | 29.5-32.3 ug/g | | | |
| | | 57.2-60.4 ug/g | | | |
| | | 58.5-117.4ug/g | | | |
| Barley | | 106-295 | | | |
| Corn | | 41 | | | |
| | | 227-475 | | | |
| | | 77-100 | | | |
| | | 94-97 | | | |
| Bush beans | | 60 | | | |
| | | 184-328 | 328-499 | | |
| | | 52-84 | | | |
| | | 158 | 164-189 | | |
| Corn | | 53 | | | |
| | | | 509-1025 | | |
| | | 126-184 | | | |
| | | 202-241 | | | |
| Bush beans | | 48 | | | |
| | | | 305-634 | | |
| | | 55-61 | | | |
| | | 211-225 | | | |
| Carrots | | 23-103 | | | |
| Lettuce | | 21-225 | | | |
| Peas | | 49-327 | | | |
| Potatoes | | 24-53 | | | |
| Radishes | | 37-98 | | | |
| Sweet corn | | 22-293 | | | |
| Tomatoes | | 9-31 | | | |
| Wheat | | 34.8-54.2 | | | |
| Corn | | 196-508 | | | |
| | | 60-186 | 313 | | |
| | | 31-92 | | | |
| | | 104 | 1604-10178 | | |
| | | 14-18 | | | |
| | | 21-42 | | | |
| | | 23-112 | | | |
| | | 45-145 | | | |
| Pearl millet | | 56 ug/g | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | yield | significant yield reduction | 167 |
| Snap bean | | | 58 |
| | | none mentioned | 138 |
| | | none mentioned | 138 |
| | | none mentioned | 138 |
| Barley | | | 124 |
| Corn | | | 74 |
| | | | 74 |
| | | | 74 |
| | | | 74 |
| Bush beans | | | 74 |
| | yield | vine & pod yield reduction | 74 |
| | | | 74 |
| | yield | pod yield reduction | 74 |
| Corn | | | 74 |
| | yield | up to 59% yield reduciton | 74 |
| | | | 74 |
| | | | 74 |
| Bush beans | | | 74 |
| | yield | up to 99% yield reduction | 74 |
| | | | 74 |
| | | | 74 |
| Carrots | | | 56 |
| Lettuce | | | 56 |
| Peas | | | 56 |
| Potatoes | | | 56 |
| Radishes | | | 56 |
| Sweet corn | | | 56 |
| Tomatoes | | | 56 |
| Wheat | | | 206 |
| Corn | | | 169 |
| | yield | reduciton attributed elsewhere | 169 |
| | | | 169 |
| | yield | reduction of 10-96% | 169 |
| | | | 169 |
| | | | 96 |
| | | | 96 |
| | | | 96 |
| Pearl millet | | | 128 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Red oak | Quercus ruba | | leaves | field | 5.3-6.9 |
| Black Walnut | Juglans nigra | | leaves | field | 5.3-6.9 |
| Wheat | Triticum aestivum | | | pots | 5.2<br>>6.5 |
| Lettuce | Lactuca sativa | Bibb | leaves | field | |
| | | | | | 6.5 |
| | | Romaine | leaves | field | |
| | | | | | 6.5 |
| | | Boston | leaves | field | |
| | | | | | 6.5 |
| Cabbage | Brassica oleracea | capitata | edible parts | field | |
| | | | | | 6.5 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | unfertilized | | |
| | | sludge | | 2154ug/g sludge |
| Red oak | Downer sand | fertilized | | |
| | | unfertilized | | |
| | | sludge | | 2154ug/g sludge |
| Black Walnut | Downer sand | fertilized | | |
| | | unfertilized | | |
| | | sludge | | 2154ug/g sludge |
| Wheat | Redding fine sandy loam | | | 100-200 ug/g |
| | | | | 100-200 ug/g |
| Lettuce | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Cabbage | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 47-61 ug/g | | | |
| | | 51-81 ug/g | | | |
| Red oak | | 20 | | | |
| | | 25 | | | |
| | | 22-24 | | | |
| Black Walnut | | 29 ug/g | | | |
| | | 43 ug/g | | | |
| | | 37-47 ug/g | | | |
| Wheat | | ** | | | |
| | | ** | | | |
| Lettuce | | 46 | | | |
| | | 74 | | | |
| | | 103 | | | |
| | | 121 | | | |
| | | 43 | | | |
| | | 40 | | | |
| | | 68 | | | |
| | | 93 | | | |
| | | 35 | | | |
| | | 43 | | | |
| | | 53 | | | |
| | | 128 | | | |
| | | 31 | | | |
| | | 49 | | | |
| | | 51 | | | |
| | | 79 | | | |
| | | 29 | | | |
| | | 88 | | | |
| | | 116 | | | |
| | | 125 | | | |
| | | 31 | | | |
| | | 50 | | | |
| | | 63 | | | |
| | | 64 | | | |
| Cabbage | | 29 | | | |
| | | 34 | | | |
| | | 46 | | | |
| | | 41 | | | |
| | | 48 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 128 |
| | | | 128 |
| Red oak | | | 128 |
| | | | 128 |
| | | | 128 |
| Black Walnut | | | 128 |
| | | | 128 |
| | | | 128 |
| Wheat | yield | reduction | 15 |
| | | | 15 |
| Lettuce | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Cabbage | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Carrot | Daucus carota sotiva | | edible parts | field | |
| | | | | | 6.5 |
| Cantaloupe | Cucumis melo | Hal's Best | edible parts | field | |
| | | | | | 6.5 |
| Pepper | Capsicum spp. | California Wonder | edible parts | field | |
| | | | | | 6.5 |
| Lettuce | Lactuca sativa | Great lakes | leaves | field | |
| Corn | Zea mays | Silver Queen | edible tissue,foliage | field | |
| Squash | Cucurbita pepo | Yellow Crookneck | edible tissue ,foliage | field | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Carrot | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Cantaloupe | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Pepper | Sango sil | no lime:no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| | Sango sil | limed : no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Lettuce | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Corn | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Squash | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 64 | | | |
| | | 59 | | | |
| | | 53 | | | |
| Carrot | | 22 | | | |
| | | 20 | | | |
| | | 29 | | | |
| | | 25 | | | |
| | | 39 | | | |
| | | 34 | | | |
| | | 30 | | | |
| | | 40 | | | |
| Cantaloupe | | 18 | | | |
| | | 15 | | | |
| | | 20 | | | |
| | | 24 | | | |
| | | 18 | | | |
| | | 12 | | | |
| | | 25 | | | |
| | | 30 | | | |
| Pepper | | 24 | | | |
| | | 33 | | | |
| | | 29 | | | |
| | | 29 | | | |
| | | 29 | | | |
| | | 26 | | | |
| | | 33 | | | |
| | | 37 | | | |
| Lettuce | | 48-54 | | | |
| | | 41-44 | | | |
| | | 74-131 | | | |
| | | 70-142 | | | |
| Corn | | 52 | | | |
| | | 54 | | | |
| | | 142 | | | |
| | | 178 | | | |
| Squash | | 48 | | | |
| | | 88 | | | |
| | | 120 | | | |
| | | 121 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Carrot | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Cantaloupe | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Pepper | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Lettuce | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Corn | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Squash | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Pepper | Capsicum spp. | California Wonder | edible tissue,foliage | field | |
| Beans | Phaseolus vulgaris | Contender | edible tissue,foliage | field | |
| Broccoli | Brassica oleracea | | edible tissue | field | |
| Eggplant | Solanum melongena | Black Beauty | edible tissue,foliage | field | |
| Tomatoes | Lycopersicon esculentum | Better Boy | edible tissue,foliage | field | |
| Potatoes | Solanum tuberosum | red Irish | edible tissue,foliage | field | |
| Little bluestem | Andropogen scoparius | | whole | greenhouse | 4.8<br>7.82 |
| Black-eyed Susan | Rudbeckia hirta | | whole | greenhouse | 4.8<br>7.82 |
| Wheat | Triticum aestivum | | shoots,roots | greenhouse | |
| Corn | Zea mays | Dekald XL-43 | seedlings,grain,stovers | field | 5.6<br>6<br>6.3 |
| Oats | Avena sativa | Norline | grain | field | 5.6<br>6<br>6.3 |
| Wheat | Triticum aestivum | Arthur | grain | field | 5.6<br>6 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Pepper | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Beans | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Broccoli | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Eggplant | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Tomatoes | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Potatoes | Sango sil | no heat | | |
| | | heat | | |
| | | sludge | | |
| | | sludge,heat | | |
| Little bluestem | rural Plainfield sand | ZnCl2 | | 2000-4000ug/g |
| | urban Oakville sand | ZnCl2 | | 2000-4000ug/g |
| Black-eyed Susan | rural Plainfield sand | ZnCl2 | | 2000-4000ug/g |
| | urban Oakville sand | ZnCl2 | | 2000-4000ug/g |
| Wheat | clay loam | control | | |
| | | 0-2 cm depth | | |
| | | 18-20cm depth | | |
| Corn | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |
| | sandy | 112 metric tons | 84.0-99.0 | |
| Oats | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |
| | sandy | 112 metric tons | 84.0-99.0 | |
| Wheat | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Pepper | | 71 | | | |
| | | 64 | | | |
| | | 96 | | | |
| | | 109 | | | |
| Beans | | 37 | | | |
| | | 46 | | | |
| | | 71 | | | |
| | | 62 | | | |
| Broccoli | | 87 | | | |
| | | 93 | | | |
| | | 99 | | | |
| | | 130 | | | |
| Eggplant | | 21 | | | |
| | | 19 | | | |
| | | 22 | | | |
| | | 25 | | | |
| Tomatoes | | 38 | | | |
| | | 41 | | | |
| | | 32 | | | |
| | | 47 | | | |
| Potatoes | | 27 | | | |
| | | 39 | | | |
| | | 33 | | | |
| | | 65 | | | |
| Little bluestem | | | ** | | |
| | | | ** | | |
| Black-eyed Susan | | | ** | | |
| | | | ** | | |
| Wheat | | 52 | | | |
| | | 81.1 | | | |
| | | 87.5 | | | |
| Corn | | 42-86 | | | |
| | | 289-405 | | | |
| | | 331-411 | | | |
| Oats | | 13 | | | |
| | | 39 | | | |
| | | 42 | | | |
| Wheat | | 19 | | | |
| | | 61 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Pepper | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Beans | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Broccoli | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Eggplant | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Tomatoes | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Potatoes | | | 75 |
| | | | 75 |
| | | | 75 |
| | | | 75 |
| Little bluestem | yield | lack of germination | 164 |
| | yield | lack of germination | 164 |
| Black-eyed Susan | yield | lack of germination | 164 |
| | yield | lack of germination | 164 |
| Wheat | | | 126 |
| | | | 126 |
| | | | 126 |
| Corn | | | 212 |
| | | | 212 |
| | | | 212 |
| Oats | | | 212 |
| | | | 212 |
| | | | 212 |
| Wheat | | | 212 |
| | | | 212 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.3 |
| Rye | Secale cereale | Balboa | grain | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Crimson clover | Trifolium incarnatum | Auburn | whole | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Arrowleaf clover | Trifolium vesiculosum | Yuchi | whole | field | 5.6 |
| | | | | | 6 |
| | | | | | 6.3 |
| Carrots | Daucus carota | Danvers | tubers,shoots | field | 5.5-5.8 |
| Radishes | Raphanus sativus | Cherry belle | tubers,shoots | field | 5.5-5.8 |
| Tomatoes | Lycopersicon esculentum | New Yorker | fruit | field | 5.5-5.8 |
| Lettuce | Lactuca sativa | Salad bowl | leaves | field | 5.5-5.8 |
| Brome grass | Bromus inermis | Leyes | | field | 6.7-7.9 |
| Corn | Zea mays | | grain | field | 6.7-7.9 |
| | | | leaves, kernels | field | 5.7 |
| Fescue grass | Festuca arundinacea | | | pot | 6.5 |
| | | | | | 6,5 |
| | | | | | 6.5 |
| | | | | | 6.5 |
| Corn | Zea mays | Pioneer 3369A | leaves | field | low |
| Grain Sorghum | Sorghum bicolor | Funk G-522 | leaves | field | low |
| Soybeans | Glycine max | Centennial | seedlings | field | low |
| Barley | Hordeum vulgare | Barsoy | leaves,straw, grain | pot | 6 |
| | | Briggs | leaves, straw,grain | pot | 6 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | sandy | 112 metric tons | 84.0-99.0 | |
| Rye | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |
| | sandy | 112 metric tons | 84.0-99.0 | |
| Crimson clover | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |
| | sandy | 112 metric tons | 84.0-99.0 | |
| Arrowleaf clover | sandy | no sludge | 1.0-1.6 | |
| | sandy | 56 metric tons | 42.0-52.0 | |
| | sandy | 112 metric tons | 84.0-99.0 | |
| Carrots | Bridgehampton silt loam | | 2.3-11.7 | |
| Radishes | Bridgehampton silt loam | | 2.3-11.7 | |
| Tomatoes | Bridgehampton silt loam | | 2.3-11.7 | |
| Lettuce | Bridgehampton silt loam | | 2.3-11.7 | |
| Brome grass | Conestoga loam | $NH_4NO_3$ | 4-7 | |
| | | sludge low | | |
| | | sludge high | 45-249 | |
| Corn | Conestoga loam | $NH_4NO_3$ | 6-9 | |
| | | Ca sludge | 32-89 | 27-59 |
| | | Al sludge | 66-156 | 38-87 |
| | | Fe sludge | 63-92 | 23-38 |
| | Willamette silt loam | control | | |
| | | NHSO | | |
| | | Portland sludge | | 2800mg/kg |
| | | Rock Creek sludge | | 2200mg/kg |
| | | Salum sludge | | 1670mg/kg |
| Fescue grass | Norfolk fine loamy | | | |
| | Cecil sandy clay loam | | | |
| | Norfolk fine loamy | swine sludge | | 76 kg/ha |
| | Norfolk fine loamy | municipal sludge | | 88 kg/ha |
| Corn | fine sandy loam | | | |
| Grain Sorghum | fine sandy loam | | | |
| Soybeans | fine sandy loam | | | |
| Barley | Ramona sandy loam | control | | |
| | | sludge low | | |
| | | sludge high | | |
| | Ramona sandy loam | control | | |
| | | sludge low | | |
| | | sludge high | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 72 | | | |
| Rye | | 21 | | | |
| | | 91 | | | |
| | | 94 | | | |
| Crimson clover | | 50 | | | |
| | | 102 | | | |
| | | 112 | | | |
| Arrowleaf clover | | 51 | | | |
| | | 187 | | | |
| | | 312 | | | |
| Carrots | | 23-79 | | | |
| Radishes | | 62-164 | | | |
| Tomatoes | | 35-49 | | | |
| Lettuce | | 46-133 | | | |
| Brome grass | | 17-25 | | | |
| | | 19-27 | | | |
| | | 26-31 | | | |
| Corn | | 21 | | | |
| | | 22-24 | | | |
| | | 20-27 | | | |
| | | 25-30 | | | |
| | | 26-41 | | | |
| | | 33-62 | | | |
| | | 53-84 | | | |
| | | 41-70 | | | |
| | | 29-66 | | | |
| Fescue grass | | 15-43 | | | |
| | | 22-50 | | | |
| | | 18-46 | | | |
| | | 20-47 | | | |
| Corn | | 37-200 | 400-707 | | |
| Grain Sorghum | | 50-200 | | | |
| Soybeans | | 45-223 | 778-1188 | | |
| Barley | | 30 | | | |
| | | 41 | | | |
| | | 52 | | | |
| | | 24 | | | |
| | | 31 | | | |
| | | 61 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Rye | | | 212 |
| | | | 212 |
| | | | 212 |
| Crimson clover | | | 212 |
| | | | 212 |
| | | | 212 |
| Arrowleaf clover | | | 212 |
| | | | 212 |
| | | | 212 |
| Carrots | | | 212 |
| Radishes | | | 211 |
| Tomatoes | | | 211 |
| Lettuce | | | 211 |
| Brome grass | | | 211 |
| | | | 224 |
| | | | 224 |
| Corn | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 224 |
| | | | 92 |
| | | | 92 |
| | | | 92 |
| | | | 92 |
| | | | 92 |
| Fescue grass | | | 123 |
| | | | 123 |
| | | | 123 |
| | | | 123 |
| Corn | yield | reduction in certain years | 143 |
| Grain Sorghum | | | 143 |
| Soybeans | yield/visual | to 48% reduciton/ chlorosis/death | 143 |
| Barley | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | Florida 103 | leaves,straw,grain | pot | 6 |
| | | Larker | leaves,straw,grain | pot | 6 |
| | | Briggs | leaves,straw,grains | pot | 7.1 |
| | | | | | 7.8 |
| Winter wheat | Triticum spp. | Anza | straw,grain | field | 7.6 |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 7.7 |
| | | | | | 7 |
| | | | | | 5.5 |
| Sweet corn | Zea mays | Jubilee | plant,seeds | field | |
| Alfalfa | Medicago sativa | Ranger | leaves,stems | field | |
| Wheat | Triticum vulgare | Fremont | plant,seeds | field | |
| Corn | Zea mays | Pride 110 | leaves,kernels | field | 6.5 |
| | | | | | 6.5 |
| Fodder rape | Brassica napus | Kenton | | greenhouse | 5.6 |
| | | | | | 6 |
| | | | | | 7.5 |
| Barley | Hordeum vulgare | Larker | | greenhouse | 4.0-6.4 |
| Rye grass | Lolium multiflorum | Westerwool | | greenhouse | 4.0-6.4 |
| Barley | Hordeum vulgare | | leaves | field | 5.5-7.0 |
| Corn | Zea mays | Pioneer 3517 | leaves,grain | field | 7.6-8.1 |
| | | Jubilee | leaves,kernels | field | 5.8-7.1 |
| Fodder rape | Brassica napus | Kenton | | greenhouse | 5.6 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Ramona sandy loam | control | | |
| | | sludge low | | |
| | | sludge high | | |
| | Ramona sandy loam | control | | |
| | | sludge low | | |
| | | sludge high | | |
| | Greenfield sandy loam | control | | |
| | | sludge low | | |
| | | sludge high | | |
| | Domino loam soil | control | | |
| | | sludge low | | |
| | | sludge high | | |
| Winter wheat | Omni silty clay | | 98-177 | 567 kg/ha |
| Swiss chard | Domino silt loam | | | 20-160 |
| | Hanford sandy loam | | | 20-160 |
| | Redding fine sand | | | 20-160 |
| Sweet corn | fine silty | | 25-74 | |
| Alfalfa | fine silty | | 25-74 | |
| Wheat | fine silty | | 25-74 | |
| Corn | Sulton silt loam | limed | | 0-449 kg/ha |
| | | unlimed | | 0-448 kg/ha |
| | Puyallup fine sandy loam | limed | | 0-448 kg/ha |
| | | unlimed | | 0-448 kg/ha |
| Fodder rape | sandy | | | 417mg/kg sludge |
| | sandy | | | 417mg/kg sludge |
| | sandy | | | 417mg/kg sludge |
| Barley | Marginally productive soil | dredged material | | |
| Rye grass | Marginally productive soil | dredged material | | |
| Barley | Domino loam soil | compost | | 2000 kg/ha |
| | | liquid | | 2000 kg/ha |
| | Greenfield sandy loam | compost | | 2000 kg/ha |
| | | liquid | | 2000 kg/ha |
| Corn | calcareous strip-mined spoil | control | 3.4-9.5mg/kg | |
| | | sludge | 3.6-114mg/kg | |
| | Willamette silt loam | control | 11-14umol/kg | |
| | | NH4NO3n | 9 umol/kg | |
| | | tannery waste | 9-26umol/kg | |
| Fodder rape | sandy | control | 125 mg/pot | |
| | | sludge | 240-354mg/pot | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 29 | | | |
| | | 51 | | | |
| | | 121 | | | |
| | | 26 | | | |
| | | 35 | | | |
| | | 67 | | | |
| | | 16 | | | |
| | | 26 | | | |
| | | 57 | | | |
| | | 16 | | | |
| | | 23 | | | |
| | | 32 | | | |
| Winter wheat | | 22-45 | | | |
| Swiss chard | | 80-170 | | | |
| | | 75-250 | 250-360 | | |
| | | | 300-600 | | |
| Sweet corn | | 31-67 | | | |
| Alfalfa | | 21-38 | | | |
| Wheat | | 23-75 | | | |
| Corn | | 26.8-342.6 | | | |
| | | 28.0-587.7 | | | |
| | | 27.3-508.7 | | | |
| | | 28.7-677.3 | | | |
| Fodder rape | | 34.8-70.5 | | | |
| | | 21.8-41.2 | | | |
| | | 17.6-27.8 | | | |
| Barley | | 24-200 | 200-291 | | |
| Rye grass | | 41-258 | | | |
| Barley | | 14.2-51.0 | | | |
| | | 16.1-51.4 | | | |
| | | 12.5-57.3 | | | |
| | | 18.4-81.9 | | | |
| Corn | | 13-33 | | | |
| | | 34-200 | | | |
| | | .44-.46mmol/kg | | | |
| | | .43-.46mmol/kg | | | |
| | | .55-.67mmol/kg | | | |
| Fodder rape | | 1318 ug/pot | | | |
| | | 1698-2545ug/pot | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| | | | 31 |
| Winter wheat | | | 32 |
| Swiss chard | | | 242 |
| | yield | reduction | 242 |
| | yield | reduction | 242 |
| Sweet corn | | | 24 |
| Alfalfa | | | 24 |
| Wheat | | | 24 |
| Corn | | | 185 |
| | | | 185 |
| | | | 185 |
| | | | 185 |
| Fodder rape | | | 173 |
| | | | 173 |
| | | | 173 |
| Barley | | | 41 |
| Rye grass | visual | chlorosis | 41 |
| Barley | | | 33 |
| | | | 33 |
| | | | 33 |
| | | | 33 |
| Corn | | | 188 |
| | | | 188 |
| | | | 226 |
| | | | 226 |
| | | | 226 |
| Fodder rape | | | 215 |
| | | | 215 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6 |
| | | | | | 7.5 |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 5.6-5.9 |
| Rye grass | Lolium perenne | | | greenhouse | 5.6-5.9 |
| Upland cotton | Gossypium hirsutum | | leaves,seeds | field | 8.2 |
| Timothy | Phleum pratense | | | field | 6.3 |
| | | | | | 6.1 |
| Tomato | Lycopersicon lycopersium | Tropic | leaves, fruit | greenhouse | 7.9<br>7.8<br>7.6<br>6.9<br>7 |
| Bell pepper | Capsicum annuum | California Wonder | leaves,fruit | greenhouse | 6.5<br>7.9<br>7.8<br>7.6<br>6.9<br>7 |
| Cos lettuce | Lactuca sativa | Cos Paris White | leaves | greenhouse | 6.5<br>7.9<br>7.8<br>7.6<br>6.9<br>7 |
| Head lettuce | Lactuca sativa | Great Lakes 118 | leaves | greenhouse | 6.5<br>7.9<br>7.8 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | sandy | control | 125 mg/pot | |
| | | sludge | 240-354mg/pot | |
| | sandy | control | 125 mg/pot | |
| | | sludge | 240-354mg/pot | |
| Swiss chard | Chalmers silty clay loam and Russel silt loam | control | 62 mg/kg | |
| | | drilling fluid | 35-6170mg/kg | |
| Rye grass | Chalmers silty clay loam and Russel silt loam | control | 62 mg/kg | |
| | | drilling fluid | 35-6170mg/kg | |
| Upland cotton | Pima clay loam | control | | |
| | | fertilized | | |
| | | sludge | | |
| Timothy | Dalhousie clay loam | control | | |
| | | fertilized | | |
| | | pig manure | | |
| | | sludge | | |
| | St. Bernard sandy loam | control | | |
| | | fertilized | | |
| | | pig manure | | |
| | | sludge | | |
| Tomato | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Bell pepper | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Cos lettuce | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Head lettuce | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 1177 ug/pot | | | |
| | | 1025-1322ug/pot | | | |
| | | 641 ug/pot | | | |
| | | 749-1157ug/pot | | | |
| Swiss chard | | 72 mg/kg | | | |
| | | 72-2072 mg/kg | | | |
| Rye grass | | 43 mg/kg | | | |
| | | 43-995mg/kg | | | |
| Upland cotton | | 42.8 mg/kg | | | |
| | | 39.5 mg/kg | | | |
| | | 41.1-49.1 mg/kg | | | |
| Timothy | | 19-30 mg/kg | | | |
| | | 19-25 mg/kg | | | |
| | | 20-27 mg/kg | | | |
| | | 19-29 mg/kg | | | |
| | | 22-29 mg/kg | | | |
| | | 21-28 mg/kg | | | |
| | | 23-34 mg/kg | | | |
| | | 24-33 mg/kg | | | |
| Tomato | | 22 | | | |
| | | 20 | | | |
| | | 68 | | | |
| | | 99.5 | | | |
| | | 92.3 | | | |
| | | 121 | | | |
| Bell pepper | | 178.8 | | | |
| | | 108 | | | |
| | | 242.8 | | | |
| | | 205 | | | |
| | | 195.3 | | | |
| | | 195.8 | | | |
| Cos lettuce | | 52.5 | | | |
| | | 58 | | | |
| | | 75.8 | | | |
| | | 137 | | | |
| | | 116.3 | | | |
| | | 354 | | | |
| Head lettuce | | 53.5 | | | |
| | | 57.3 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 215 |
| | | | 215 |
| | | | 215 |
| | | | 215 |
| Swiss chard | | | 176 |
| | | | 176 |
| Rye grass | | | 176 |
| | | | 176 |
| Upland cotton | | | 259 |
| | | | 259 |
| | | | 259 |
| Timothy | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| | | | 257 |
| Tomato | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Bell pepper | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Cos lettuce | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Head lettuce | | | 122 |
| | | | 122 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Radishes | Raphanus sativus | Cherry Belle | leaves,tubers | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Potato | Solanum tuberosum | Gold Russet | leaves,tuber | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Corn | Zea mays | Golden Bantam | leaves | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Wheat | Triticum aestivum | Anza | leaves,seeds | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Swiss chard | Beta vulgaris | Large White | leaves | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Broccoli | Brassica oleracea | Green Comet | leaves,fruit | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Radishes | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Potato | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Corn | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Wheat | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Swiss chard | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Broccoli | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 83.5 | | | |
| | | 143.8 | | | |
| | | 177 | | | |
| | | 281 | | | |
| Radishes | | 56.5 | | | |
| | | 48.8 | | | |
| | | 168 | | | |
| | | 246.8 | | | |
| | | 200.8 | | | |
| | | 332.8 | | | |
| Potato | | 21.5 | | | |
| | | 26.5 | | | |
| | | 23.3 | | | |
| | | 27.5 | | | |
| | | 31 | | | |
| | | 50.5 | | | |
| Corn | | 63.3 | | | |
| | | 47 | | | |
| | | 129.3 | | | |
| | | 154.8 | | | |
| | | 125.5 | | | |
| | | 239.5 | | | |
| Wheat | | 34.5 | | | |
| | | 42.5 | | | |
| | | 89.5 | | | |
| | | 130.5 | | | |
| | | 102.3 | | | |
| | | 210 | | | |
| Swiss chard | | 39.5 | | | |
| | | 33.5 | | | |
| | | 250.8 | | | |
| | | 349.8 | | | |
| | | 412.3 | | | |
| | | 884 | | | |
| Broccoli | | 14.3 | | | |
| | | 19 | | | |
| | | 75.5 | | | |
| | | 167.8 | | | |
| | | 91 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Radishes | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Potato | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Corn | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Wheat | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Swiss chard | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Broccoli | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.5 |
| Carrot | Daucus carota | Imperator | leaves, tubers | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Beet | Beta vulgaris | Red Detroit | leaves,tubers | greenhouse | 7.9 |
| | | | | | 7.8 |
| | | | | | 7.6 |
| | | | | | 6.9 |
| | | | | | 7 |
| | | | | | 6.5 |
| Corn | Zea mays | | leaves,grain | field | 7 |
| | | Pioneer 3192 | leaves,grain | field | >6.5 |
| | | | | | >6.5 |
| | | | | | >6.5 |
| Soybean | Glycine max | Corsoy | Seedling tissue | pot | 5.9 |
| Corn | Zea mays | | leaves,grain | field | |
| Sorghum | Sorghum bicolor | Moench | roots,leaves,stem,grain | field | 6.9-7.7 |
| | | | | | 5.8-7.2 |
| Winter wheat | Triticum aestivum | | grain, roots | field | 6.9-7.7 |
| | | | | | 5.8-7.2 |
| Corn | Zea mays | | | field | 6.5 |
| | | | | | 5.1-5.5 |
| Lettuce | Lactuca sativa | | whole | field | 7.56 |
| | | | | | 7.06 |
| | | | | | 8.53 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Greenfield II coarse-loamy | | | |
| Carrot | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Beet | Las Virgines I fine loamy | | | |
| | Las Virgines II fine loamy | | | |
| | Domino I fine loamy | | | |
| | Domino II fine loamy | | | |
| | Greenfield I coarse-loamy | | | |
| | Greenfield II coarse-loamy | | | |
| Corn | Davidson silty clay | control | | |
| | | $ZnSO_4$ | | 695-897kg/ha |
| | Guernsey silt loam | control | | |
| | | pig manure | | |
| | | $CuSO_4$ | | |
| | Bertie fine sandy loam | control | | |
| | | pig manure | | |
| | | $CuSO_4$ | | |
| | Starr-Dyke clay loam | control | | |
| | | pig manure | | |
| | | $CuSO_4$ | | |
| Soybean | Nicollet loam soil | $ZnSO_4$ | | 0-72 mg/kg |
| | | sludge | | 0-92 mg/kg |
| Corn | Blount silt loam | control | 68 | |
| | | 1/4 max sludge | 188 | |
| | | 1/2 max sludge | 326 | |
| | | maximum | 454 | |
| Sorghum | Haynie fine sandy loam | fertilized | 0.8 | |
| | Haynie fine sandy loam | sludge | 10.2 | |
| Winter wheat | Haynie fine sandy loam | fertilized | 0.8 | |
| | Haynie fine sandy loam | sludge | 10.2 | |
| Corn | Bount silt loam | control | | 0 |
| | Bount silt loam | sludge | | 0-2358 kg/ha |
| Lettuce | land fill | control | 2169 | |
| | land fill | sludge | 1824 | |
| | clay | control | 117 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 288 | | | |
| Carrot | | 51 | | | |
| | | 47.8 | | | |
| | | 91 | | | |
| | | 109.5 | | | |
| | | 98.5 | | | |
| | | 155.5 | | | |
| Beet | | 51.8 | | | |
| | | 48.3 | | | |
| | | 286.3 | | | |
| | | 446.5 | | | |
| | | 363.5 | | | |
| | | 1023.3 | | | |
| Corn | | 19.2-19.6 mg/kg | | | |
| | | 21.1-54.3mg/kg | | | |
| | | 45 | | | |
| | | 41 | | | |
| | | 38-39 | | | |
| | | 45 | | | |
| | | 37 | | | |
| | | 44-48 | | | |
| | | 25 | | | |
| | | 17 | | | |
| | | 25-26 | | | |
| Soybean | | 32-55 | | | |
| | | 32-112 | | | |
| Corn | | 14.5-28.3 | | | |
| | | 32.0-84.4 | | | |
| | | 43.7-156.1 | | | |
| | | 61.8-281.8 | 188.8-217.2 | | |
| Sorghum | | 50 | | | |
| | | 101 | | | |
| Winter wheat | | 28 | | | |
| | | 56 | | | |
| Corn | | 28-60 | | | |
| | | 85-381 | | | |
| Lettuce | | 26.93 | | | |
| | | 39.21 | | | |
| | | 11.3 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 122 |
| Carrot | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Beet | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| | | | 122 |
| Corn | | | 183 |
| | | | 183 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| | | | 184 |
| Soybean | | | 57 |
| | | | 57 |
| Corn | | | 95 |
| | | | 95 |
| | | | 95 |
| | yield/visual | yield reduction/delayed flowering | 95 |
| Sorghum | | | 127 |
| | | | 127 |
| Winter wheat | | | 127 |
| | | | 127 |
| Corn | | | 94 |
| | | | 94 |
| Lettuce | | | 72 |
| | | | 72 |
| | | | 72 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 8.06 |
| | | | | | 6.8 |
| | | | | | 6.86 |
| | | | | | 6.74 |
| | | | | | 7.32 |
| Tomato | Lycopersicon esculentum | | fruit | field | 7.56 |
| | | | | | 7.06 |
| | | | | | 8.53 |
| | | | | | 8.06 |
| | | | | | 6.8 |
| | | | | | 6.86 |
| | | | | | 6.74 |
| | | | | | 7.32 |
| Wheat | Triticum aestivum | | grain,whole | field | 7.56 |
| | | | | | 7.06 |
| | | | | | 8.53 |
| | | | | | 8.06 |
| | | | | | 6.8 |
| | | | | | 6.86 |
| | | | | | 6.74 |
| | | | | | 7.32 |
| Onion | Allium cepa | | root, whole | field | 7.56 |
| | | | | | 7.06 |
| | | | | | 8.53 |
| | | | | | 8.06 |
| | | | | | 6.8 |
| | | | | | 6.86 |
| | | | | | 6.74 |
| | | | | | 7.32 |
| Radish | Raphanus sativa | | root,whole | field | 7.56 |
| | | | | | 7.06 |
| | | | | | 8.53 |
| | | | | | 8.06 |
| | | | | | 6.8 |
| | | | | | 6.86 |
| | | | | | 6.74 |
| | | | | | 7.32 |
| Splash pine | Pinus elliotttii | | pine needles | field | 4.8-5.1 |
| | | | | | 4.9-5.3 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | clay | sludge | 150 | |
| | brown loam | control | 176 | |
| | brown loam | sludge | 335 | |
| | black top soil | control | 97 | |
| | black top soil | sludge | 200 | |
| Tomato | land fill | control | 2169 | |
| | land fill | sludge | 1824 | |
| | clay | control | 117 | |
| | clay | sludge | 150 | |
| | brown loam | control | 176 | |
| | brown loam | sludge | 335 | |
| | black top soil | control | 97 | |
| | black top soil | sludge | 200 | |
| Wheat | land fill | control | 2169 | |
| | land fill | sludge | 1824 | |
| | clay | control | 117 | |
| | clay | sludge | 150 | |
| | brown loam | control | 176 | |
| | brown loam | sludge | 335 | |
| | black top soil | control | 97 | |
| | black top soil | sludge | 200 | |
| Onion | land fill | control | 2169 | |
| | land fill | sludge | 1824 | |
| | clay | control | 117 | |
| | clay | sludge | 150 | |
| | brown loam | control | 176 | |
| | brown loam | sludge | 335 | |
| | black top soil | control | 97 | |
| | black top soil | sludge | 200 | |
| Radish | land fill | control | 2169 | |
| | land fill | sludge | 1824 | |
| | clay | control | 117 | |
| | clay | sludge | 150 | |
| | brown loam | control | 176 | |
| | brown loam | sludge | 335 | |
| | black top soil | control | 97 | |
| | black top soil | sludge | 200 | |
| Splash pine | Troup fine sandy loam | control | 0.9 | 0 |
| | Troup fine sandy loam | low sludge | 7.7-12.6 | 49-146 kg/ha |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 10.14 | | | |
| | | 25.4 | | | |
| | | 14.07 | | | |
| | | 8.76 | | | |
| | | 6.75 | | | |
| Tomato | | 2.99 | | | |
| | | 3.45 | | | |
| | | 2.14 | | | |
| | | 2.68 | | | |
| | | 2.87 | | | |
| | | 2.74 | | | |
| | | 2.04 | | | |
| | | 2.65 | | | |
| Wheat | | 233.3 | | | |
| | | 148.4 | | | |
| | | 50.3 | | | |
| | | 78 | | | |
| | | 77.9 | | | |
| | | 67.6 | | | |
| | | 50.9 | | | |
| | | 59.6 | | | |
| Onion | | 10.19 | | | |
| | | 11.38 | | | |
| | | 4.29 | | | |
| | | 6.06 | | | |
| | | 12.91 | | | |
| | | 6.52 | | | |
| | | 6.09 | | | |
| | | 7.17 | | | |
| Radish | | 6.67 | | | |
| | | 6.07 | | | |
| | | 7.58 | | | |
| | | 11.05 | | | |
| | | 6.89 | | | |
| | | 9.42 | | | |
| | | 4.44 | | | |
| | | 7.01 | | | |
| Splash pine | | 36 | | | |
| | | 41-74 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| Tomato | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| Wheat | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| Onion | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| Radish | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| | | | 72 |
| Splash pine | | | 144 |
| | | | 144 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Oats | | Harmon | root,seed,stem | field | 4.8-5.2 |
| Sudangrass | Sorghum bicolor | Piper | whole | field | 5.32<br>5.18 |
| Corn | Zea mays | | stems,roots,leaves,husks,grain | field | 5.77-6.38<br>6.2 |
| Perennial ryegrass | Loluim perenne | | | pot | 4.3-5.26<br>4.76-5.72<br>6.16-7.11 |
| Swiss chard | Beta vulgaris | | leaves | pot | 4.9-5.5<br>5.2-6.2<br>5.2-5.8<br>5.2-5.7<br>5.1-5.7 |
| Tobacco | Nicotiana tabacum | Virginia 115 and Island gold | leaves | field | 5.9-6.2 |
| Wheat | | | kernels,straw | greenhouse | 8.1<br>6.5 |
| | | | | field | 8.1 |
| Brome alfalfa | | | whole | greenhouse | 8.1<br>6.5 |
| perennial ryegrass | | | | pot | 5.5 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Troup fine sandy loam | high sludge | 8.3-13.3 | 195-244 kg/ha |
| Oats | | control | 25-31.1 | |
| | | 25 % sludge | 42.8 | |
| | | 50% sludge | 81.4 | |
| Sudangrass | Wahiawa silty clay | control | | |
| | Wahiawa silty clay | fertilized | | |
| | Wahiawa silty clay | sludge | | |
| Corn | Warsaw silt loam | control | 158 | |
| | | sludge | 2065 | 1010 tons/ha |
| Perennial ryegrass | Acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| | Acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| | Acid clay loam | Control | 0 | |
| | | sludge | 4-8% | |
| | | sludge | 0.12 | |
| Swiss chard | Puyallup sandy loam | sludge | 40-145 | 0-246 kg/ha |
| | Sultan silt loam | sludge | 50-150 | 0-246 kg/ha |
| | Schalcar muck | sludge | 95-185 | 0-246 kg/ha |
| | Chehalis clay loam | sludge | 75-195 | 0-246 kg/ha |
| | Olympic clay loam | sludge | 70-225 | 0-246 kg/ha |
| Tobacco | fine sandy loam | control | | 0 |
| | | Zn sulfate | | 6.7-20.1 kg/ha |
| | | Zn sulfate | | 26.8-40.2 kg/ha |
| Wheat | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 87.75-877.5 kg/ha |
| | Red River noncalcareous fine | control | | 0 |
| | | sludge | | 87.75-877.5 kg/ha |
| | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 824-1648 kg/ha |
| Brome alfalfa | Lakeland calcareous fine | control | | 0 |
| | | sludge | | 87.75-877.5 kg/ha |
| | Red River noncalcareous fine | control | | 0 |
| | | sludge | | 87.75-877.5 kg/ha |
| perennial ryegrass | sandy soil | control | 89 mg/pot | |
| | | sludge | 712 mg/pot | 126 g/pot |
| | | sulfate | 712 mg/pot | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 73-85 | | | |
| Oats | | 42 | | | |
| | | 68 | | | |
| | | 99 | | | |
| Sudangrass | | 129 | | | |
| | | 176 | | | |
| | | 115-172 | | | |
| Corn | | 165 | | | |
| | | 320 | | | |
| Perennial ryegrass | | 80 | | | |
| | | 250-365 | | | |
| | | | 500 | | |
| | | 60-75 | | | |
| | | 200-300 | | | |
| | | | 400-450 | | |
| | | 40 | | | |
| | | 100-150 | | | |
| | | 250 | | | |
| Swiss chard | | .10-.86 mg/g | | | |
| | | .10-.86 mg/g | | | |
| | | .60-1.3 mg/g | | | |
| | | .10-.60 mg/g | | | |
| | | .10-.40 mg/g | | | |
| Tobacco | | 16.8-27.0 | | | |
| | | 22.1-53.8 | | | |
| | | 43.2-114.6 | | | |
| Wheat | | 15.9 | | | |
| | | 23.0-52.0 | | | |
| | | 30.3 | | | |
| | | 30.9-64.5 | | | |
| | | 32-44 | | | |
| | | 45-96 | | | |
| Brome alfalfa | | 14 | | | |
| | | 22.0-61.0 | | | |
| | | 21 | | | |
| | | 33-66 | | | |
| perennial ryegrass | | 35 mg/pot | | | |
| | | 68 mg/pot | | | |
| | | 150 mg/pot | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 144 |
| Oats | | | 73 |
| | | | 73 |
| | | | 73 |
| Sudangrass | | | 104 |
| | | | 104 |
| | | | 104 |
| Corn | | | 125 |
| | | | 125 |
| Perennial ryegrass | | | 19 |
| | | | 19 |
| | yield | yield reduces again | 19 |
| | | | 19 |
| | | | 19 |
| | yield | yield reduces again | 19 |
| | | | 19 |
| | | | 19 |
| | | | 19 |
| Swiss chard | | | 134 |
| | | | 134 |
| | | | 134 |
| | | | 134 |
| | | | 134 |
| Tobacco | | | 80 |
| | | | 80 |
| | | | 80 |
| Wheat | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| Brome alfalfa | | | 270 |
| | | | 270 |
| | | | 270 |
| | | | 270 |
| perennial ryegrass | | | 55 |
| | | | 55 |
| | | | 55 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Soybean | Glycine max | Bragg | seed, pod wall, stem | greenhouse | 6.2 |
| | | Ransom | seed, pod wall, stem | greenhouse | 6.2 |
| White pine | Pinus strobus | | leaves, roots | greenhouse | |
| Red maple | Acer rubrum | | leaves, roots | greenhouse | |
| Norway spruce | Picea abies | | leaves,roots | greenhouse | |
| Lettuce | | Imperial 847 | tops | pot | |
| Onions | | Early flat Baretta | bulbs | pot | |
| Lettuce | | Imperial 847 | tops | field | |
| Onions | | Early flat Baretta | bulbs | field | |
| Lettuce | | Imperial 847 | tops | greenhouse | |
| Lucerne | Medicago sativa | Wairau | whole | pot | 5<br>5.1-5.6<br>6.6<br>5.2<br>5.4-6.0<br>6.8 |
| Tomato | Lycopersicon esculentum | Money maker | leaves,fruit,root<br>fruit | pot<br>pot | 4.6-6.9<br>4.6-6.6<br>6.6-6.9<br>6.6-6.7 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | combination | 712 mg/pot | |
| Soybean | Enon sandy loam | control | | 0 |
| | | low sludge | | 12.2-24.4 kg/ha |
| | | high sludge | | 36.6 kg/ha |
| | Enon sandy loam | control | | 0 |
| | | low sludge | | 12.2-24.4 kg/ha |
| | | high sludge | | 36.6 kg/ha |
| White pine | sand | Zn solution | | 0 |
| | | | | 6.25-50 ug/l |
| | | | | 100-400 ug/l |
| Red maple | sand | Zn solution | | 0 |
| | | | | 6.25-50 ug/l |
| | | | | 100-400 ug/l |
| Norway spruce | sand | Zn solution | | 0 |
| | | | | 6.25-50 ug/l |
| | | | | 100-400 ug/l |
| Lettuce | loamy fine sand | Control | | 0 |
| | | low sludge | | 3.68-18.4 kg/ha |
| | | high sludge | | 18.4-33.12 kg/ha |
| Onions | loamy fine sand | control | | 0 |
| | | low sludge | | 3.68-18.4 kg/ha |
| | | high sludge | | 18.4-33.12 kg/ha |
| Lettuce | loamy fine sand | control | | 0 |
| | | sludge | | 3.68-66.24 kg/ha |
| Onions | loamy fine sand | control | | 0 |
| | | sludge | | 3.68-66.24 kg/ha |
| Lettuce | sand loam | control | | 0 |
| | | sludge | | 3.68-289.08 |
| | | heated sludge | | 11.04-33.12 |
| Lucerne | Waitarere sand | 0 | 37 | |
| | Waitarere sand | 5-40% sludge | 95.15-502.2 | |
| | Waitarere sand | 100% sludge | 1200 | |
| | Levin silt loam | 0 | 65 | |
| | Levin silt loam | 5-40% sludge | 121.75-519 | |
| | Levin silt loam | 100% sludge | 1200 | |
| Tomato | | sludge | 380 | 0-378 kg/ha |
| | | 0 | | 0 |
| | | 25-75% sludge | | 94.5-283.5 kg/ha |
| | | 100% sludge | | 378 kg/ha |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 17 mg/pot | | | |
| Soybean | | 53.33 | | | |
| | | 60.66-62.33 | | | |
| | | 61.3 | | | |
| | | 52 | | | |
| | | 57.33-57.66 | | | |
| | | 63.33 | | | |
| White pine | | 98.8 | | | |
| | | 128.3-433.8 | | | |
| | | 647.1-1005.5 | 1005.5-2650 | | |
| Red maple | | 49.3 | | | |
| | | 147.5-381.3 | 421.3 | | |
| | | 260.8-385.8 | | | |
| Norway spruce | | 133.8 | | | |
| | | 165.0-242.5 | 621.3 | | |
| | | 0 | 496.3-1625.0 | | |
| Lettuce | | 50 | | | |
| | | 87-220 | | | |
| | | 220-300 | | | |
| Onions | | 35 | | | |
| | | 60-120 | | | |
| | | 120-180 | | | |
| Lettuce | | 40 | | | |
| | | 40 | | | |
| Onions | | 17 | | | |
| | | 14-18 | | | |
| Lettuce | | 55 | | | |
| | | 85-698 | | | |
| | | 117-169 | | | |
| Lucerne | | 80-180 | | | |
| | | 130-880 | | | |
| | | 150-350 | | | |
| | | 84 | | | |
| | | 110-280 | | | |
| | | 170 | | | |
| Tomato | | 62 | | | |
| | | 46 | | | |
| | | 42-51 | | | |
| | | 56 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Soybean | | | 55 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| | | | 202 |
| White pine | | | 166 |
| | | | 166 |
| Red maple | visual | foliar toxicity/interveinal chlorosis | 166 |
| | | | 166 |
| | visual | foliar toxicity/interveinal chlorosis | 166 |
| | | | 166 |
| Norway spruce | | | 166 |
| | visual | foliar toxicity/ stunted growth | 166 |
| | visual | foliar toxicity/stunted growth | 166 |
| Lettuce | | | 54 |
| | | | 54 |
| | | | 54 |
| Onions | | | 54 |
| | | | 54 |
| | | | 54 |
| Lettuce | | | 54 |
| | | | 54 |
| Onions | | | 54 |
| | | | 54 |
| Lettuce | | | 54 |
| | | | 53 |
| | | | 53 |
| Lucerne | | | 53 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| | | | 261 |
| Tomato | | | 262 |
| | | | 262 |
| | | | 262 |
| | | | 262 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Sweet corn | Zea mays | Jubilee | leaves,kernels | field | 5.4<br>4.7-5.1<br>5.1-5.2<br>5.1-5.3<br>5.1 |
| Soybean | Glycine max | | stem,leaves,seeds,pods | pot | |
| | Picea abies | | needles | field | |
| Endive | Chicorium endivia | Florida Deepheart | leaves | greenhouse | 4.5-4.9 |
| Barley | Hordeum vulgare | Julia | tops | sand | |
| Rye grass | Lolium perenne | S24 | tops | greenhouse | 6 |
| | | | | | 7.6 |
| Lettuce | Lactuca sativa | Grand rapids | leaves | pots | 6.7 |
| Carrots | Daucus carota | Amstel | tubers | pots | 6.7 |
| Peas | Pisum sativum | Thomas Laxton | fruit | pots | 6.7 |
| Tomato | Lycopersicon esculentum | | shoots | greenhouse | 5.33<br>7.96-8.09<br>8.01-8.11 |
| Lettuce | | | tops | | 4.9 |
| | | | | | 7.7 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Sweet corn | Willamette silt loam | control | | |
| | Willamette silt loam | fertilized | | |
| | Willamette silt loam | Portland sludge | | 88-177 lb/acre |
| | Willamette silt loa | Rock Creek sludge | | 40-80 lb/acre |
| | Willamette silt loam | Salem sludge | | 26-52 lb/acre |
| Soybean | Rizville silt loam | control | 74 | |
| | | Zn solution | | 2.5 ug/g |
| | | control | | |
| | | polluted | | |
| Endive | Merrimac loamy sand and | control | | 0 |
| | Suffield loam and | ZnSO4 | | 100-400 mg/kg |
| | Hadley silt loam | ZnSO4 | | 800 mg/kg |
| | | sludge | | 16 mg/kg |
| | | sludge + ZnSO4 | | 100-400 + 16 mg/kg |
| | | sludge + ZnSO4 | | 800 + 16 mg/kg |
| Barley | washed silver sand | ZnSO4 | 3.5-12.6 | |
| | | ZnSO4 | 430-1500 | |
| Rye grass | sandy soil | control | | 0 |
| | | salt | | 51-410 mg/kg |
| | | sludge | | 51-410 mg/kg |
| | heavy clay soil | control | | 0 |
| | | salt | | 51-410 mg/kg |
| | | sludge | | 51-410 mg/kg |
| Lettuce | very fine non-calcareous | control | 99 | 0 |
| | | low sludge | | 160.6-321.2 kg/ha |
| | | high sludge | | 642.4 kg/ha |
| Carrots | very fine non-calcareous | control | 99 | 0 |
| | | low sludge | | 160.6-321.2 kg/ha |
| | | high sludge | | 642.4 kg/ha |
| Peas | very fine non-calcareous | control | 99 | 0 |
| | | low sludge | | 160.6-321.2 kg/ha |
| | | high sludge | | 642.4 kg/ha |
| Tomato | Elkton silt loam | control | 82.2 | |
| | Elkton silt loam | low 2-6% sludge | 88.7-101.8 | |
| | Elkton silt loam | high 8-10% sludge | 108.3-114.9 | |
| Lettuce | Steinhof sandy loam | NaNO3 | 0-60 | |
| | | | 60-144 | |
| | Erlach soil | NaNO3 | 60-144 | |
| | | | 144-475 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Sweet corn | | 47 | | | |
| | | 54-59 | | | |
| | | 130-164 | | | |
| | | 108-118 | | | |
| | | 79-95 | | | |
| Soybean | | 12.1 | | | |
| | | 10.4 | | | |
| | | 65 | | | |
| | | 30-70 | | | |
| Endive | | 250 | | | |
| | | | 500-900 | | |
| | | | 115-1500 | | |
| | | 290 | | | |
| | | | 600-1000 | | |
| | | | 1500 | | |
| Barley | | 124-220 | | | |
| | | | 2000-19000 | | |
| Rye grass | | 69 | | | |
| | | 117-1001 | | | |
| | | 99-232 | | | |
| | | 32.4 | | | |
| | | 62.4-163 | | | |
| | | 55.4-100.7 | | | |
| Lettuce | | 35 | | | |
| | | 135-181 | | | |
| | | 320 | | | |
| Carrots | | 11 | | | |
| | | 35-43 | | | |
| | | 53 | | | |
| Peas | | 83 | | | |
| | | 52-61 | | | |
| | | 67 | | | |
| Tomato | | 334.6 | | | |
| | | 87.5-101.4 | | | |
| | | 114-119.2 | | | |
| Lettuce | | 50-200 | | | |
| | | | 200-800 | | |
| | | 75-200 | | | |
| | | | 200-1000 | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Sweet corn | | | 121 |
| | | | 121 |
| | | | 121 |
| | | | 121 |
| | | | 121 |
| Soybean | | | 27 |
| | | | 27 |
| | | | 112 |
| | | | 112 |
| Endive | | | 165 |
| | yield | 6-57.5% reduction | 165 |
| | yield | 54% reduction/death | 165 |
| | | | 165 |
| | yield | 23.5-41% reduction | 165 |
| | yield | 64% reduction | 165 |
| Barley | | | 6 |
| | visual | death | 6 |
| Rye grass | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| | | | 43 |
| Lettuce | | | 271 |
| | | | 271 |
| | | | 271 |
| Carrots | | | 271 |
| | | | 271 |
| | | | 271 |
| Peas | | | 271 |
| | | | 271 |
| | | | 271 |
| Tomato | | | 62 |
| | | | 62 |
| | | | 62 |
| Lettuce | | | 78 |
| | visual | phytotoxic | 78 |
| | | | 78 |
| | visual | phytotoxic | 78 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 6.9 |
| Red clover | | | tops | | 5.7 |
| | | | | | 7.3 |
| Grass | | timothy,brown top | | field | 6.05 |
| | | sweet vernal,blue | | | 6.2 |
| Alfalfa & Red clover | | | | field | 6.05 |
| | | | | | 6.2 |
| Wheat | Triticum aestivum | Gamenya | seedlings | solution | 3.5-6.0 |
| Dwarf beans | Phaseolus vulgaris | Limburgse vroege | leaves | solution | |
| Various | | | shoots | field | |
| Oats | Avena sativa | Selma | leaves | pot | 6.6 |
| | | | | | 6.2 |
| | | | | | 7.5 |
| Eucalyptus | Eucalyptus maculata | Hook | leaves | greenhouse | 6.5-7.5 |
| | Eucalyptus marginata | Donn | leaves | greenhouse | 6.5-7.5 |
| | Eucalyptus patens | Benth | leaves | greenhouse | 6.5-7.5 |
| Wheat | Triticum eastivum | Gamenya | leaves | greenhouse | 6.5-7.5 |
| Highbush blueberry | Vaccinium corymbosum | Blueray | | pot | 3.9-7.1 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | La Chatange soil | NaNO3 | 144-210 | |
| | | | 210-350 | |
| Red clover | Gansemoos soil | control | 68 | |
| | | low NaNO3 | 77-106 | |
| | | high NaNO3 | 219 | |
| | Erlach soil | control | 61 | |
| | | low NaNO3 | 70-96 | |
| | | high NaNO3 | 202 | |
| Grass | clay and sandy loams | control | .4-4.5 | |
| | clay and sandy loams | sludge | .6-5.94 | 27.39-62.77 kg/ha |
| Alfalfa & Red clover | clay and sandy loams | control | .4-4.5 | |
| | clay and sandy loams | sludge | .6-5.94 | 27.39-62.77 kg/ha |
| Wheat | solution | control | | 0 |
| | | sulfate | | .05-1.0 uM half plant |
| | | sulfate | | 1.0 uM whole plant |
| Dwarf beans | Hoaglands ZnSO4 solution | | 0-1.9 | |
| | | | 3.8-15.3 | |
| | | | 19.1-30.6 | |
| Various | serpentine soil | natural | 30-79 | |
| Oats | sandy loam | control | 36.9 | |
| | | nitrate compound | 67.4 | |
| | sandy soil | control | 20.8 | |
| | | nitrate compound | 46.4 | |
| | organic soil | control | 72.9 | |
| | | nitrate compound | 122.2 | |
| Eucalyptus | sand | control | 0 | |
| | | sulfate | 50-200 ug/3kg | |
| | | sulfate | 600-1200 ug/3 kg | |
| | sand | control | 0 | |
| | | sulfate | 50-200 ug/3kg | |
| | | sulfate | 600-1200 ug/3 kg | |
| | sand | control | 0 | |
| | | sulfate | 50-200 ug/3kg | |
| | | sulfate | 600-1200 ug/3 kg | |
| Wheat | sand | control | 0 | |
| | | sulfate | 50-200 ug/3kg | |
| | | sulfate | 600-1200 ug/3 kg | |
| Highbush blueberry | peat | control | | |
| | | low MnCl2 | | 4 g/pot |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 75-200 | | | |
| | | | 200-425 | | |
| Red clover | | 132 | | | |
| | | 235-428 | | | |
| | | | 1364 | | |
| | | 57 | | | |
| | | 61-70 | | | |
| | | 94 | | | |
| Grass | | 15.8-31.7 | | | |
| | | 14.9-29.5 | | | |
| Alfalfa & Red clover | | 19.9-39.3 | | | |
| | | 15.8-50.1 | | | |
| Wheat | | 11.0-15 | | | |
| | | 18-47 | | | |
| | | 62-72 | | | |
| Dwarf beans | | 25-35 | | | |
| | | 50-226 | 226-300 | | |
| | | | 226-500 | | |
| Various | | 18-75 | | | |
| Oats | | 13.5-27.3 | | | |
| | | 62.3-126.9 | | | |
| | | 10.3-23.7 | | | |
| | | 90.0-330.9 | | | |
| | | 20.5-37.3 | | | |
| | | 38.0-56.7 | | | |
| Eucalyptus | 9.1 | | | visual/yield | necrotic,purple/2% shoot weight |
| | 5.5-7.5 | | | visual/yield | necrotic,purple/4% shoot weight |
| | | 12.4-29.9 | | | |
| | 2.6 | | | visual/yield | necrotic,purple/26% shoot weight |
| | 2.0-2.4 | | | visual/yield | necrotic,purple/29% shoot weight |
| | | 15.2-36.6 | | | |
| | 5.2 | | | visual/yield | necrotic,purple/3% shoot weight |
| | 3.8-6.8 | | | visual/yield | necrotic,purple/16% shoot weight |
| | | 13.8-28.4 | | | |
| Wheat | 4.8 | | | visual/yield | necrotic,purple/5% shoot weight |
| | 4.4-5.8 | | | visual/yield | necrotic,purple/8% shoot weight |
| | | 17.4-25.4 | | | |
| Highbush blueberry | | 25-37 | | | |
| | | 32-49 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 78 |
| | visual | phytotoxic | 78 |
| Red clover | | | 78 |
| | | | 78 |
| | yield | 71.4% yield reduction | 78 |
| | | | 78 |
| | | | 78 |
| | | | 78 |
| Grass | | | 147 |
| | | | 147 |
| Alfalfa & Red clover | | | 147 |
| | | | 147 |
| Wheat | | | 142 |
| | | | 142 |
| | | | 142 |
| Dwarf beans | | | 243 |
| | yield | 20-30% reduction in shoot length | 243 |
| | yield | 20-55% reduction in shoot length | 243 |
| Various | | | 5 |
| Oats | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| | | | 17 |
| Eucalyptus | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| | | | 51 |
| Wheat | | | 51 |
| | | | 51 |
| | | | 51 |
| Highbush blueberry | | | 87 |
| | | | 87 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Corn | Zea mays | Asgrow UH7 | whole | greenhouse | 6.3 |
| | | | | | 5.9 |
| | | | | | 6.5 |
| Lettuce | Lactuca sativa | Grand Rapids Forcing | whole | greenhouse | 6.3 |
| | | | | | 5.9 |
| | | | | | 6.5 |
| Barley | Hordeum vulgare | | straw | field | 6.0-7.4 |
| | | | | | 4.5-5.5 |
| Oats | Avena sativa | Garry | straw | field | 5.09 |
| | | | | | 5.84 |
| | | | | | 6 |
| Soybean | Glycine max | Clark | shoots | field | 6.9 |
| | | | | | 6.6 |
| | | | | | 6.4 |
| | | | | | 5.9-7.4 |
| | | | | | 7.0-7.7 |
| | | | | | 6.9-7.6 |
| | | | | | 5.8-7.1 |
| | | | | | 5.7-6.0 |
| | | | | | 5.1-5.3 |
| | | | | | 6.4-6.6 |
| | | | | | 5.7-5.9 |
| Sunflower | Helianthus annuus | 894A | whole | field | 7.2-7.4 |
| | | | | | 6.0-6.3 |
| | | | | | 8.4 |
| | | | | | 6.0-6.2 |
| Barley | Hordeum vulgare | Mariout | grain | field | 5.3 |
| | | | | | 4.7-4.9 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | high MnCl2 | | 8 g/pot |
| Corn | Grenville loam | control | | 0-480 ppm |
| | | fertilized | | 0-480 ppm |
| | | sludge | | 0-480 +18 ppm |
| | Rideau clay | sludge | | 0-480 +18 ppm |
| | Rideau clay | sludge + lime | | 0-480 +18 ppm |
| Lettuce | Grenville loam | sludge | | 0-480 +18 ppm |
| | Rideau clay | sludge | | 0-480 +18 ppm |
| | Rideau clay | sludge + lime | | 0-480 +18 ppm |
| Barley | Dublin loam | Pacheco sludge control | | 0 |
| | | low sludge | | 21.6-64.8 kg/ha |
| | | high sludge | | 86.4-108 kg/ha |
| | Dublin loam | Oakland sludge control | | 0 |
| | | low sludge | | 172.8-518.4 kg/ha |
| | | high sludge | | 691.2 kg/ha |
| Oats | peat | CuSO4 | 54 | 0 |
| | muck | CuSO4 | 85 | 0 |
| | mucky peat | CuSO4 | 46 | 0 |
| Soybean | Sassafras sandy loam | control | | 0 |
| | Sassafras sandy loam | sludge | | 246.4 kg/ha |
| | Sassafras sandy loam | sludge | | 492.8 kg/ha |
| | Christiana fine sandy loam | control | | 0 |
| | Christiana fine sandy loam | limed-digested | | 35.8-286.3 kg/ha |
| | Christiana fine sandy loam | limed-raw | | 33.5-134.2 kg/ha |
| | Christiana fine sandy loam | limed-compost | | 40.9-491.2 kg/ha |
| | Christiana fine sandy loam | heated sludge | | 74.5-297.9 kg/ha |
| | Christiana fine sandy loam | heated sludge | | 74.5-297.9 kg/ha |
| | Christiana fine sandy loam | Nu-Earth | | 207-414 kg/ha |
| | Christiana fine sandy loam | Nu-Earth | | 207-414 kg/ha |
| Sunflower | irrigated loamy fine sand | control | | 0 |
| | | Zn sulfate | | 5 kg/ha |
| | dry loamy fine sand | control | | 0 |
| | | Zn sulfate | | 5 kg/ha |
| | dry fine sandy loam | control | | 0 |
| | | Zn sulfate | | 5 kg/ha |
| | irrigated fine sand | control | | 0 |
| | | Zn sulfate | | 5 kg/ha |
| Barley | Dublin loam | Oakland sludge control | | 0 |
| | Dublin loam | low sludge | | 176-352 kg/ha |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 40-54 | | | |
| Corn | | 48-709 | | | |
| | | 28-292 | 436 | | |
| | | 28-260 | | | |
| | | 37-190 | 469 | | |
| | | 21-107 | | | |
| Lettuce | | 75-159 | 259-578 | | |
| | | 87-241 | 417-1821 | | |
| | | 61-217 | | | |
| Barley | | 30.5-97.6 | | | |
| | | 43.7-92.7 | | | |
| | | 41.5-89.3 | | | |
| | | 37.1-116.0 | | | |
| | | 76.2-461.6 | | | |
| | | 113.0-820.1 | | | |
| Oats | | 54.9-66.5 | | | |
| | | 43.1-53.7 | | | |
| | | 65.4-76.2 | | | |
| Soybean | | 24-26 | | | |
| | | 80-103 | | | |
| | | 134-165 | | | |
| | | 29-70 | | | |
| | | 35-46 | | | |
| | | 31-37 | | | |
| | | 40-54 | | | |
| | | 57-62 | | | |
| | | 85-153 | | | |
| | | 70-74 | | | |
| | | 81-95 | | | |
| Sunflower | | 42 | | | |
| | | 54 | | | |
| | | 39 | | | |
| | | 48 | | | |
| | | 22 | | | |
| | | 24 | | | |
| | | 56 | | | |
| | | 67 | | | |
| Barley | | 38 | | | |
| | | 46-47 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 87 |
| Corn | | | 146 |
| | yield | 20% yield reduction | 146 |
| | | | 146 |
| | yield | 12% yield reduction | 146 |
| | | | 146 |
| Lettuce | yield | 32-81% yield reduction | 146 |
| | yield | 54.7-95% yield reduction | 146 |
| | | | 146 |
| Barley | | | 245 |
| | | | 245 |
| | | | 245 |
| | | | 245 |
| | | | 245 |
| | | | 245 |
| Oats | | | 7 |
| | | | 7 |
| | | | 7 |
| Soybean | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| | | | 89 |
| Sunflower | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| | | | 93 |
| Barley | | | 246 |
| | | | 246 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 4.4-4.5 |
| | | | | | 5.3 |
| | | | | | 6.4-6.5 |
| | | | | | 6.5-6.6 |
| Oats | Avena sativa | Clintford | stover | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Wheat | Triticum aestivum | Potomac | stover | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Chard | Beta vulgaris | Fordhook Giant Swiss | whole | field | 5 |
| | | | | | 6.5 |
| | | | | | 6.7 |
| | | | | | 5.4 |
| | | | | | 6.7 |
| Snapbeans | | Bush Blue Lake 47 | | field | 6.6 |
| | | | | | 6.7 |
| | | | | | 6.7 |
| Bush bean | Phaseolus vulgaris | Tender crops | beans | pots | 5 |
| | | | | | 5.3 |
| Cabbage | Brassica oleracea | Golden Acre | leaves | pots | 5 |
| | | | | | 5.3 |
| Carrots | Daucus carota | Scarlet Nantes | tubers | pots | 5 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Dublin loam | high sludge | | 528-704 kg/ha |
| | Dublin loam | Pacheco sludge control | | 0 |
| | Dublin loam | low sludge | | 19.8-39.6 kg/ha |
| | Dublin loam | high sludge | | 59.4-99 kg/ha |
| Oats | Galestown Evesboro loamy sand | control | DTPA: 3.7 | |
| | Galestown Evesboro loamy sand | control + lime | 3.4 | |
| | Galestown Evesboro loamy sand | limed-raw | 4.2 | |
| | Galestown Evesboro loamy sand | digested | 10.2 | |
| | Galestown Evesboro loamy sand | limed-digested | 14.5 | |
| Wheat | Galestown Evesboro loamy sand | control | DTPA: 3.7 | |
| | Galestown Evesboro loamy sand | control + lime | 3.4 | |
| | Galestown Evesboro loamy sand | limed-raw | 4.2 | |
| | Galestown Evesboro loamy sand | digested | 10.2 | |
| | Galestown Evesboro loamy sand | limed-digested | 14.5 | |
| Chard | Galestown Evesboro loamy sand | control | DTPA: 3.7 | |
| | Galestown Evesboro loamy sand | control + lime | 3.4 | |
| | Galestown Evesboro loamy sand | limed-raw | 4.2 | |
| | Galestown Evesboro loamy sand | digested | 10.2 | |
| | Galestown Evesboro loamy sand | limed-digested | 14.5 | |
| Snapbeans | Pope silt loam | control | | 0 |
| | | ZnSO4 | | 5.6-11.2 kg/ha |
| | | ZnCl2 | | 11.2 kg/ha |
| | | ZnO | | 11.2 kg/ha |
| | | Zn chelate | | 11.2 kg/ha |
| | Chenango silt loam | control | | 0 |
| | | ZnSO4 | | 5.6-11.2 kg/ha |
| | | ZnCl2 | | 11.2 kg/ha |
| | | ZnO | | 11.2 kg/ha |
| | | Zn chelate | | 11.2 kg/ha |
| | Leek Kill Channery silt loam | control | | 0 |
| | | ZnSO4 | | 5.6-11.2 kg/ha |
| | | ZnCl2 | | 11.2 kg/ha |
| | | ZnO | | 11.2 kg/ha |
| | | Zn chelate | | 11.2 kg/ha |
| Bush bean | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Cabbage | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Carrots | Arkport fine sand loam | peat | 162 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 65-70 | | | |
| | | 31 | | | |
| | | 31-32 | | | |
| | | 35-39 | | | |
| Oats | | 35.3 | | | |
| | | 20.5 | | | |
| | | 5.3 | | | |
| | | 171.2 | | | |
| | | 71.4 | | | |
| Wheat | | 42.8 | | | |
| | | 42.2 | | | |
| | | 5.3 | | | |
| | | 76.4 | | | |
| | | 69.7 | | | |
| Chard | | 142 | | | |
| | | 158 | | | |
| | | 53 | | | |
| | | 322 | | | |
| | | 254 | | | |
| Snapbeans | | 32 | | | |
| | | 44.0-62.4 | | | |
| | | 51.6 | | | |
| | | 45.8 | | | |
| | | 34.6 | | | |
| | | 21.2 | | | |
| | | 19.8-24.4 | | | |
| | | 23 | | | |
| | | 22.2 | | | |
| | | 20.6 | | | |
| | | 22 | | | |
| | | 22.4-24.2 | | | |
| | | 24.8 | | | |
| | | 23.2 | | | |
| | | 23.2 | | | |
| Bush bean | | 44 | | | |
| | | 79 | | | |
| Cabbage | | 68-204 | | | |
| | | 1086-1640 | | | |
| Carrots | | 122 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 246 |
| | | | 246 |
| | | | 246 |
| | | | 246 |
| Oats | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Wheat | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Chard | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| | | | 214 |
| Snapbeans | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| | | | 20 |
| Bush bean | | | 68 |
| | | | 68 |
| Cabbage | | | 68 |
| | | | 68 |
| Carrots | | | 68 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 5.3 |
| Millet | Echinochloa crusigalli | Japanese | edible tissue | pots | 5 |
| | | | | | 5.3 |
| Onions | Allium cepa | Downing Yellow Sweet | fruit | pots | 5 |
| | | Spanish | | | 5.3 |
| Potatoes | Solanum tuberosum | Katahdin | tubers | pots | 5 |
| | | | | | 5.3 |
| Tomatoes | Lycopersicon esculentum | Vendor | fruit | pots | 5 |
| | | | | | 5.3 |
| Cocoa | Theobroma cacao | Amazon | seedlings | pot | 6.4 |
| | | Amelonado | seedlings | pot | 6.4 |
| Bush beans | Phaseolus vulgaris | Contender | leaves | solution | 5 |
| Celery | Apium graveolens | Utah 52-70 | leaves | field | 6.88 |
| | | | | | 5.68 |
| | | | | | 6.91 |
| Perennial ryegrass | Lolium perenne | Melle | leaves | pot | 7 |
| Wheat | Triticum aestivum | HDM 1553 | stem | field | 8 |
| Lettuce | Lactuca sativa | Climax | | solution | 6.2 |
| Cabbage | Brassica Parachinensis | flowering Chinese | leaves | pot | 6.35 |
| | | | | | 5.8-6.32 |
| | | | | | 5.82-6.27 |
| | | | | | 6.55-7.32 |
| | | | | | 6.18-7.33 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | Arkport fine sand loam | sludge | 357 | |
| Millet | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Onions | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Potatoes | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Tomatoes | Arkport fine sand loam | peat | 162 | |
| | Arkport fine sand loam | sludge | 357 | |
| Cocoa | sandy loam | control | 0 | |
| | | ZnSO4 | 5.0-10.0 | |
| | | ZnSO4 | 20-50 | |
| | sandy loam | control | 0 | |
| | | ZnSO4 | 5.0-10.0 | |
| | | ZnSO4 | 20-50 | |
| Bush beans | Hoaglands solution | control | | 2 uM/14 l |
| | | low ZnSO4 | | 6.6 uM/14 l |
| | | medium ZnSO4 | | 9.6 uM/14 l |
| | | high ZnSO4 | | 13.5 uM/14 l |
| Celery | muck soil | control | 190 | |
| | muck soil | high metal soil | 287 | |
| | muck soil | limed high metal soil | 265 | |
| Perennial ryegrass | Sutton sandy loam | control | 148 | |
| | | low sludge | 309-446 | 342 kg/ha |
| | | medium sludge | 707-1307 | |
| | | high sludge | 1979 | |
| Wheat | clay | control | 22.2 | 0 |
| | | 50% sludge | 34.6 | |
| | | 66% sludge | 80 | |
| | | 100% sludge | 85.2 | |
| | | 10 ton/ha sludge | 47 | 5.62 kg/ha |
| | | 20 ton/ha sludge | 81.8 | 11.24 kg/ha |
| Lettuce | Hoagland solution | | | |
| Cabbage | redyellow podzol soil | control | 68 | |
| | redyellow podzol soil | activated sludge | 51.0-82.0 | |
| | redyellow podzol soil | digested sludge | 81.0-204.5 | |
| | redyellow podzol soil | chicken manure | 8.33-55.5 | |
| | redyellow podzol soil | pig manure | 55.75-70.25 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 56 | | | |
| Millet | | 290 | | | |
| | | 491 | | | |
| Onions | | 288 | | | |
| | | 174 | | | |
| Potatoes | | 34 | | | |
| | | 35 | | | |
| Tomatoes | | 18.1 | | | |
| | | 17.4 | | | |
| Cocoa | 30 | | | visual | sickle shapes leaves |
| | 20-24 | | | visual | sickle shapes leaves |
| | | 46-54 | | | |
| | 20 | | | visual | sickle shapes leaves |
| | 16-18 | | | visual | sickle shapes leaves |
| | | 36-76 | | | |
| Bush beans | | 70 | | | |
| | | 115 | | | |
| | | | 150 | | |
| | | | 160 | | |
| Celery | | 77 | | | |
| | | 92 | | | |
| | | 86 | | | |
| Perennial ryegrass | | 89 | | | |
| | | 140 | 143-186 | | |
| | | | 247-390 | | |
| | | | 425 | | |
| Wheat | | 76.38 | | | |
| | | 84.86 | | | |
| | | 94.86 | | | |
| | | 117.61 | | | |
| | | 91.1 | | | |
| | | 104.54 | | | |
| Lettuce | | <63 ueg/l | >63 ueg/l | | |
| | | 450-500 | 500-525 | | |
| Cabbage | | | | | |
| | | 300 | 480-1470 | | |
| | | 250-400 | 500 | | |
| | | 125-300 | | | |
| | | 100-125 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 68 |
| Millet | | | 68 |
| | | | 68 |
| Onions | | | 68 |
| | | | 68 |
| Potatoes | | | 68 |
| | | | 68 |
| Tomatoes | | | 68 |
| | | | 68 |
| Cocoa | | | 39 |
| | | | 39 |
| | | | 39 |
| | | | 39 |
| | | | 39 |
| | | | 39 |
| Bush beans | | | 205 |
| | | | 205 |
| | yield | 21% growth reduction in leaves | 205 |
| | yield | 21% growth reduction in leaves | 205 |
| Celery | | | 16 |
| | | | 16 |
| | | | 16 |
| Perennial ryegrass | | | 50 |
| | yield | 0-10% reduction | 50 |
| | yield | 10-40% reduction | 50 |
| | yield | 40-60% reduction | 50 |
| Wheat | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| | | | 29 |
| Lettuce | yield | 60% reduced root length | 10 |
| | yield | 10% yield reduction | 9 |
| Cabbage | | | 36 |
| | visual | small,short,young budding stage | 36 |
| | visual | opaque granluate deposits | 36 |
| | | | 36 |
| | | | 36 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| Wheat | Triticum aestivum | WH-147 | whole | pots | 7.9 |
| Corn | Zea mays | | shoot | greenhouse | |
| Barley | Hordeum vulgare | UC 566 | tops | greenhouse | 7.9 |
| | | | | | 5 |
| Brittlebush | Encelia farinosa | | leaves | greenhouse | 7.9 |
| | | | | | 5 |
| Wheat | Triticum aestivum | | tops | pots | 5.0-5.5 |
| | | | | | 6.1-8.3 |
| | | | | | 7.5-8.0 |
| Corn | Zea mays | Early American | shoots | pot | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| Wheat | loamy sand soil | control | | 0-.01 kg/ha |
| | | farm yard manure | | .25-1.2 kg/ha |
| | | dhaincha | | .1-.6 kg/ha |
| | | wheat straw | | .04-.36 kg/ha |
| Corn | Chalmers Indiana | control | | 0 |
| | | sludge | | 340 kg/ha |
| | Celina Michigan | control | | 0 |
| | | sludge | | 340 kg/ha |
| | Celina Ohio | control | | 0 |
| | | sludge | | 340 kg/ha |
| | Plano Wisconsin | control | | 0 |
| | | sludge | | 340 kg/ha |
| Barley | Arizo sandy loam | control | | |
| | | fly ash 2-8% | | |
| | Redding loam | control | | |
| | | fly ash 2-8% | | |
| Brittlebush | Arizo sandy loam | control | | |
| | | fly ash 2-8% | | |
| | Redding loam | control | | |
| | | fly ash 2-8% | | |
| Wheat | Orentano histosol | control | 208.8 | |
| | | fly ash 2% | 181 | |
| | | fly ash 5% | 183 | |
| | Lamporecchio fluvisol | control | 169.1 | |
| | | fly ash 2% | 143 | |
| | | fly ash 5% | 143.1 | |
| | Guardia regosol | control | 64.6 | |
| | | fly ash 2% | 88.8 | |
| | | fly ash 5% | 110 | |
| Corn | Low carbonate clay loam | control | | 0 |
| | | low ZnSO4 | | 2.5 mg/kg |
| | | medium ZnSO4 | | 5 mg/kg |
| | | high ZnSO4 | | 10 mg/kg |
| | medium carbonate sandly loam | control | | 0 |
| | | low ZnSO4 | | 2.5 mg/kg |
| | | medium ZnSO4 | | 5 mg/kg |
| | | high ZnSO4 | | 10 mg/kg |
| | high carbonate clay loam | control | | 0 |
| | | low ZnSO4 | | 2.5 mg/kg |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| Wheat | | 14.30-61.97 | | | |
| | | 18.11-70.07 | | | |
| | | 17.64-72.93 | | | |
| | | 13.82-51.92 | | | |
| Corn | | 1.33 umol/g | | | |
| | | 6.10 umol/g | | | |
| | | 1.24 umol/g | | | |
| | | 2.91 umol/g | | | |
| | | 1.44 umol/g | | | |
| | | 2.15 umol/g | | | |
| | | 2.38 umol/g | | | |
| | | 5.46 umol/g | | | |
| Barley | | 280-325 | | | |
| | | 50-110 | | | |
| | | 125-140 | | | |
| | | 80-85 | | | |
| Brittlebush | | 290-320 | | | |
| | | 100-150 | | | |
| | | 200-270 | | | |
| | | 120-170 | | | |
| Wheat | | 51.9 | | | |
| | | 51.2 | | | |
| | | 47.8 | | | |
| | | 34.4 | | | |
| | | 33.2 | | | |
| | | 32.9 | | | |
| | | 36.3 | | | |
| | | 35.4 | | | |
| | | 33.4 | | | |
| Corn | | 183 | | | |
| | | 224 | | | |
| | | 333 | | | |
| | | 460 | | | |
| | | 118 | | | |
| | | 171 | | | |
| | | 238 | | | |
| | | 293 | | | |
| | | 53 | | | |
| | | 84 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| Wheat | | | 195 |
| | | | 195 |
| | | | 195 |
| | | | 195 |
| Corn | | | 171 |
| | | | 171 |
| | | | 171 |
| | | | 171 |
| | | | 171 |
| | | | 171 |
| | | | 171 |
| | | | 171 |
| Barley | | | 63 |
| | | | 63 |
| | | | 63 |
| | | | 63 |
| Brittlebush | | | 63 |
| | | | 63 |
| | | | 63 |
| | | | 63 |
| Wheat | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| | | | 186 |
| Corn | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |
| | | | 178 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | Mol 17 x H98 | leaves | field | 7.4 |
| | | Oh545 x B73 | leaves | field | 7.4 |
| | | Pioneer 3369A | whole | pot | 6.6-6.7 |
| | | | | | 6.2-6.6 |
| | | | | | 5.8-6.4 |
| | | | | | 6.2-6.4 |
| | | | | | 6.1-6.3 |
| | | | | | 6.5-6.6 |
| | | | | | 6.2-6.3 |
| | | | | | 6.2-6.4 |
| | | | | | 6.3-6.5 |
| | | | | | 6.3-6.4 |
| | | | | | 6.4-6.5 |
| | | | | | 5.7-6.2 |
| | | | | | 6.4 |
| | | | | | 6.3 |
| | | | | | 6.1-6.5 |
| | | | | | 6.2-6.4 |
| | | | | | 6.2-6.3 |
| | | | | | 6.0-6.6 |
| Highbush blueberry | Vaccinium corymbosium | Blueray | whole | pot | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |
| | | | | | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |
| | | | | | 3.8-4.0 |
| | | | | | 4.6-5.0 |
| | | | | | 5.4-6.4 |
| Corn | Zea mays | FRM017 x H98 | shoots | greenhouse | 5.5-7.1 |
| | | | | | 7.0-7.4 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | | medium ZnSO4 | | 5 mg/kg |
| | | high ZnSO4 | | 10 mg/kg |
| | Blount silt loam | control | 73-79 | 0 |
| | | 1/4 sludge | 200-268 | 634-723 kg/ha |
| | | 1/2 sludge | 321-390 | 1269-1446 kg/ha |
| | | max sludge | 537-606 | 2537-2891 kg/ha |
| | Blount silt loam | control | 73-79 | 0 |
| | | 1/4 sludge | 200-268 | 634-723 kg/ha |
| | | 1/2 sludge | 321-390 | 1269-1446 kg/ha |
| | | max sludge | 537-606 | 2537-2891 kg/ha |
| | Rutledge | control | | 0 |
| | Rutledge | ZnSO4 | | " 457-470 kg/ha |
| | Rutledge | sludge | | 457-470 kg/ha |
| | Evesboro | control | | 0 |
| | Evesboro | ZnSO4 | | " 457-470 kg/ha |
| | Evesboro | sludge | | 457-470 kg/ha |
| | Downer | control | | 0 |
| | Downer | ZnSO4 | | " 457-470 kg/ha |
| | Downer | sludge | | 457-470 kg/ha |
| | Collington | control | | 0 |
| | Collington | ZnSO4 | | " 457-470 kg/ha |
| | Collington | sludge | | 457-470 kg/ha |
| | Manor | control | | 0 |
| | Manor | ZnSO4 | | " 457-470 kg/ha |
| | Manor | sludge | | 457-470 kg/ha |
| | Myersville | control | | 0 |
| | Myersville | ZnSO4 | | " 457-470 kg/ha |
| | Myersville | sludge | | 457-470 kg/ha |
| Highbush blueberry | Tempelton silt loam | control | | |
| | Tempelton silt loam | control | | |
| | Tempelton silt loam | control | | |
| | Tempelton silt loam | ZnSO4 | | 4 g/m3 |
| | Tempelton silt loam | ZnSO4 | | 4 g/m3 |
| | Tempelton silt loam | ZnSO4 | | 4 g/m3 |
| | Tempelton silt loam | ZnSO4 | | 8 g/m3 |
| | Tempelton silt loam | ZnSO4 | | 8 g/m3 |
| | Tempelton silt loam | ZnSO4 | | 8 g/m3 |
| Corn | various | control | 36-120 | |
| | various | control + lime | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 98 | | | |
| | | 123 | | | |
| | | 15.9-19.3 | | | |
| | | 51.6-56.5 | | | |
| | | 77.6-89.3 | | | |
| | | 138-173 | | | |
| | | 13.7-14.8 | | | |
| | | 39.9-49.2 | | | |
| | | 61.3-76.0 | | | |
| | | 118-139 | | | |
| | | 17-23 | | | |
| | | 81 | 166 | | |
| | | 71-122 | | | |
| | | 18-19 | | | |
| | | 152 | | | |
| | | 46-60 | 350 | | |
| | | 17-19 | | | |
| | | 123-145 | | | |
| | | 65-72 | | | |
| | | 14-17 | | | |
| | | 131-175 | | | |
| | | 80-107 | | | |
| | | 15-18 | | | |
| | | 113-144 | | | |
| | | 70-85 | | | |
| | | 15-17 | | | |
| | | 86-100 | | | |
| | | 76-95 | | | |
| Highbush blueberry | | 32-36 | | | |
| | | 42-47 | | | |
| | | 26-39 | | | |
| | | 45-47 | | | |
| | | 50-55 | | | |
| | | 30-47 | | | |
| | | 57-59 | | | |
| | | 56-62 | | | |
| | | 34-51 | | | |
| Corn | | 22-108 | | | |
| | | 28-74 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | | 178 |
| | | | 178 |
| | | | 98 |
| | | | 98 |
| | | | 98 |
| | | | 98 |
| | | | 98 |
| | | | 98 |
| | | | 98 |
| | | | 129 |
| | yield | 40% reduction | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | yield | 53% reduction | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| | | | 129 |
| Highbush blueberry | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| | | | 86 |
| Corn | | | 151 |
| | | | 151 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Scientific Name | Variety | Parts | Cultivation | PH |
|---|---|---|---|---|---|
| | | | | | 3.6-7.5 |
| | | | | | 5.8-7.3 |
| Swiss chard | Beta vulgaris | Fordhook Giant | | greenhouse | 5.5-7.1 |
| | | | | | 7.0-7.4 |
| | | | | | 3.6-7.5 |
| | | | | | 5.8-7.3 |
| Ryegrass | | S24 | | pots | 4.7-5.8 |
| | | | | | 6.0-7.8 |
| | | | | | 4.9-5.7 |
| | | | | | 5.9-7.3 |
| | | | | | 4.7-5.8 |
| | | | | | 6.1-7.2 |
| | | | | | 4.6-5.6 |
| | | | | | 6.0-7.4 |
| | | | | | 5.3-6.0 |
| | | | | | 6.2-7.3 |
| | | | | | 4.9-5.2 |
| | | | | | 6.0-7.4 |
| | | | | | 4.9-5.5 |
| | | | | | 5.8-7.2 |
| | | | | | 5.5-5.6 |
| | | | | | 6.2-7.0 |
| | | | | | 4.9-5.5 |
| | | | | | 5.9-7.3 |
| | | | | | 5.3-5.7 |
| | | | | | 6.3-7.2 |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | Soil Type | Treatment | Concentration in soil | Loading rate |
|---|---|---|---|---|
| | various | sludge | 90-500 | |
| | various | sludge + lime | | |
| Swiss chard | various | control | 36-120 | |
| | various | control + lime | | |
| | various | sludge | 90-500 | |
| | various | sludge + lime | | |
| Ryegrass | silty clay loam | no sludge | 57 | |
| | silty clay loam | no sludge | 57 | |
| | silty clay loam | low metal sludge | 86 | |
| | silty clay loam | low metal sludge | 86 | |
| | silty clay loam | Zn sludge | 470 | |
| | silty clay loam | Zn sludge | 470 | |
| | silty clay loam | Cu sludge | 70 | |
| | silty clay loam | Cu sludge | 70 | |
| | silty clay loam | Ni sludge | 86 | |
| | silty clay loam | Ni sludge | 86 | |
| | sandy loam | no sludge | 42 | |
| | sandy loam | no sludge | 42 | |
| | sandy loam | low metal sludge | 64 | |
| | sandy loam | low metal sludge | 64 | |
| | sandy loam | Zn sludge | 360 | |
| | sandy loam | Zn sludge | 360 | |
| | sandy loam | Cu sludge | 57 | |
| | sandy loam | Cu sludge | 57 | |
| | sandy loam | Ni sludge | 80 | |
| | sandy loam | Ni sludge | 80 | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | plant tissue concentration | | | phytotoxicity deficiency | |
|---|---|---|---|---|---|
| | deficiency | normal | toxic | type | symptoms |
| | | 68-726 | | | |
| | | 68-232 | | | |
| Swiss chard | | 53-159 | | | |
| | | 32-46 | | | |
| | | 78-1810 | | | |
| | | 51-142 | | | |
| Ryegrass | | 47-49 | | | |
| | | 31-43 | | | |
| | | 152-204 | | | |
| | | 57-111 | | | |
| | | 1190 | 2840 | | |
| | | 389-945 | | | |
| | | 156-170 | | | |
| | | 63-120 | | | |
| | | 124-150 | | | |
| | | 60-91 | | | |
| | | 30-34 | | | |
| | | 25-42 | | | |
| | | 120-143 | | | |
| | | 61-137 | | | |
| | | 1240-1525 | | | |
| | | 443-1140 | | | |
| | | 188-210 | | | |
| | | 63-142 | | | |
| | | 110-183 | | | |
| | | 51-92 | | | |

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

| Plant Name | phytotoxicity | | reference |
|---|---|---|---|
| | type | symptoms | |
| | | none mentioned | 151 |
| | | | 151 |
| Swiss chard | | | 151 |
| | | none mentioned | 151 |
| | | | 151 |
| | | | 151 |
| Ryegrass | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | yield | 50-100% yield reduction | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |
| | | | 210 |

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# APPENDIX F

## Phytotoxicity Data from Field Experiments with Sludge

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TABLE F-1. CHROMIUM DATA

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 1 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 2 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 3 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 4 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 5 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 6 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 7 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 8 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 9 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 10 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 11 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 12 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 13 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 14 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 15 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 16 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 17 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 18 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 19 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 20 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 21 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 22 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 23 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 24 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 25 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 26 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 27 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 28 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 29 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 30 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 31 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 32 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 33 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 34 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 35 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 36 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 37 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 38 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 2 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 3 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 4 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 5 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 6 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 7 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 8 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 9 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 10 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 11 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 12 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 13 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 14 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 15 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 16 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 17 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 18 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 19 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 20 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 21 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 22 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 23 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 24 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 25 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 26 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 27 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 28 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 29 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 30 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 31 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 32 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 33 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 34 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 35 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 36 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 37 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 38 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 1 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 2 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 3 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 4 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 5 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 6 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 7 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 8 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 9 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 10 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SIL | |
| 11 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | BLOUNT | SIL | |
| 12 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | BLOUNT | SIL | |
| 13 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | BLOUNT | SIL | |
| 14 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | BLOUNT | SIL | |
| 15 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | BLOUNT | SIL | |
| 16 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | BLOUNT | SIL | |
| 17 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | BLOUNT | SIL | |
| 18 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | BLOUNT | SIL | |
| 19 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | BLOUNT | SIL | |
| 20 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | BLOUNT | SIL | |
| 21 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | BLOUNT | SIL | |
| 22 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | BLOUNT | SIL | |
| 23 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | BLOUNT | SIL | |
| 24 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | BLOUNT | SIL | |
| 25 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | BLOUNT | SIL | |
| 26 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | BLOUNT | SIL | |
| 27 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | BLOUNT | SIL | |
| 28 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | BLOUNT | SIL | |
| 29 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | BLOUNT | SIL | |
| 30 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | BLOUNT | SIL | |
| 31 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | BLOUNT | SIL | |
| 32 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | BLOUNT | SIL | |
| 33 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | BLOUNT | SIL | |
| 34 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SIL | |
| 35 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SIL | |
| 36 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SIL | |
| 37 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SIL | |
| 38 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SIL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 1 | | | | 0.85 | 7.8 | 0 | HCL-HF | 39 | 1 | LEAF |
| 2 | | | | 0.9 | 6.9 | 0 | HCL-HF | 36 | 1.3 | LEAF |
| 3 | | | | 0.94 | 7.6 | 0 | HCL-HF | 50 | 0.9 | LEAF |
| 4 | | | | 0.93 | 7.6 | 0 | HCL-HF | 35 | <.6 | LEAF |
| 5 | | | | 0.92 | 7.8 | 0 | HCL-HF | 54 | 0.7 | LEAF |
| 6 | | | | 0.87 | 7.5 | 0 | HCL-HF | 48 | <.6 | LEAF |
| 7 | | | | 0.9 | 7.6 | 0 | HCL-HF | 45 | 1.3 | LEAF |
| 8 | | | | 0.88 | 7.5 | 0 | HCL-HF | 54 | <.6 | LEAF |
| 9 | | | | 0.73 | 7.6 | 0 | HCL-HF | 49 | <.6 | LEAF |
| 10 | | | | 1 | 7.4 | 0 | HCL-HF | 40 | <.1 | LEAF |
| 11 | | | | 1.06 | 7.7 | 133 | HCL-HF | 74 | 0.8 | LEAF |
| 12 | | | | 1.11 | 6.9 | 146 | HCL-HF | 57 | 1.5 | LEAF |
| 13 | | | | 1.18 | 7.5 | 168 | HCL-HF | 73 | 1.2 | LEAF |
| 14 | | | | 1.4 | 7.5 | 168 | HCL-HF | 75 | <.6 | LEAF |
| 15 | | | | 1.16 | 7.6 | 168 | HCL-HF | 82 | 1.6 | LEAF |
| 16 | | | | 1.08 | 7.5 | 168 | HCL-HF | 82 | <.6 | LEAF |
| 17 | | | | 1.18 | 7.7 | 168 | HCL-HF | 75 | 0.8 | LEAF |
| 18 | | | | 1.23 | 7.6 | 168 | HCL-HF | 95 | <.6 | LEAF |
| 19 | | | | 1.09 | 7.5 | 168 | HCL-HF | 89 | <.6 | LEAF |
| 20 | | | | 1.32 | 7.3 | 168 | HCL-HF | 63 | 0.2 | LEAF |
| 21 | | | | 1.38 | 7.6 | 265 | HCL-HF | 109 | 1 | LEAF |
| 22 | | | | 1.12 | 7 | 292 | HCL-HF | 74 | 1.4 | LEAF |
| 23 | | | | 1.29 | 7.4 | 335 | HCL-HF | 116 | 1.6 | LEAF |
| 24 | | | | 1.83 | 7.3 | 335 | HCL-HF | 97 | 0.7 | LEAF |
| 25 | | | | 1.36 | 7.5 | 335 | HCL-HF | 114 | 0.6 | LEAF |
| 26 | | | | 1.34 | 7.2 | 335 | HCL-HF | 99 | 0.7 | LEAF |
| 27 | | | | 1.6 | 7.4 | 335 | HCL-HF | 107 | 0.9 | LEAF |
| 28 | | | | 1.31 | 7.3 | 335 | HCL-HF | 145 | <.6 | LEAF |
| 29 | | | | 1.54 | 7.1 | 335 | HCL-HF | 104 | <.6 | LEAF |
| 30 | | | | 1.62 | 7.1 | 335 | HCL-HF | 87 | <.1 | LEAF |
| 31 | | | | 1.62 | 7.6 | 529 | HCL-HF | 180 | 1 | LEAF |
| 32 | | | | 1.63 | 6.8 | 583 | HCL-HF | 135 | 1.1 | LEAF |
| 33 | | | | 1.94 | 7.3 | 670 | HCL-HF | 176 | 1 | LEAF |
| 34 | | | | 2.5 | 7.2 | 670 | HCL-HF | 199 | 0.6 | LEAF |
| 35 | | | | 1.83 | 7.3 | 670 | HCL-HF | 175 | 1.2 | LEAF |
| 36 | | | | 1.88 | 7.2 | 670 | HCL-HF | 175 | <.6 | LEAF |
| 37 | | | | 2.03 | 7.3 | 670 | HCL-HF | 180 | 1.1 | LEAF |
| 38 | | | | 1.6 | 7.1 | 670 | HCL-HF | 207 | <.6 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 1 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 2 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 3 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 4 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 5 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 6 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 7 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 8 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 9 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 10 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 11 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 12 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 13 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 14 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 15 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 16 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 17 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 18 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 19 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 20 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 21 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 22 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 23 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 24 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 25 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 26 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 27 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 28 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 29 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 30 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 31 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 32 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 33 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 34 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 35 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 36 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 37 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 38 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 1 | | JOLIET, ILLINOIS |
| 2 | | JOLIET, ILLINOIS |
| 3 | | JOLIET, ILLINOIS |
| 4 | | JOLIET, ILLINOIS |
| 5 | | JOLIET, ILLINOIS |
| 6 | | JOLIET, ILLINOIS |
| 7 | | JOLIET, ILLINOIS |
| 8 | | JOLIET, ILLINOIS |
| 9 | | JOLIET, ILLINOIS |
| 10 | | JOLIET, ILLINOIS |
| 11 | | JOLIET, ILLINOIS |
| 12 | | JOLIET, ILLINOIS |
| 13 | | JOLIET, ILLINOIS |
| 14 | | JOLIET, ILLINOIS |
| 15 | | JOLIET, ILLINOIS |
| 16 | | JOLIET, ILLINOIS |
| 17 | | JOLIET, ILLINOIS |
| 18 | | JOLIET, ILLINOIS |
| 19 | | JOLIET, ILLINOIS |
| 20 | | JOLIET, ILLINOIS |
| 21 | | JOLIET, ILLINOIS |
| 22 | | JOLIET, ILLINOIS |
| 23 | | JOLIET, ILLINOIS |
| 24 | | JOLIET, ILLINOIS |
| 25 | | JOLIET, ILLINOIS |
| 26 | | JOLIET, ILLINOIS |
| 27 | | JOLIET, ILLINOIS |
| 28 | | JOLIET, ILLINOIS |
| 29 | | JOLIET, ILLINOIS |
| 30 | | JOLIET, ILLINOIS |
| 31 | | JOLIET, ILLINOIS |
| 32 | | JOLIET, ILLINOIS |
| 33 | | JOLIET, ILLINOIS |
| 34 | | JOLIET, ILLINOIS |
| 35 | | JOLIET, ILLINOIS |
| 36 | | JOLIET, ILLINOIS |
| 37 | | JOLIET, ILLINOIS |
| 38 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 39 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 40 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 41 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 42 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 43 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 44 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 45 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 46 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 47 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 48 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 49 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 50 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 51 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 52 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 53 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 54 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 55 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 56 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 57 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 58 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 59 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 60 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 61 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 62 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 63 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 64 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 65 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 66 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 67 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 68 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 69 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 70 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 71 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 72 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 73 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 74 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 75 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 76 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 40 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 41 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 42 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 43 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 44 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 45 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 46 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 47 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 48 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 49 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 50 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 51 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 52 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 53 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 54 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 55 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 56 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 57 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 58 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 59 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 60 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 61 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 62 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 63 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 64 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 65 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 66 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 67 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 68 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 69 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 70 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 71 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 72 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 73 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 74 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 75 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 76 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 39 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL | |
| 40 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL | |
| 41 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 42 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 43 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 44 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 45 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 46 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 47 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 48 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 49 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 50 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 51 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | ELLIOT | SiL | |
| 52 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | ELLIOT | SiL | |
| 53 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | ELLIOT | SiL | |
| 54 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | ELLIOT | SiL | |
| 55 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | ELLIOT | SiL | |
| 56 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | ELLIOT | SiL | |
| 57 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | ELLIOT | SiL | |
| 58 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | ELLIOT | SiL | |
| 59 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | ELLIOT | SiL | |
| 60 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | ELLIOT | SiL | |
| 61 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | ELLIOT | SiL | |
| 62 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | ELLIOT | SiL | |
| 63 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | ELLIOT | SiL | |
| 64 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | ELLIOT | SiL | |
| 65 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | ELLIOT | SiL | |
| 66 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | ELLIOT | SiL | |
| 67 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | ELLIOT | SiL | |
| 68 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | ELLIOT | SiL | |
| 69 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | ELLIOT | SiL | |
| 70 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | ELLIOT | SiL | |
| 71 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | ELLIOT | SiL | |
| 72 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | ELLIOT | SiL | |
| 73 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | ELLIOT | SiL | |
| 74 | CENT POLY, FECL3 | 69.8 | 302.3 | 0 | | ELLIOT | SiL | |
| 75 | CENT POLY, FECL3 | 54 | 356.3 | 0 | | ELLIOT | SiL | |
| 76 | CENT POLY, FECL3 | 72 | 428.3 | 0 | | ELLIOT | SiL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 39 | | | | 1.54 | 7.1 | 670 | HCL-HF | 126 | <.6 | LEAF |
| 40 | | | | 1.84 | 7 | 670 | HCL-HF | 121 | 0.2 | LEAF |
| 41 | | | | 1.64 | 7.6 | 0 | HCL-HF | 31 | 1 | LEAF |
| 42 | | | | 1.61 | 6.8 | 0 | HCL-HF | 37 | 2.2 | LEAF |
| 43 | | | | 1.54 | 7.2 | 0 | HCL-HF | 40 | 1.1 | LEAF |
| 44 | | | | 1.53 | 7.2 | 0 | HCL-HF | 34 | <.6 | LEAF |
| 45 | | | | 1.54 | 7 | 0 | HCL-HF | 42 | 2.1 | LEAF |
| 46 | | | | 1.51 | 7 | 0 | HCL-HF | 41 | <.6 | LEAF |
| 47 | | | | 1.58 | 7.4 | 0 | HCL-HF | 38 | 2.7 | LEAF |
| 48 | | | | 1.54 | 7.2 | 0 | HCL-HF | 50 | <.6 | LEAF |
| 49 | | | | 1.51 | 7 | 0 | HCL-HF | 60 | <.6 | LEAF |
| 50 | | | | 1.62 | 7 | 0 | HCL-HF | 37 | <.1 | LEAF |
| 51 | | | | 1.64 | 7.3 | 133 | HCL-HF | 64 | 1 | LEAF |
| 52 | | | | 1.84 | 6.8 | 146 | HCL-HF | 73 | 1.5 | LEAF |
| 53 | | | | 1.74 | 7.1 | 168 | HCL-HF | 65 | 0.9 | LEAF |
| 54 | | | | 2.18 | 7.1 | 223 | HCL-HF | 73 | <.6 | LEAF |
| 55 | | | | 1.86 | 7.2 | 266 | HCL-HF | 74 | 0.6 | LEAF |
| 56 | | | | 1.67 | 7.2 | 321 | HCL-HF | 74 | <.6 | LEAF |
| 57 | | | | 1.83 | 7.5 | 321 | HCL-HF | 88 | <.6 | LEAF |
| 58 | | | | 1.55 | 7.2 | 321 | HCL-HF | 90 | <.6 | LEAF |
| 59 | | | | 1.68 | 7 | 321 | HCL-HF | 81 | 0.7 | LEAF |
| 60 | | | | 1.89 | 7.1 | 321 | HCL-HF | 71 | <.1 | LEAF |
| 61 | | | | 1.97 | 7.8 | 265 | HCL-HF | 121 | 1.2 | LEAF |
| 62 | | | | 1.81 | 7 | 292 | HCL-HF | 96 | 1.3 | LEAF |
| 63 | | | | 1.88 | 7.3 | 335 | HCL-HF | 106 | 1.4 | LEAF |
| 64 | | | | 2.21 | 7.3 | 440 | HCL-HF | 99 | <.6 | LEAF |
| 65 | | | | 1.99 | 7.4 | 525 | HCL-HF | 116 | 2.9 | LEAF |
| 66 | | | | 1.89 | 7.3 | 635 | HCL-HF | 112 | <.6 | LEAF |
| 67 | | | | 1.94 | 7.4 | 635 | HCL-HF | 102 | 2.1 | LEAF |
| 68 | | | | 1.72 | 7.4 | 635 | HCL-HF | 155 | <.6 | LEAF |
| 69 | | | | 1.79 | 7.2 | 635 | HCL-HF | 110 | <.6 | LEAF |
| 70 | | | | 1.87 | 7.2 | 635 | HCL-HF | 91 | <.1 | LEAF |
| 71 | | | | 2.23 | 7.5 | 529 | HCL-HF | 216 | 1.2 | LEAF |
| 72 | | | | 2.22 | 6.4 | 583 | HCL-HF | 145 | 1.2 | LEAF |
| 73 | | | | 2.28 | 6.5 | 670 | HCL-HF | 174 | 1 | LEAF |
| 74 | | | | 2.61 | 6.5 | 880 | HCL-HF | 188 | <.6 | LEAF |
| 75 | | | | 2.74 | 6.5 | 1050 | HCL-HF | 242 | 1 | LEAF |
| 76 | | | | 2.94 | 5.9 | 1269 | HCL-HF | 248 | <.6 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 39 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 40 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 41 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 42 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 43 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 44 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 45 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 46 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 47 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 48 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 49 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 50 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 51 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 52 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 53 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 54 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 55 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 56 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 57 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 58 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 59 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 60 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 61 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 62 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 63 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 64 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 65 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 66 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 67 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 68 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 69 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 70 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 71 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 72 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 73 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 74 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 75 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 76 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 39 | | JOLIET, ILLINOIS |
| 40 | | JOLIET, ILLINOIS |
| 41 | | JOLIET, ILLINOIS |
| 42 | | JOLIET, ILLINOIS |
| 43 | | JOLIET, ILLINOIS |
| 44 | | JOLIET, ILLINOIS |
| 45 | | JOLIET, ILLINOIS |
| 46 | | JOLIET, ILLINOIS |
| 47 | | JOLIET, ILLINOIS |
| 48 | | JOLIET, ILLINOIS |
| 49 | | JOLIET, ILLINOIS |
| 50 | | JOLIET, ILLINOIS |
| 51 | | JOLIET, ILLINOIS |
| 52 | | JOLIET, ILLINOIS |
| 53 | | JOLIET, ILLINOIS |
| 54 | | JOLIET, ILLINOIS |
| 55 | | JOLIET, ILLINOIS |
| 56 | | JOLIET, ILLINOIS |
| 57 | | JOLIET, ILLINOIS |
| 58 | | JOLIET, ILLINOIS |
| 59 | | JOLIET, ILLINOIS |
| 60 | | JOLIET, ILLINOIS |
| 61 | | JOLIET, ILLINOIS |
| 62 | | JOLIET, ILLINOIS |
| 63 | | JOLIET, ILLINOIS |
| 64 | | JOLIET, ILLINOIS |
| 65 | | JOLIET, ILLINOIS |
| 66 | | JOLIET, ILLINOIS |
| 67 | | JOLIET, ILLINOIS |
| 68 | | JOLIET, ILLINOIS |
| 69 | | JOLIET, ILLINOIS |
| 70 | | JOLIET, ILLINOIS |
| 71 | | JOLIET, ILLINOIS |
| 72 | | JOLIET, ILLINOIS |
| 73 | | JOLIET, ILLINOIS |
| 74 | | JOLIET, ILLINOIS |
| 75 | | JOLIET, ILLINOIS |
| 76 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 77 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 78 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 79 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 80 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 81 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 82 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 83 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 84 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 85 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 86 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 87 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 88 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 89 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 90 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 91 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 92 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 93 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 94 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 95 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 96 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 97 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 98 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 99 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 100 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 101 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 102 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 103 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 104 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 105 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 106 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 107 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 108 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 109 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 110 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 111 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 112 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 113 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 114 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 77 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 78 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 79 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 80 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 81 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 82 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 83 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 84 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 85 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 86 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 87 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 88 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 89 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 90 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 91 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 92 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 93 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 94 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 95 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 96 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 97 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 98 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 99 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 100 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 101 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 102 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 103 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 104 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 105 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 106 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 107 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 108 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 109 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 110 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 111 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 112 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 113 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 114 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 77 | CENT POLY, FECL3 | 0 | 428.3 | 1 | | ELLIOT | SiL | |
| 78 | CENT POLY, FECL3 | 0 | 428.3 | 2 | | ELLIOT | SiL | |
| 79 | CENT POLY, FECL3 | 0 | 428.3 | 3 | | ELLIOT | SiL | |
| 80 | CENT POLY, FECL3 | 0 | 428.3 | 4 | | ELLIOT | SiL | |
| 81 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 82 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 83 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 84 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 85 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 86 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 87 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 88 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 89 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 90 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 91 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | PLAINFIELD | SL | |
| 92 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | PLAINFIELD | SL | |
| 93 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | PLAINFIELD | SL | |
| 94 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | PLAINFIELD | SL | |
| 95 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | PLAINFIELD | SL | |
| 96 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | PLAINFIELD | SL | |
| 97 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | PLAINFIELD | SL | |
| 98 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | PLAINFIELD | SL | |
| 99 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | PLAINFIELD | SL | |
| 100 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | PLAINFIELD | SL | |
| 101 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | PLAINFIELD | SL | |
| 102 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | PLAINFIELD | SL | |
| 103 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | PLAINFIELD | SL | |
| 104 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | PLAINFIELD | SL | |
| 105 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | PLAINFIELD | SL | |
| 106 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | PLAINFIELD | SL | |
| 107 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | PLAINFIELD | SL | |
| 108 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | PLAINFIELD | SL | |
| 109 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | PLAINFIELD | SL | |
| 110 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | PLAINFIELD | SL | |
| 111 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | PLAINFIELD | SL | |
| 112 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | PLAINFIELD | SL | |
| 113 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | PLAINFIELD | SL | |
| 114 | CENT POLY, FECL3 | 69.8 | 302.3 | 0 | | PLAINFIELD | SL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 77 | | | | 3.92 | 5.9 | 1269 | HCL-HF | 294 | 0.6 | LEAF |
| 78 | | | | 3.77 | 5.8 | 1269 | HCL-HF | 432 | <.6 | LEAF |
| 79 | | | | 2.6 | 6.1 | 1269 | HCL-HF | 193 | 0.6 | LEAF |
| 80 | | | | 3.2 | 6.1 | 1269 | HCL-HF | 220 | 0.2 | LEAF |
| 81 | | | | 0.39 | 7.8 | 0 | HCL-HF | 22 | 1.1 | LEAF |
| 82 | | | | 0.17 | 7.1 | 0 | HCL-HF | 16 | 1.4 | LEAF |
| 83 | | | | 0.26 | 7.3 | 0 | HCL-HF | 23 | 1 | LEAF |
| 84 | | | | 0.27 | 6.8 | 0 | HCL-HF | 25 | <.6 | LEAF |
| 85 | | | | 0.33 | 7.6 | 0 | HCL-HF | 31 | 0.8 | LEAF |
| 86 | | | | 0.27 | 7.5 | 0 | HCL-HF | 22 | <.6 | LEAF |
| 87 | | | | 0.29 | 7.5 | 0 | HCL-HF | 16 | 2.4 | LEAF |
| 88 | | | | 0.42 | 7.4 | 0 | HCL-HF | 29 | <.6 | LEAF |
| 89 | | | | 0.49 | 7.4 | 0 | HCL-HF | 38 | 0.7 | LEAF |
| 90 | | | | 0.64 | 7.3 | 0 | HCL-HF | 25 | 0.2 | LEAF |
| 91 | | | | 0.36 | 7.6 | 133 | HCL-HF | 67 | 1.2 | LEAF |
| 92 | | | | 0.28 | 7.1 | 146 | HCL-HF | 38 | 0.9 | LEAF |
| 93 | | | | 0.61 | 7.4 | 168 | HCL-HF | 48 | 1.2 | LEAF |
| 94 | | | | 0.91 | 7.3 | 223 | HCL-HF | 58 | 0.7 | LEAF |
| 95 | | | | 0.56 | 7.4 | 266 | HCL-HF | 59 | 0.8 | LEAF |
| 96 | | | | 0.58 | 7.1 | 321 | HCL-HF | 55 | <.6 | LEAF |
| 97 | | | | 0.45 | 7.5 | 321 | HCL-HF | 43 | 1.3 | LEAF |
| 98 | | | | 0.34 | 7.7 | 321 | HCL-HF | 55 | <.6 | LEAF |
| 99 | | | | 0.47 | 7.4 | 321 | HCL-HF | 85 | 0.6 | LEAF |
| 100 | | | | 0.83 | 7.4 | 321 | HCL-HF | 52 | 0.6 | LEAF |
| 101 | | | | 0.58 | 7.5 | 265 | HCL-HF | 129 | 1.7 | LEAF |
| 102 | | | | 0.44 | 6.9 | 292 | HCL-HF | 56 | 1.4 | LEAF |
| 103 | | | | 0.81 | 7.1 | 335 | HCL-HF | 83 | 1 | LEAF |
| 104 | | | | 0.95 | 6.8 | 440 | HCL-HF | 83 | 0.6 | LEAF |
| 105 | | | | 0.75 | 7.1 | 525 | HCL-HF | 103 | 1.3 | LEAF |
| 106 | | | | 0.96 | 7.1 | 635 | HCL-HF | 69 | <.6 | LEAF |
| 107 | | | | 0.59 | 6.9 | 635 | HCL-HF | 91 | 1.3 | LEAF |
| 108 | | | | 0.89 | 7 | 635 | HCL-HF | 90 | <.6 | LEAF |
| 109 | | | | 0.81 | 7.1 | 635 | HCL-HF | 105 | 0.8 | LEAF |
| 110 | | | | 0.52 | 7.1 | 635 | HCL-HF | 39 | <.1 | LEAF |
| 111 | | | | 0.9 | 7.6 | 529 | HCL-HF | 273 | 1 | LEAF |
| 112 | | | | 0.6 | 6.6 | 583 | HCL-HF | 93 | 1.1 | LEAF |
| 113 | | | | 2.4 | 6.8 | 670 | HCL-HF | 226 | 1.2 | LEAF |
| 114 | | | | 1.85 | 6.5 | 880 | HCL-HF | 93 | <.6 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 77 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 78 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 79 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 80 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 81 | SLUDGE, FIELD, MATURITY | NA | GRAIN | 0 | STOVER | NO |
| 82 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 83 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 84 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 85 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 86 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 87 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 88 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 89 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 90 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 91 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 92 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 93 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 94 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 95 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 96 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 97 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 98 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 99 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 100 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 101 | SLUDGE, FIELD, MATURITY | NA | GRAIN | NA | STOVER | NO |
| 102 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 103 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 104 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 105 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 106 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 107 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 108 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 109 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 110 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 111 | SLUDGE, FIELD, MATURITY | NA | GRAIN | NA | STOVER | NO |
| 112 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 113 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 114 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 77 | | JOLIET, ILLINOIS |
| 78 | | JOLIET, ILLINOIS |
| 79 | | JOLIET, ILLINOIS |
| 80 | | JOLIET, ILLINOIS |
| 81 | | JOLIET, ILLINOIS |
| 82 | | JOLIET, ILLINOIS |
| 83 | | JOLIET, ILLINOIS |
| 84 | | JOLIET, ILLINOIS |
| 85 | | JOLIET, ILLINOIS |
| 86 | | JOLIET, ILLINOIS |
| 87 | | JOLIET, ILLINOIS |
| 88 | | JOLIET, ILLINOIS |
| 89 | | JOLIET, ILLINOIS |
| 90 | | JOLIET, ILLINOIS |
| 91 | | JOLIET, ILLINOIS |
| 92 | | JOLIET, ILLINOIS |
| 93 | | JOLIET, ILLINOIS |
| 94 | | JOLIET, ILLINOIS |
| 95 | | JOLIET, ILLINOIS |
| 96 | | JOLIET, ILLINOIS |
| 97 | | JOLIET, ILLINOIS |
| 98 | | JOLIET, ILLINOIS |
| 99 | | JOLIET, ILLINOIS |
| 100 | | JOLIET, ILLINOIS |
| 101 | | JOLIET, ILLINOIS |
| 102 | | JOLIET, ILLINOIS |
| 103 | | JOLIET, ILLINOIS |
| 104 | | JOLIET, ILLINOIS |
| 105 | | JOLIET, ILLINOIS |
| 106 | | JOLIET, ILLINOIS |
| 107 | | JOLIET, ILLINOIS |
| 108 | | JOLIET, ILLINOIS |
| 109 | | JOLIET, ILLINOIS |
| 110 | | JOLIET, ILLINOIS |
| 111 | | JOLIET, ILLINOIS |
| 112 | | JOLIET, ILLINOIS |
| 113 | | JOLIET, ILLINOIS |
| 114 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 115 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 116 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 117 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 118 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 119 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 120 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 121 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 122 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 123 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 124 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 125 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 126 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 127 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 128 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 129 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 130 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 131 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 132 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 133 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 134 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 135 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 136 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 137 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 138 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 139 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 140 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 141 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 142 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 143 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 144 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 145 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 146 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 147 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 148 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 149 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 150 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 151 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 152 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 116 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 117 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 118 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 119 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 120 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 121 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 122 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 123 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 124 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 125 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 126 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 127 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 128 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 129 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 130 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 131 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 132 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 133 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 134 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 135 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 136 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 137 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 138 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 139 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 140 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 141 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 142 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 143 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 144 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 145 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 146 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 147 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 148 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 149 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 150 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 151 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 152 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 115 | CENT POLY, FECL3 | 54 | 356.3 | 0 | | PLAINFIELD | SL | |
| 116 | CENT POLY, FECL3 | 72 | 428.3 | 0 | | PLAINFIELD | SL | |
| 117 | CENT POLY, FECL3 | 0 | 428.3 | 1 | | PLAINFIELD | SL | |
| 118 | CENT POLY, FECL3 | 0 | 428.3 | 2 | | PLAINFIELD | SL | |
| 119 | CENT POLY, FECL3 | 0 | 428.3 | 3 | | PLAINFIELD | SL | |
| 120 | CENT POLY, FECL3 | 0 | 428.3 | 4 | | PLAINFIELD | SL | |
| 121 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL | |
| 122 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL | |
| 123 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL | |
| 124 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL | |
| 125 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL | |
| 126 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | BLOUNT | SiL | |
| 127 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | BLOUNT | SiL | |
| 128 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | BLOUNT | SiL | |
| 129 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | BLOUNT | SiL | |
| 130 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | BLOUNT | SiL | |
| 131 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | BLOUNT | SiL | |
| 132 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | BLOUNT | SiL | |
| 133 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | BLOUNT | SiL | |
| 134 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | BLOUNT | SiL | |
| 135 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | BLOUNT | SiL | |
| 136 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | BLOUNT | SiL | |
| 137 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | BLOUNT | SiL | |
| 138 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | BLOUNT | SiL | |
| 139 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | BLOUNT | SiL | |
| 140 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | BLOUNT | SiL | |
| 141 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 142 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 143 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 144 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 145 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 146 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 147 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 148 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 149 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 150 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 151 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL | |
| 152 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | ELLIOT | SiL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | | | | 1.78 | 6.1 | 1050 | HCL-HF | 218 | 1.3 | LEAF |
| 116 | | | | 1.96 | 6.2 | 1269 | HCL-HF | 224 | 0.7 | LEAF |
| 117 | | | | 2.84 | 6 | 1269 | HCL-HF | 268 | 0.9 | LEAF |
| 118 | | | | 3.35 | 5.9 | 1269 | HCL-HF | 522 | <.6 | LEAF |
| 119 | | | | 2.1 | 6.2 | 1269 | HCL-HF | 234 | <.6 | LEAF |
| 120 | | | | 3.03 | 6.1 | 1269 | HCL-HF | 352 | 0.3 | LEAF |
| 121 | | | | 1.19 | NA | 0 | HCL-HF | 36 | 1 | LEAF |
| 122 | | | | 1.01 | 7.1 | 0 | HCL-HF | 28 | 1.1 | LEAF |
| 123 | | | | 0.93 | 7.5 | 0 | HCL-HF | 47 | 1.2 | LEAF |
| 124 | | | | 1.05 | 7.7 | 0 | HCL-HF | 40 | 0.6 | LEAF |
| 125 | | | | 1.07 | 7.3 | 0 | HCL-HF | 47 | 0.9 | LEAF |
| 126 | | | | 1.29 | NA | 138 | HCL-HF | 54 | 1 | LEAF |
| 127 | | | | 1.06 | 7.2 | 148 | HCL-HF | 50 | 1.1 | LEAF |
| 128 | | | | 1.1 | 7.6 | 167 | HCL-HF | 83 | 0.9 | LEAF |
| 129 | | | | 1.29 | 7.6 | 218 | HCL-HF | 71 | 0.6 | LEAF |
| 130 | | | | 1.17 | 7.6 | 261 | HCL-HF | 103 | 1.3 | LEAF |
| 131 | | | | 1.38 | NA | 276 | HCL-HF | 71 | 1 | LEAF |
| 132 | | | | 1.15 | 7.1 | 296 | HCL-HF | 56 | 0.9 | LEAF |
| 133 | | | | 1.29 | 7.6 | 334 | HCL-HF | 95 | 1.6 | LEAF |
| 134 | | | | 1.58 | 7.6 | 436 | HCL-HF | 93 | <.6 | LEAF |
| 135 | | | | 1.75 | 7.5 | 521 | HCL-HF | 146 | 0.7 | LEAF |
| 136 | | | | 1.63 | NA | 551 | HCL-HF | 110 | 1 | LEAF |
| 137 | | | | 1.28 | 6.9 | 591 | HCL-HF | 96 | 1.1 | LEAF |
| 138 | | | | 1.59 | 7.5 | 667 | HCL-HF | 150 | 1.1 | LEAF |
| 139 | | | | 1.9 | 7.5 | 872 | HCL-HF | 142 | 0.7 | LEAF |
| 140 | | | | 2.56 | 7.3 | 1042 | HCL-HF | 329 | 0.7 | LEAF |
| 141 | | | | 1.51 | NA | 0 | HCL-HF | 31 | 0.9 | LEAF |
| 142 | | | | 1.34 | 7 | 0 | HCL-HF | 27 | 1 | LEAF |
| 143 | | | | 1.29 | 7.2 | 0 | HCL-HF | 47 | 1.2 | LEAF |
| 144 | | | | 1.45 | 7.1 | 0 | HCL-HF | 35 | 0.9 | LEAF |
| 145 | | | | 1.3 | 7.6 | 0 | HCL-HF | 48 | <.6 | LEAF |
| 146 | | | | 1.3 | 7 | 0 | HCL-HF | 48 | <.6 | LEAF |
| 147 | | | | 1.41 | 7.2 | 0 | HCL-HF | 45 | <.6 | LEAF |
| 148 | | | | 1.32 | 6.7 | 0 | HCL-HF | 49 | <.6 | LEAF |
| 149 | | | | 1.38 | 7 | 0 | HCL-HF | 44 | <.6 | LEAF |
| 150 | | | | 1.69 | 7 | 0 | HCL-HF | 38 | 0.2 | LEAF |
| 151 | | | | 1.48 | 7.4 | 0 | HCL-HF | 45 | NA | LEAF |
| 152 | | | | 1.52 | NA | 138 | HCL-HF | 53 | 1 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 115 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 116 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 117 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 118 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 119 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 120 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 121 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 122 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 123 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 124 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 125 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 126 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 127 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 128 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 37* | STOVER | *NO |
| 129 | SLUDGE, FIELD, MATURITY | 60* | GRAIN | 0 | STOVER | *NO |
| 130 | SLUDGE, FIELD, MATURITY | 28* | GRAIN | 0 | STOVER | *NO |
| 131 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 132 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 133 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 22* | STOVER | *NO |
| 134 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 135 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 136 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 137 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 138 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 139 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 140 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 141 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 142 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 143 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 144 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 145 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 146 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 147 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 148 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 149 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 150 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 151 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 152 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 115 | | JOLIET, ILLINOIS |
| 116 | | JOLIET, ILLINOIS |
| 117 | | JOLIET, ILLINOIS |
| 118 | | JOLIET, ILLINOIS |
| 119 | | JOLIET, ILLINOIS |
| 120 | | JOLIET, ILLINOIS |
| 121 | | JOLIET, ILLINOIS |
| 122 | | JOLIET, ILLINOIS |
| 123 | | JOLIET, ILLINOIS |
| 124 | | JOLIET, ILLINOIS |
| 125 | | JOLIET, ILLINOIS |
| 126 | | JOLIET, ILLINOIS |
| 127 | | JOLIET, ILLINOIS |
| 128 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 129 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 130 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 131 | | JOLIET, ILLINOIS |
| 132 | | JOLIET, ILLINOIS |
| 133 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 134 | | JOLIET, ILLINOIS |
| 135 | | JOLIET, ILLINOIS |
| 136 | | JOLIET, ILLINOIS |
| 137 | | JOLIET, ILLINOIS |
| 138 | | JOLIET, ILLINOIS |
| 139 | | JOLIET, ILLINOIS |
| 140 | | JOLIET, ILLINOIS |
| 141 | | JOLIET, ILLINOIS |
| 142 | | JOLIET, ILLINOIS |
| 143 | | JOLIET, ILLINOIS |
| 144 | | JOLIET, ILLINOIS |
| 145 | | JOLIET, ILLINOIS |
| 146 | | JOLIET, ILLINOIS |
| 147 | | JOLIET, ILLINOIS |
| 148 | | JOLIET, ILLINOIS |
| 149 | | JOLIET, ILLINOIS |
| 150 | | JOLIET, ILLINOIS |
| 151 | | JOLIET, ILLINOIS |
| 152 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 153 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 154 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 155 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 156 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 157 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 158 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 159 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 160 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 161 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 162 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 163 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 164 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 165 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 166 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 167 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 168 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 169 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 170 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 171 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 172 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 173 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 174 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 175 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 176 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 177 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 178 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 179 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 180 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 181 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 182 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 183 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 184 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 185 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 186 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 187 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 188 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 189 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 190 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 153 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 154 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 155 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 156 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 157 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 158 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 159 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 160 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 161 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 162 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 163 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 164 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 165 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 166 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 167 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 168 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 169 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 170 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 171 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 172 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 173 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 174 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 175 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 176 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 177 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 178 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 179 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 180 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 181 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 182 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 183 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 184 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 185 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 186 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 187 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 188 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 189 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 190 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 153 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | ELLIOT | SiL | |
| 154 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | ELLIOT | SiL | |
| 155 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | ELLIOT | SiL | |
| 156 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | ELLIOT | SiL | |
| 157 | CENT POLY, FECL3 | 17.8 | 111.5 | 0 | | ELLIOT | SiL | |
| 158 | CENT POLY, FECL3 | 0 | 111.5 | 1 | | ELLIOT | SiL | |
| 159 | CENT POLY, FECL3 | 0 | 111.5 | 2 | | ELLIOT | SiL | |
| 160 | CENT POLY, FECL3 | 0 | 111.5 | 3 | | ELLIOT | SiL | |
| 161 | CENT POLY, FECL3 | 0 | 111.5 | 4 | | ELLIOT | SiL | |
| 162 | CENT POLY, FECL3 | 0 | 111.5 | 5 | | ELLIOT | SiL | |
| 163 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | ELLIOT | SiL | |
| 164 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | ELLIOT | SiL | |
| 165 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | ELLIOT | SiL | |
| 166 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | ELLIOT | SiL | |
| 167 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | ELLIOT | SiL | |
| 168 | CENT POLY, FECL3 | 35.6 | 223 | 0 | | ELLIOT | SiL | |
| 169 | CENT POLY, FECL3 | 0 | 223 | 1 | | ELLIOT | SiL | |
| 170 | CENT POLY, FECL3 | 0 | 223 | 2 | | ELLIOT | SiL | |
| 171 | CENT POLY, FECL3 | 0 | 223 | 3 | | ELLIOT | SiL | |
| 172 | CENT POLY, FECL3 | 0 | 223 | 4 | | ELLIOT | SiL | |
| 173 | CENT POLY, FECL3 | 0 | 223 | 5 | | ELLIOT | SiL | |
| 174 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | ELLIOT | SiL | |
| 175 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | ELLIOT | SiL | |
| 176 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | ELLIOT | SiL | |
| 177 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | ELLIOT | SiL | |
| 178 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | ELLIOT | SiL | |
| 179 | CENT POLY, FECL3 | 71.2 | 446 | 0 | | ELLIOT | SiL | |
| 180 | CENT POLY, FECL3 | 0 | 446 | 1 | | ELLIOT | SiL | |
| 181 | CENT POLY, FECL3 | 0 | 446 | 2 | | ELLIOT | SiL | |
| 182 | CENT POLY, FECL3 | 0 | 446 | 3 | | ELLIOT | SiL | |
| 183 | CENT POLY, FECL3 | 0 | 446 | 4 | | ELLIOT | SiL | |
| 184 | CENT POLY, FECL3 | 0 | 446 | 5 | | ELLIOT | SiL | |
| 185 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 186 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 187 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 188 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 189 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 190 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 153 | | | | 1.4 | 6.9 | 148 | HCL-HF | 42 | 0.9 | LEAF |
| 154 | | | | 1.35 | 7.2 | 167 | HCL-HF | 64 | 1.7 | LEAF |
| 155 | | | | 1.58 | 7.4 | 218 | HCL-HF | 65 | 2 | LEAF |
| 156 | | | | 1.54 | 7.1 | 261 | HCL-HF | 84 | <.6 | LEAF |
| 157 | | | | 1.64 | 6.9 | 318 | HCL-HF | 99 | 0.6 | LEAF |
| 158 | | | | 1.69 | 6.9 | 318 | HCL-HF | 94 | 1.4 | LEAF |
| 159 | | | | 1.91 | 7 | 318 | HCL-HF | 116 | <.6 | LEAF |
| 160 | | | | 1.66 | 7.3 | 318 | HCL-HF | 110 | <.6 | LEAF |
| 161 | | | | 2.05 | 7.1 | 318 | HCL-HF | 100 | <.1 | LEAF |
| 162 | | | | 1.95 | 7.2 | 318 | HCL-HF | 78 | NA | LEAF |
| 163 | | | | 1.71 | NA | 276 | HCL-HF | 65 | 1.1 | LEAF |
| 164 | | | | 1.57 | 6.9 | 296 | HCL-HF | 51 | 1 | LEAF |
| 165 | | | | 1.57 | 7.3 | 334 | HCL-HF | 85 | 1.6 | LEAF |
| 166 | | | | 1.79 | 7.1 | 436 | HCL-HF | 83 | 0.9 | LEAF |
| 167 | | | | 1.93 | 6.9 | 521 | HCL-HF | 117 | <.6 | LEAF |
| 168 | | | | 2.09 | 6.6 | 634 | HCL-HF | 99 | 1.2 | LEAF |
| 169 | | | | 2.37 | 6.4 | 634 | HCL-HF | 145 | 1 | LEAF |
| 170 | | | | 2.4 | 6.4 | 634 | HCL-HF | 235 | 1.8 | LEAF |
| 171 | | | | 2.4 | 6.8 | 634 | HCL-HF | 173 | <.6 | LEAF |
| 172 | | | | 2.38 | 6.8 | 634 | HCL-HF | 122 | 0.2 | LEAF |
| 173 | | | | 2.48 | 7.2 | 634 | HCL-HF | 131 | NA | LEAF |
| 174 | | | | 2.06 | NA | 551 | HCL-HF | 91 | 1 | LEAF |
| 175 | | | | 2 | 6.4 | 591 | HCL-HF | 106 | 1.1 | LEAF |
| 176 | | | | 1.76 | 6.4 | 667 | HCL-HF | 106 | 1.9 | LEAF |
| 177 | | | | 2.67 | 6.2 | 872 | HCL-HF | 149 | 0.6 | LEAF |
| 178 | | | | 2.72 | 6.1 | 1042 | HCL-HF | 235 | 0.8 | LEAF |
| 179 | | | | 3.53 | 5.4 | 1268 | HCL-HF | 311 | 1.9 | LEAF |
| 180 | | | | 3.35 | 5.5 | 1268 | HCL-HF | 272 | 0.6 | LEAF |
| 181 | | | | 3.29 | 5.8 | 1268 | HCL-HF | 314 | 2.6 | LEAF |
| 182 | | | | 2.68 | 6 | 1268 | HCL-HF | 207 | <.6 | LEAF |
| 183 | | | | 3.02 | 6 | 1268 | HCL-HF | 179 | 0.2 | LEAF |
| 184 | | | | 2.2 | 6.3 | 1268 | HCL-HF | 132 | NA | LEAF |
| 185 | | | | 0.36 | NA | 0 | HCL-HF | 12 | 1.1 | LEAF |
| 186 | | | | 0.17 | 7 | 0 | HCL-HF | 13 | 1.4 | LEAF |
| 187 | | | | 0.21 | 7.2 | 0 | HCL-HF | 22 | 1.2 | LEAF |
| 188 | | | | 0.42 | 7.1 | 0 | HCL-HF | 19 | <.6 | LEAF |
| 189 | | | | 0.44 | 7 | 0 | HCL-HF | 29 | <.6 | LEAF |
| 190 | | | | 0.56 | 6.9 | 0 | HCL-HF | 15 | <.6 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 153 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 154 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 155 | SLUDGE, FIELD, MATURITY | 60* | GRAIN | 0 | STOVER | *NO |
| 156 | SLUDGE, FIELD, MATURITY | 28* | GRAIN | 0 | STOVER | *NO |
| 157 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 158 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 159 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 160 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 161 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 162 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 163 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 164 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 165 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 166 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 167 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 168 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 169 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 170 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 171 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 172 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 173 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 174 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 175 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 176 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 177 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 178 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 179 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 180 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 181 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 182 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 183 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 184 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 185 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 186 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 187 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 188 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 189 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 190 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 153 | | JOLIET, ILLINOIS |
| 154 | | JOLIET, ILLINOIS |
| 155 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 156 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 157 | | JOLIET, ILLINOIS |
| 158 | | JOLIET, ILLINOIS |
| 159 | | JOLIET, ILLINOIS |
| 160 | | JOLIET, ILLINOIS |
| 161 | | JOLIET, ILLINOIS |
| 162 | | JOLIET, ILLINOIS |
| 163 | | JOLIET, ILLINOIS |
| 164 | | JOLIET, ILLINOIS |
| 165 | | JOLIET, ILLINOIS |
| 166 | | JOLIET, ILLINOIS |
| 167 | | JOLIET, ILLINOIS |
| 168 | | JOLIET, ILLINOIS |
| 169 | | JOLIET, ILLINOIS |
| 170 | | JOLIET, ILLINOIS |
| 171 | | JOLIET, ILLINOIS |
| 172 | | JOLIET, ILLINOIS |
| 173 | | JOLIET, ILLINOIS |
| 174 | | JOLIET, ILLINOIS |
| 175 | | JOLIET, ILLINOIS |
| 176 | | JOLIET, ILLINOIS |
| 177 | | JOLIET, ILLINOIS |
| 178 | | JOLIET, ILLINOIS |
| 179 | | JOLIET, ILLINOIS |
| 180 | | JOLIET, ILLINOIS |
| 181 | | JOLIET, ILLINOIS |
| 182 | | JOLIET, ILLINOIS |
| 183 | | JOLIET, ILLINOIS |
| 184 | | JOLIET, ILLINOIS |
| 185 | | JOLIET, ILLINOIS |
| 186 | | JOLIET, ILLINOIS |
| 187 | | JOLIET, ILLINOIS |
| 188 | | JOLIET, ILLINOIS |
| 189 | | JOLIET, ILLINOIS |
| 190 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 191 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 192 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 193 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 194 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 195 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 196 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 197 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 198 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 199 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 200 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 201 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 202 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 203 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 204 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 205 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 206 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 207 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 208 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 209 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 210 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 211 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 212 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 213 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 214 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 215 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 216 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 217 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 218 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 219 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 220 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 221 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 222 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 223 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 224 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 225 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 226 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 227 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 228 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 191 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 192 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 193 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 194 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 195 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 196 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 197 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 198 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 199 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 200 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 201 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 202 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 203 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 204 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 205 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 206 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 207 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 208 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 209 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 210 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 211 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 212 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 213 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 214 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 215 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 216 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 217 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 218 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 219 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 220 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 221 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 222 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 223 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 224 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 225 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 226 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 227 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 228 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 191 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 192 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 193 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 194 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 195 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | SL | |
| 196 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | PLAINFIELD | SL | |
| 197 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | PLAINFIELD | SL | |
| 198 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | PLAINFIELD | SL | |
| 199 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | PLAINFIELD | SL | |
| 200 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | PLAINFIELD | SL | |
| 201 | CENT POLY, FECL3 | 17.8 | 111.5 | 0 | | PLAINFIELD | SL | |
| 202 | CENT POLY, FECL3 | 0 | 111.5 | 1 | | PLAINFIELD | SL | |
| 203 | CENT POLY, FECL3 | 0 | 111.5 | 2 | | PLAINFIELD | SL | |
| 204 | CENT POLY, FECL3 | 0 | 111.5 | 3 | | PLAINFIELD | SL | |
| 205 | CENT POLY, FECL3 | 0 | 111.5 | 4 | | PLAINFIELD | SL | |
| 206 | CENT POLY, FECL3 | 0 | 111.5 | 5 | | PLAINFIELD | SL | |
| 207 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | PLAINFIELD | SL | |
| 208 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | PLAINFIELD | SL | |
| 209 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | PLAINFIELD | SL | |
| 210 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | PLAINFIELD | SL | |
| 211 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | PLAINFIELD | SL | |
| 212 | CENT POLY, FECL3 | 35.6 | 223 | 0 | | PLAINFIELD | SL | |
| 213 | CENT POLY, FECL3 | 0 | 223 | 1 | | PLAINFIELD | SL | |
| 214 | CENT POLY, FECL3 | 0 | 223 | 2 | | PLAINFIELD | SL | |
| 215 | CENT POLY, FECL3 | 0 | 223 | 3 | | PLAINFIELD | SL | |
| 216 | CENT POLY, FECL3 | 0 | 223 | 4 | | PLAINFIELD | SL | |
| 217 | CENT POLY, FECL3 | 0 | 223 | 5 | | PLAINFIELD | SL | |
| 218 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | PLAINFIELD | SL | |
| 219 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | PLAINFIELD | SL | |
| 220 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | PLAINFIELD | SL | |
| 221 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | PLAINFIELD | SL | |
| 222 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | PLAINFIELD | SL | |
| 223 | CENT POLY, FECL3 | 71.2 | 446 | 0 | | PLAINFIELD | SL | |
| 224 | CENT POLY, FECL3 | 0 | 446 | 1 | | PLAINFIELD | SL | |
| 225 | CENT POLY, FECL3 | 0 | 446 | 2 | | PLAINFIELD | SL | |
| 226 | CENT POLY, FECL3 | 0 | 446 | 3 | | PLAINFIELD | SL | |
| 227 | CENT POLY, FECL3 | 0 | 446 | 4 | | PLAINFIELD | SL | |
| 228 | CENT POLY, FECL3 | 0 | 446 | 5 | | PLAINFIELD | SL | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 191 | | | | 0.48 | 7 | 0 | HCL-HF | 34 | 0.8 | LEAF |
| 192 | | | | 0.75 | 7 | 0 | HCL-HF | 54 | 1.2 | LEAF |
| 193 | | | | 0.76 | 7 | 0 | HCL-HF | 46 | 0.7 | LEAF |
| 194 | | | | 1.21 | 6.9 | 0 | HCL-HF | 46 | 0.4 | LEAF |
| 195 | | | | 0.84 | 7.1 | 0 | HCL-HF | 53 | NA | LEAF |
| 196 | | | | 0.31 | NA | 138 | HCL-HF | 29 | 1.2 | LEAF |
| 197 | | | | 0.44 | 7.2 | 148 | HCL-HF | 37 | 1.4 | LEAF |
| 198 | | | | 0.63 | 7.3 | 167 | HCL-HF | 68 | 1.2 | LEAF |
| 199 | | | | 0.67 | 7.5 | 218 | HCL-HF | 52 | 1.2 | LEAF |
| 200 | | | | 0.78 | 7 | 261 | HCL-HF | 97 | 1.3 | LEAF |
| 201 | | | | 0.8 | 7 | 318 | HCL-HF | 87 | 1.7 | LEAF |
| 202 | | | | 0.99 | 6.6 | 318 | HCL-HF | 105 | 6.2 | LEAF |
| 203 | | | | 1.42 | 7.1 | 318 | HCL-HF | 135 | 0.9 | LEAF |
| 204 | | | | 1.71 | 7.2 | 318 | HCL-HF | 179 | <.6 | LEAF |
| 205 | | | | 1.82 | 7.2 | 318 | HCL-HF | 153 | 0.8 | LEAF |
| 206 | | | | 1.96 | 7.1 | 318 | HCL-HF | 119 | NA | LEAF |
| 207 | | | | 0.43 | NA | 276 | HCL-HF | 47 | 1.5 | LEAF |
| 208 | | | | 0.51 | 7.1 | 296 | HCL-HF | 60 | 1 | LEAF |
| 209 | | | | 0.94 | 7 | 334 | HCL-HF | 106 | 1.2 | LEAF |
| 210 | | | | 1.16 | 7.2 | 436 | HCL-HF | 102 | 0.8 | LEAF |
| 211 | | | | 1.4 | 7 | 521 | HCL-HF | 151 | 4 | LEAF |
| 212 | | | | 1.75 | 6.4 | 634 | HCL-HF | 183 | 0.8 | LEAF |
| 213 | | | | 2 | 6.3 | 634 | HCL-HF | 189 | 0.8 | LEAF |
| 214 | | | | 2.16 | 6.8 | 634 | HCL-HF | 207 | <.6 | LEAF |
| 215 | | | | 2.02 | 6.8 | 634 | HCL-HF | 250 | 0.7 | LEAF |
| 216 | | | | 2.33 | 7.1 | 634 | HCL-HF | 212 | <.1 | LEAF |
| 217 | | | | 1.66 | 7 | 634 | HCL-HF | 199 | NA | LEAF |
| 218 | | | | 0.73 | NA | 551 | HCL-HF | 115 | 1 | LEAF |
| 219 | | | | 0.57 | 6.8 | 591 | HCL-HF | 75 | 1.3 | LEAF |
| 220 | | | | 1.3 | 6.7 | 667 | HCL-HF | 136 | 1.2 | LEAF |
| 221 | | | | 1.42 | 6.6 | 872 | HCL-HF | 169 | 0.8 | LEAF |
| 222 | | | | 2.4 | 6.4 | 1042 | HCL-HF | 341 | <.6 | LEAF |
| 223 | | | | 2.76 | 6.1 | 1268 | HCL-HF | 327 | 0.6 | LEAF |
| 224 | | | | 3.44 | 5.8 | 1268 | HCL-HF | 344 | 3.6 | LEAF |
| 225 | | | | 3.16 | 5.9 | 1268 | HCL-HF | 452 | 1.3 | LEAF |
| 226 | | | | 3.28 | 6.2 | 1268 | HCL-HF | 334 | 0.7 | LEAF |
| 227 | | | | 3.1 | 6.4 | 1268 | HCL-HF | 347 | <.1 | LEAF |
| 228 | | | | 3.15 | 6.5 | 1268 | HCL-HF | 379 | NA | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 191 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 192 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 193 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 194 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 195 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 196 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 197 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 198 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 199 | SLUDGE, FIELD, MATURITY | 60* | GRAIN | 0 | STOVER | *NO |
| 200 | SLUDGE, FIELD, MATURITY | 60* | GRAIN | 0 | STOVER | *NO |
| 201 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 202 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 203 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 204 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 205 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 206 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 207 | SLUDGE, FIELD, MATURITY | NA | GRAIN | NA | STOVER | NO |
| 208 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 209 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 210 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 211 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 212 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 213 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 214 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 215 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 216 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 217 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 218 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | NA | STOVER | NO |
| 219 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 220 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 221 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 222 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 223 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 224 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 225 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 226 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 227 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |
| 228 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 191 | | JOLIET, ILLINOIS |
| 192 | | JOLIET, ILLINOIS |
| 193 | | JOLIET, ILLINOIS |
| 194 | | JOLIET, ILLINOIS |
| 195 | | JOLIET, ILLINOIS |
| 196 | | JOLIET, ILLINOIS |
| 197 | | JOLIET, ILLINOIS |
| 198 | | JOLIET, ILLINOIS |
| 199 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 200 | *DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 201 | | JOLIET, ILLINOIS |
| 202 | | JOLIET, ILLINOIS |
| 203 | | JOLIET, ILLINOIS |
| 204 | | JOLIET, ILLINOIS |
| 205 | | JOLIET, ILLINOIS |
| 206 | | JOLIET, ILLINOIS |
| 207 | | JOLIET, ILLINOIS |
| 208 | | JOLIET, ILLINOIS |
| 209 | | JOLIET, ILLINOIS |
| 210 | | JOLIET, ILLINOIS |
| 211 | | JOLIET, ILLINOIS |
| 212 | | JOLIET, ILLINOIS |
| 213 | | JOLIET, ILLINOIS |
| 214 | | JOLIET, ILLINOIS |
| 215 | | JOLIET, ILLINOIS |
| 216 | | JOLIET, ILLINOIS |
| 217 | | JOLIET, ILLINOIS |
| 218 | | JOLIET, ILLINOIS |
| 219 | | JOLIET, ILLINOIS |
| 220 | | JOLIET, ILLINOIS |
| 221 | | JOLIET, ILLINOIS |
| 222 | | JOLIET, ILLINOIS |
| 223 | | JOLIET, ILLINOIS |
| 224 | | JOLIET, ILLINOIS |
| 225 | | JOLIET, ILLINOIS |
| 226 | | JOLIET, ILLINOIS |
| 227 | | JOLIET, ILLINOIS |
| 228 | | JOLIET, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 229 | CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29 | WHEAT | HDM 1553 | 8.4 | | | | |
| 230 | CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29 | WHEAT | HDM 1553 | | | | | |
| 231 | CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29 | WHEAT | HDM 1553 | | | | | |
| 232 | GILLIES ET AL 1989 | OAT | HARMON | | | | | 4.6 |
| 233 | GILLIES ET AL 1989 | OAT | HARMON | | | | | 4.6 |
| 234 | GILLIES ET AL 1989 | OAT | HARMON | | | | | 4.6 |
| 235 | KIRKHAM 1983 | SORGHAM | MOENCH. | 6.7 | | | | 29.2 |
| 236 | KIRKHAM 1983 | SORGHAM | MOENCH. | 6.7 | | | | 29.2 |
| 237 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 238 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 239 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 240 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 241 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 242 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 243 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 244 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 245 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 246 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 247 | WEBBER 1972 | RED BEET | | | | | | |
| 248 | WEBBER 1972 | RED BEET | | | | | | |
| 249 | WEBBER 1972 | RED BEET | | | | | | |
| 250 | WEBBER 1972 | RED BEET | | | | | | |
| 251 | WEBBER 1972 | RED BEET | | | | | | |
| 252 | WEBBER 1972 | RED BEET | | | | | | |
| 253 | WEBBER 1972 | CELERY | | | | | | |
| 254 | WEBBER 1972 | CELERY | | | | | | |
| 255 | WEBBER 1972 | CELERY | | | | | | |
| 256 | WEBBER 1972 | CELERY | | | | | | |
| 257 | WEBBER 1972 | CELERY | | | | | | |
| 258 | WEBBER 1972 | CELERY | | | | | | |
| 259 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 260 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 261 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 262 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 263 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 264 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 265 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 266 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 229 | N/D | 10 | | | | | | 30 | | Well Water(Control) |
| 230 | 45 | 428 | | | | | | 562 | | Well Water + 10 t/ha sludge |
| 231 | 45 | 428 | | | | | | 562 | | Well Water + 20 t/ha sludge |
| 232 | 191 | 143 | | | 26.3 | 27200 | 194 | 420 | | |
| 233 | 191 | 143 | | | 26.3 | 27200 | 194 | 420 | | |
| 234 | 191 | 143 | | | 26.3 | 27200 | 194 | 420 | | |
| 235 | 851 | 375 | | | 35.6 | 21300 | 124 | 1890 | | |
| 236 | 851 | 375 | | | 35.6 | 21300 | 124 | 1890 | | |
| 237 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 238 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 239 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 240 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 241 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 242 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 243 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 244 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 245 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 246 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 247 | | | | | | | | | | |
| 248 | 240 | 1100 | | | 210 | | | 3000 | | |
| 249 | 9750 | 795 | | | 130 | | | 900 | | |
| 250 | 9750 | 795 | | | 130 | | | 900 | | |
| 251 | 240 | 1100 | | | 210 | | | 3000 | | |
| 252 | 9750 | 795 | | | 130 | | | 900 | | |
| 253 | | | | | | | | | | |
| 254 | 240 | 1100 | | | 210 | | | 3000 | | |
| 255 | 9750 | 795 | | | 130 | | | 900 | | |
| 256 | 9750 | 795 | | | 130 | | | 900 | | |
| 257 | 240 | 1100 | | | 210 | | | 3000 | | |
| 258 | 9750 | 795 | | | 130 | | | 900 | | |
| 259 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 260 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 261 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 262 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 263 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 264 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 265 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 266 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 229 | | | | | | | Clayey | |
| 230 | | 10 | 10 | 0 | | | Clayey | |
| 231 | | 20 | 20 | 0 | | | Clayey | |
| 232 | | 0 | 0 | | | | | |
| 233 | | 75 | 75 | | | | | |
| 234 | | 150 | 150 | | | | | |
| 235 | | 0 | 0 | | Typic Udifluvent | Haynie | fine sandy loam | |
| 236 | | 32 | 128 | | Typic Udifluvent | Haynie | fine sandy loam | |
| 237 | | 0 | 0 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 238 | | 25 | 25 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 239 | | 50 | 50 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 240 | | 100 | 100 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 241 | | 200 | 200 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 242 | | 0 | 0 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 243 | | 25 | 25 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 244 | | 50 | 50 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 245 | | 100 | 100 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 246 | | 200 | 200 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | |
| 247 | | 0 | 0 | 0 | | | | |
| 248 | | 125.5 | 125.5 | 2 | | | | |
| 249 | | 125.5 | 125.5 | 2 | | | | |
| 250 | | 125.5 | 125.5 | 2 | | | | |
| 251 | | 31.4 | 94.2 | 0 | | | | |
| 252 | | 31.4 | 94.2 | 0 | | | | |
| 253 | | 0 | 0 | 0 | | | | |
| 254 | | 125.5 | 125.5 | 2 | | | | |
| 255 | | 125.5 | 125.5 | 2 | | | | |
| 256 | | 125.5 | 125.5 | 2 | | | | |
| 257 | | 31.4 | 94.2 | 0 | | | | |
| 258 | | 31.4 | 94.2 | 0 | | | | |
| 259 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 260 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 261 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 262 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 263 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 264 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 265 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 266 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 229 | | | | 0.7 | 8 | | HCL04/HNO3 | 17 | 3 | Earhead |
| 230 | | | | 0.7 | 8 | | HCL04/HNO3 | 27 | 3.1 | Earhead |
| 231 | | | | 0.7 | 8 | | HCL04/HNO3 | 31 | 3.4 | Earhead |
| 232 | | | 28 | | | | | 9.6 | 43 | Root |
| 233 | | | | | | | | | 72 | Root |
| 234 | | | | | | | | | 56 | Root |
| 235 | | | | | 7 | 0 | | 0.2 | 0.398 | Leaves |
| 236 | | | | | 5.9 | 108.9 | | 0.24 | 0.2 | Leaves |
| 237 | | | | | 6.5 | 0 | | N.L. | 3.3 | LEAF |
| 238 | | | | | 6.5 | 28 | | N.L. | 3.6 | LEAF |
| 239 | | | | | 6.5 | 55 | | N.L. | 6.9 | LEAF |
| 240 | | | | | 6.5 | 110 | | N.L. | 7.4 | LEAF |
| 241 | | | | | 6.5 | 220 | | N.L. | 11.9 | LEAF |
| 242 | | | | | 6.5 | 0 | | N.L. | 0.7 | LEAF |
| 243 | | | | | 6.5 | 28 | | N.L. | 0.7 | LEAF |
| 244 | | | | | 6.5 | 55 | | N.L. | 0.8 | LEAF |
| 245 | | | | | 6.5 | 110 | | N.L. | 0.6 | LEAF |
| 246 | | | | | 6.5 | 220 | | N.L. | 0.5 | LEAF |
| 247 | | | | | 6.1 | 0 | .5 M HOAC | N.R. | | |
| 248 | | | | | NR | 29 | .5 M HOAC | N.R. | | |
| 249 | | | | | NR | 552 | .5 M HOAC | N.R. | | |
| 250 | | | | | NR | 1104 | .5 M HOAC | N.R. | | |
| 251 | | | | | NR | 22 | .5 M HOAC | N.R. | | |
| 252 | | | | | NR | 104 | .5 M HOAC | N.R. | | |
| 253 | | | | | 6.1 | 0 | .5 M HOAC | N.R. | | |
| 254 | | | | | NR | 29 | .5 M HOAC | N.R. | | |
| 255 | | | | | NR | 552 | .5 M HOAC | N.R. | | |
| 256 | | | | | NR | 1104 | .5 M HOAC | N.R. | | |
| 257 | | | | | NR | 22 | .5 M HOAC | N.R. | | |
| 258 | | | | | NR | 104 | .5 M HOAC | N.R. | | |
| 259 | | | | 0.44 | 7.5 | 0 | 0.1 M HCl | 6.5 | 0.67 | LEAF |
| 260 | | | | 0.36 | 7.5 | 0 | 0.1 M HCl | 5.2 | 0.79 | LEAF |
| 261 | | | | 0.36 | 7.5 | 0 | 0.1 M HCl | 4.2 | 6.47 | LEAF |
| 262 | | | | 0.46 | 7.5 | 0 | 0.1 M HCl | 5.3 | 6.03 | LEAF |
| 263 | | | | 0.46 | 7.5 | 0 | 0.1 M HCl | 4.97 | 7.15 | LEAF |
| 264 | | | | 0.73 | 7.5 | 0 | 0.1 M HCl | 4.03 | 0.44 | LEAF |
| 265 | | | | 0.73 | 7.5 | 0 | 0.1 M HCl | 10.5 | 0.3 | LEAF |
| 266 | | | | 0.7 | 7.5 | 0 | 0.1 M HCl | 9.17 | 0.24 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 229 | SALT, FIELD, MATURITY | 0 | Whole Plant | 0 | GRAIN | |
| 230 | SALT, FIELD, MATURITY | 0 | Whole Plant | 0 | GRAIN | |
| 231 | SALT, FIELD, MATURITY | 0 | Whole Plant | 0 | GRAIN | |
| 232 | FIELD, SLUDGE, MATURITY | | | 0 | GRAIN | |
| 233 | FIELD, SLUDGE, MATURITY | | | 0 | GRAIN | |
| 234 | FIELD, SLUDGE, MATURITY | | | 0 | GRAIN | |
| 235 | FIELD, SLUDGE, MATURITY | NOT REPORTED | | | | |
| 236 | FIELD, SLUDGE, MATURITY | NOT REPORTED | | | | |
| 237 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 238 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 239 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 240 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 241 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 242 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 243 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 244 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 245 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 246 | SLUDGE, FIELD, MATURITY | 0 | GRAIN | | | |
| 247 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 248 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 249 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 250 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 251 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 252 | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS | | | NO |
| 253 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 254 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 255 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 256 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 257 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 258 | SLUDGE, FIELD, MATURITY | 0 | STALKS | | | NO |
| 259 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 260 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 261 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 262 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 263 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 264 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 265 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 266 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 229 | | India |
| 230 | | India |
| 231 | | India |
| 232 | | Canada |
| 233 | | Canada |
| 234 | | Canada |
| 235 | | Manhattan, Kansas |
| 236 | | Manhattan, Kansas |
| 237 | | MINNESOTA |
| 238 | | MINNESOTA |
| 239 | | MINNESOTA |
| 240 | | MINNESOTA |
| 241 | | MINNESOTA |
| 242 | | MINNESOTA |
| 243 | | MINNESOTA |
| 244 | | MINNESOTA |
| 245 | | MINNESOTA |
| 246 | | MINNESOTA |
| 247 | | LEEDS, U.K. |
| 248 | | LEEDS, U.K. |
| 249 | | LEEDS, U.K. |
| 250 | | LEEDS, U.K. |
| 251 | | LEEDS, U.K. |
| 252 | | LEEDS, U.K. |
| 253 | | LEEDS, U.K. |
| 254 | | LEEDS, U.K. |
| 255 | | LEEDS, U.K. |
| 256 | | LEEDS, U.K. |
| 257 | | LEEDS, U.K. |
| 258 | | LEEDS, U.K. |
| 259 | | FULTON COUNTY, ILLINOIS |
| 260 | | FULTON COUNTY, ILLINOIS |
| 261 | | FULTON COUNTY, ILLINOIS |
| 262 | | FULTON COUNTY, ILLINOIS |
| 263 | | FULTON COUNTY, ILLINOIS |
| 264 | | FULTON COUNTY, ILLINOIS |
| 265 | | FULTON COUNTY, ILLINOIS |
| 266 | | FULTON COUNTY, ILLINOIS |

TABLE F-1 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 267 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 268 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 269 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 270 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 271 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 272 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 273 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 274 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 275 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 276 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 277 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 278 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 279 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 280 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 281 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 282 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 283 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 284 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 285 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 286 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 287 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 288 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 289 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 290 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 291 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 292 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 293 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 294 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |

TABLE F-1 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 267 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 268 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 269 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 270 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 271 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 272 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 273 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 274 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 275 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 276 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 277 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 278 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 279 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 280 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 281 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 282 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 283 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 284 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 285 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 286 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 287 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 288 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 289 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 290 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 291 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 292 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 293 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 294 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |

TABLE F-1 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % |
|---|---|---|---|---|---|---|---|---|
| 267 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | | |
| 268 | POLYMER,FECL3 | 17.4 | 115.3 | 0 | STRIP MINE SPOIL | | | |
| 269 | POLYMER,FECL3 | 11.4 | 126.7 | 0 | STRIP MINE SPOIL | | | |
| 270 | POLYMER,FECL3 | 16.8 | 143.5 | 0 | STRIP MINE SPOIL | | | |
| 271 | POLYMER,FECL3 | 17.9 | 161.4 | 0 | STRIP MINE SPOIL | | | |
| 272 | POLYMER,FECL3 | 16.8 | 178.2 | 0 | STRIP MINE SPOIL | | | |
| 273 | POLYMER,FECL3 | 16.8 | 195 | 0 | STRIP MINE SPOIL | | | |
| 274 | POLYMER,FECL3 | 16.8 | 211.8 | 0 | STRIP MINE SPOIL | | | |
| 275 | POLYMER,FECL3 | 16.8 | 228.6 | 0 | STRIP MINE SPOIL | | | |
| 276 | POLYMER,FECL3 | 16.8 | 245.4 | 0 | STRIP MINE SPOIL | | | |
| 277 | POLYMER,FECL3 | 34.8 | 235.7 | 0 | STRIP MINE SPOIL | | | |
| 278 | POLYMER,FECL3 | 22.8 | 258.5 | 0 | STRIP MINE SPOIL | | | |
| 279 | POLYMER,FECL3 | 34.9 | 293.4 | 0 | STRIP MINE SPOIL | | | |
| 280 | POLYMER,FECL3 | 35.8 | 329.2 | 0 | STRIP MINE SPOIL | | | |
| 281 | POLYMER,FECL3 | 33.6 | 362.8 | 0 | STRIP MINE SPOIL | | | |
| 282 | POLYMER,FECL3 | 33.6 | 396.4 | 0 | STRIP MINE SPOIL | | | |
| 283 | POLYMER,FECL3 | 33.6 | 430 | 0 | STRIP MINE SPOIL | | | |
| 284 | POLYMER,FECL3 | 33.6 | 463.6 | 0 | STRIP MINE SPOIL | | | |
| 285 | POLYMER,FECL3 | 33.6 | 497.2 | 0 | STRIP MINE SPOIL | | | |
| 286 | POLYMER,FECL3 | 69.8 | 471.4 | 0 | STRIP MINE SPOIL | | | |
| 287 | POLYMER,FECL3 | 45.5 | 516.9 | 0 | STRIP MINE SPOIL | | | |
| 288 | POLYMER,FECL3 | 68.8 | 585.7 | 0 | STRIP MINE SPOIL | | | |
| 289 | POLYMER,FECL3 | 71.7 | 657.4 | 0 | STRIP MINE SPOIL | | | |
| 290 | POLYMER,FECL3 | 67.2 | 724.6 | 0 | STRIP MINE SPOIL | | | |
| 291 | POLYMER,FECL3 | 67.2 | 791.8 | 0 | STRIP MINE SPOIL | | | |
| 292 | POLYMER,FECL3 | 67.2 | 859 | 0 | STRIP MINE SPOIL | | | |
| 293 | POLYMER,FECL3 | 67.2 | 926.2 | 0 | STRIP MINE SPOIL | | | |
| 294 | POLYMER,FECL3 | 67.2 | 993.4 | 0 | STRIP MINE SPOIL | | | |

TABLE F-1 (cont.)

| | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM CR LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CR CONCENTRTN mg/kg | PLANT CR CONCENTRTN mg/kg | PLANT TISSUE SAMPLED |
|---|---|---|---|---|---|---|---|---|---|---|
| 267 | | | | 0.7 | 7.5 | 0 | 0.1 M HCl | 13.7 | 1.66 | LEAF |
| 268 | | | | 0.94 | 7.5 | 438.2 | 0.1 M HCl | 27.6 | 0.8 | LEAF |
| 269 | | | | 0.67 | 7.5 | 473.2 | 0.1 M HCl | 16.8 | 1.14 | LEAF |
| 270 | | | | 0.67 | 7.5 | 534.4 | 0.1 M HCl | 13.8 | 2.96 | LEAF |
| 271 | | | | 0.87 | 7.5 | 577.8 | 0.1 M HCl | 20.7 | 6.78 | LEAF |
| 272 | | | | 0.87 | 7.5 | 616.8 | 0.1 M HCl | 16.7 | 6.25 | LEAF |
| 273 | | | | 1.41 | 7.5 | 654.7 | 0.1 M HCl | 24 | 0.43 | LEAF |
| 274 | | | | 1.41 | 7.5 | 699.5 | 0.1 M HCl | 28.3 | 0.43 | LEAF |
| 275 | | | | 1.25 | 7.5 | 747.6 | 0.1 M HCl | 27.4 | 0.4 | LEAF |
| 276 | | | | 1.25 | 7.5 | 759 | 0.1 M HCl | 33.8 | 1.03 | LEAF |
| 277 | | | | 1.56 | 7.5 | 876.4 | 0.1 M HCl | 62.9 | 0.69 | LEAF |
| 278 | | | | 1.56 | 7.5 | 946.3 | 0.1 M HCl | 42.9 | 0.67 | LEAF |
| 279 | | | | 1.04 | 7.5 | 1068.8 | 0.1 M HCl | 33.4 | 1.95 | LEAF |
| 280 | | | | 1.04 | 7.5 | 1155.5 | 0.1 M HCl | 52.7 | 6.32 | LEAF |
| 281 | | | | 1.48 | 7.5 | 1233.6 | 0.1 M HCl | 41.5 | 3.64 | LEAF |
| 282 | | | | 1.48 | 7.5 | 1309.5 | 0.1 M HCl | 43.7 | 0.39 | LEAF |
| 283 | | | | 2.15 | 7.5 | 1399 | 0.1 M HCl | 54.7 | 0.29 | LEAF |
| 284 | | | | 2.15 | 7.5 | 1495.2 | 0.1 M HCl | 51.4 | 0.2 | LEAF |
| 285 | | | | 1.9 | 7.5 | 1518 | 0.1 M HCl | 71 | 1.58 | LEAF |
| 286 | | | | 3.02 | 7.5 | 1752.7 | 0.1 M HCl | 118.8 | 0.77 | LEAF |
| 287 | | | | 1.58 | 7.5 | 1892.6 | 0.1 M HCl | 88.8 | 0.51 | LEAF |
| 288 | | | | 1.58 | 7.5 | 2137.5 | 0.1 M HCl | 55.1 | 2.11 | LEAF |
| 289 | | | | 2.38 | 7.5 | 2311 | 0.1 M HCl | 107.7 | 3.98 | LEAF |
| 290 | | | | 2.38 | 7.5 | 2467.2 | 0.1 M HCl | 79.6 | 10.6 | LEAF |
| 291 | | | | 3.47 | 7.5 | 2618.9 | 0.1 M HCl | 99.8 | 0.43 | LEAF |
| 292 | | | | 3.47 | 7.5 | 2797.9 | 0.1 M HCl | 89.7 | 0.27 | LEAF |
| 293 | | | | 2.77 | 7.5 | 2990.4 | 0.1 M HCl | 93.9 | 0.45 | LEAF |
| 294 | | | | 2.77 | 7.5 | 3036 | 0.1 M HCl | 114 | 1.31 | LEAF |

TABLE F-1 (cont.)

| | EXPERIMENTAL PROTOCOL SUMMARY | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|---|
| 267 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 268 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 269 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 270 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 271 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 272 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 273 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 274 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 275 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 276 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 277 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 278 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 279 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 280 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 281 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 282 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 283 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 284 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 285 | FIELD, SLUDGE, MATURITY | 43.7 | GRAIN | 0 | STOVER | |
| 286 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 287 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 288 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 289 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 290 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 291 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 292 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 293 | FIELD, SLUDGE, MATURITY | 0 | GRAIN | 0 | STOVER | |
| 294 | FIELD, SLUDGE, MATURITY | 59.2 | GRAIN | 0 | STOVER | |

TABLE F-1 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 267 | | FULTON COUNTY, ILLINOIS |
| 268 | | FULTON COUNTY, ILLINOIS |
| 269 | | FULTON COUNTY, ILLINOIS |
| 270 | | FULTON COUNTY, ILLINOIS |
| 271 | | FULTON COUNTY, ILLINOIS |
| 272 | | FULTON COUNTY, ILLINOIS |
| 273 | | FULTON COUNTY, ILLINOIS |
| 274 | | FULTON COUNTY, ILLINOIS |
| 275 | | FULTON COUNTY, ILLINOIS |
| 276 | | FULTON COUNTY, ILLINOIS |
| 277 | | FULTON COUNTY, ILLINOIS |
| 278 | | FULTON COUNTY, ILLINOIS |
| 279 | | FULTON COUNTY, ILLINOIS |
| 280 | | FULTON COUNTY, ILLINOIS |
| 281 | | FULTON COUNTY, ILLINOIS |
| 282 | | FULTON COUNTY, ILLINOIS |
| 283 | | FULTON COUNTY, ILLINOIS |
| 284 | | FULTON COUNTY, ILLINOIS |
| 285 | | FULTON COUNTY, ILLINOIS |
| 286 | | FULTON COUNTY, ILLINOIS |
| 287 | | FULTON COUNTY, ILLINOIS |
| 288 | | FULTON COUNTY, ILLINOIS |
| 289 | | FULTON COUNTY, ILLINOIS |
| 290 | | FULTON COUNTY, ILLINOIS |
| 291 | | FULTON COUNTY, ILLINOIS |
| 292 | | FULTON COUNTY, ILLINOIS |
| 293 | | FULTON COUNTY, ILLINOIS |
| 294 | | FULTON COUNTY, ILLINOIS |

TABLE F-2. COPPER DATA

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GIORDANO AND MAYS 1977 | BEANS | | | | | | | | |
| 2 | GIORDANO AND MAYS 1977 | BEANS | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 3 | GIORDANO AND MAYS 1977 | BEANS | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 4 | GIORDANO AND MAYS 1977 | OKRA | | | | | | | | |
| 5 | GIORDANO AND MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 6 | GIORDANO AND MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 7 | GIORDANO AND MAYS 1977 | PEPPERS | | | | | | | | |
| 8 | GIORDANO AND MAYS 1977 | PEPPERS | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 9 | GIORDANO AND MAYS 1977 | PEPPERS | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 10 | GIORDANO AND MAYS 1977 | TOMATO | | | | | | | | |
| 11 | GIORDANO AND MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 12 | GIORDANO AND MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 13 | GIORDANO AND MAYS 1977 | SQUASH | | | | | | | | |
| 14 | GIORDANO AND MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 15 | GIORDANO AND MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 16 | GIORDANO AND MAYS 1977 | TURNIP | | | | | | | | |
| 17 | GIORDANO AND MAYS 1977 | TURNIP | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 18 | GIORDANO AND MAYS 1977 | TURNIP | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 19 | GIORDANO AND MAYS 1977 | KALE | | | | | | | | |
| 20 | GIORDANO AND MAYS 1977 | KALE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 21 | GIORDANO AND MAYS 1977 | KALE | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 22 | GIORDANO AND MAYS 1977 | OKRA | | | | | | | | |
| 23 | GIORDANO AND MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 24 | GIORDANO AND MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 25 | GIORDANO AND MAYS 1977 | PEPPER | | | | | | | | |
| 26 | GIORDANO AND MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 27 | GIORDANO AND MAYS 1977 | PEPPER | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 28 | GIORDANO AND MAYS 1977 | TOMATO | | | | | | | | |
| 29 | GIORDANO AND MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 30 | GIORDANO AND MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 31 | GIORDANO AND MAYS 1977 | SQUASH | | | | | | | | |
| 32 | GIORDANO AND MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 33 | GIORDANO AND MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 34 | GIORDANO AND MAYS 1977 | LETTUCE | | | | | | | | |
| 35 | GIORDANO AND MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 36 | GIORDANO AND MAYS 1977 | LETTUCE | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 37 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1 | | | | | | | | | |
| 2 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 3 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 4 | | | | | | | | | |
| 5 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 6 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 7 | | | | | | | | | |
| 8 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 9 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 10 | | | | | | | | | |
| 11 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 12 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 13 | | | | | | | | | |
| 14 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 15 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 16 | | | | | | | | | |
| 17 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 18 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 19 | | | | | | | | | |
| 20 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 21 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 22 | | | | | | | | | |
| 23 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 24 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 25 | | | | | | | | | |
| 26 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 27 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 28 | | | | | | | | | |
| 29 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 30 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 31 | | | | | | | | | |
| 32 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 33 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 34 | | | | | | | | | |
| 35 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 36 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 37 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | | | SANGO | SiL | | | | |
| 2 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 3 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 4 | 0 | 0 | | | SANGO | SiL | | | | |
| 5 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 6 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 7 | 0 | 0 | | | SANGO | SiL | | | | |
| 8 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 9 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 10 | 0 | 0 | | | SANGO | SiL | | | | |
| 11 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 12 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 13 | 0 | 0 | | | SANGO | SiL | | | | |
| 14 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 15 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 16 | 0 | 0 | | | SANGO | SiL | | | | |
| 17 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 18 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 19 | 0 | 0 | | | SANGO | SiL | | | | |
| 20 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 21 | 112 | 112 | 0 | | SANGO | SiL | | | | |
| 22 | 0 | 0 | | | SANGO | SiL | | | | |
| 23 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 24 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 25 | 0 | 0 | | | SANGO | SiL | | | | |
| 26 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 27 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 28 | 0 | 0 | | | SANGO | SiL | | | | |
| 29 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 30 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 31 | 0 | 0 | | | SANGO | SiL | | | | |
| 32 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 33 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 34 | 0 | 0 | | | SANGO | SiL | | | | |
| 35 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 36 | 112 | 112 | 1 | | SANGO | SiL | | | | |
| 37 | 0 | 0 | NA | | BLOUNT | SiL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 6.4 | 0 | 0.5 M HCL | 4 | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 2 | | 6.4 | 82 | 0.5 M HCL | 41 | 7.8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 3 | | 6.4 | 58 | 0.5 M HCL | 17 | 5.8 | LEAF | FIELD, SLUDGE, MATURITY | 14.3* |
| 4 | | 6.4 | 0 | 0.5 M HCL | 4 | 6.9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 5 | | 6.4 | 82 | 0.5 M HCL | 41 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 8.3* |
| 6 | | 6.4 | 58 | 0.5 M HCL | 17 | 7.1 | LEAF | FIELD, SLUDGE, MATURITY | 8.3* |
| 7 | | 6.4 | 0 | 0.5 M HCL | 4 | 19 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 8 | | 6.4 | 82 | 0.5 M HCL | 41 | 21 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 9 | | 6.4 | 58 | 0.5 M HCL | 17 | 18 | LEAF | FIELD, SLUDGE, MATURITY | 13* |
| 10 | | 6.4 | 0 | 0.5 M HCL | 4 | 19 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 11 | | 6.4 | 82 | 0.5 M HCL | 41 | 22 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 12 | | 6.4 | 58 | 0.5 M HCL | 17 | 18 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 13 | | 6.4 | 0 | 0.5 M HCL | 4 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 14 | | 6.4 | 82 | 0.5 M HCL | 41 | 19 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 15 | | 6.4 | 58 | 0.5 M HCL | 17 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 16 | | 6.4 | 0 | 0.5 M HCL | 4 | 6.3 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 17 | | 6.4 | 82 | 0.5 M HCL | 41 | 9.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 18 | | 6.4 | 58 | 0.5 M HCL | 17 | 7.3 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 19 | | 6.4 | 0 | 0.5 M HCL | 4 | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 20 | | 6.4 | 82 | 0.5 M HCL | 41 | 8.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 21 | | 6.4 | 58 | 0.5 M HCL | 17 | 7.6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 22 | | 5.8 | 0 | 0.5 M HCL | 4 | 15.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 23 | | 5.8 | 82 | 0.5 M HCL | 41 | 14.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 24 | | 5.8 | 58 | 0.5 M HCL | 17 | 14.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 25 | | 5.8 | 0 | 0.5 M HCL | 4 | 14.7 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 26 | | 5.8 | 82 | 0.5 M HCL | 41 | 15.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 27 | | 5.8 | 58 | 0.5 M HCL | 17 | 15.4 | LEAF | FIELD, SLUDGE, MATURITY | 25* |
| 28 | | 5.8 | 0 | 0.5 M HCL | 4 | 21.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 29 | | 5.8 | 82 | 0.5 M HCL | 41 | 19.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 30 | | 5.8 | 58 | 0.5 M HCL | 17 | 22.8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 31 | | 5.8 | 0 | 0.5 M HCL | 4 | 16.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 32 | | 5.8 | 82 | 0.5 M HCL | 41 | 12.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 33 | | 5.8 | 58 | 0.5 M HCL | 17 | 9.4 | LEAF | FIELD, SLUDGE, MATURITY | 21.1* |
| 34 | | 5.8 | 0 | 0.5 M HCL | 4 | 17.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 35 | | 5.8 | 82 | 0.5 M HCL | 41 | 18.1 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 36 | | 5.8 | 58 | 0.5 M HCL | 17 | 12.7 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 37 | 0.85 | 7.8 | 0 | HCL-HF | 22 | 9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| | | | | |
| 1 | EDIBLE PART | | | NO |
| 2 | EDIBLE PART | | | NO |
| 3 | EDIBLE PART | | | *NO |
| 4 | EDIBLE PART | | | NO |
| 5 | EDIBLE PART | | | *NO |
| 6 | EDIBLE PART | | | *NO |
| 7 | EDIBLE PART | | | NO |
| 8 | EDIBLE PART | | | NO |
| 9 | EDIBLE PART | | | *NO |
| 10 | EDIBLE PART | | | NO |
| 11 | EDIBLE PART | | | NO |
| 12 | EDIBLE PART | | | NO |
| 13 | EDIBLE PART | | | NO |
| 14 | EDIBLE PART | | | NO |
| 15 | EDIBLE PART | | | NO |
| 16 | EDIBLE PART | | | NO |
| 17 | EDIBLE PART | | | NO |
| 18 | EDIBLE PART | | | NO |
| 19 | EDIBLE PART | | | NO |
| 20 | EDIBLE PART | | | NO |
| 21 | EDIBLE PART | | | NO |
| 22 | EDIBLE PART | | | NO |
| 23 | EDIBLE PART | | | NO |
| 24 | EDIBLE PART | | | NO |
| 25 | EDIBLE PART | | | NO |
| 26 | EDIBLE PART | | | NO |
| 27 | EDIBLE PART | | | *NO |
| 28 | EDIBLE PART | | | NO |
| 29 | EDIBLE PART | | | NO |
| 30 | EDIBLE PART | | | NO |
| 31 | EDIBLE PART | | | NO |
| 32 | EDIBLE PART | | | NO |
| 33 | EDIBLE PART | | | *NO |
| 34 | EDIBLE PART | | | NO |
| 35 | EDIBLE PART | | | NO |
| 36 | EDIBLE PART | | | NO |
| 37 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | | |
|---|---|---|
| | | |
| | COMMENTS | LOCATION |
| | | |
| 1 | | |
| 2 | | |
| 3 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 4 | | |
| 5 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 6 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 7 | | |
| 8 | | |
| 9 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 28 | | |
| 29 | | |
| 30 | | |
| 31 | | |
| 32 | | |
| 33 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | |
| 34 | | |
| 35 | | |
| 36 | | |
| 37 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 38 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 39 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 40 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 41 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 42 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 43 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 44 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 45 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 46 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 47 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 48 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 49 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 50 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 51 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 52 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 53 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 54 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 55 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 56 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 57 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 58 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 59 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 60 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 61 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 62 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 63 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 64 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 65 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 66 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 67 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 68 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 69 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 70 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 71 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 72 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 73 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 74 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 38 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 39 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 40 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 41 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 42 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 43 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 44 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 45 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 46 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 47 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 48 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 49 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 50 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 51 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 52 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 53 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 54 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 55 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 56 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 57 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 58 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 59 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 60 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 61 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 62 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 63 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 64 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 65 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 66 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 67 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 68 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 69 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 70 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 71 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 72 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 73 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 74 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 38 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 39 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 40 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 41 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 42 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 43 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 44 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 45 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 46 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 47 | 14.5 | 31.8 | 0 | | BLOUNT | SiL | | | | |
| 48 | 11.1 | 42.9 | 0 | | BLOUNT | SiL | | | | |
| 49 | 15.3 | 58.2 | 0 | | BLOUNT | SiL | | | | |
| 50 | 0 | 58.2 | 1 | | BLOUNT | SiL | | | | |
| 51 | 0 | 58.2 | 2 | | BLOUNT | SiL | | | | |
| 52 | 0 | 58.2 | 3 | | BLOUNT | SiL | | | | |
| 53 | 0 | 58.2 | 4 | | BLOUNT | SiL | | | | |
| 54 | 0 | 58.2 | 5 | | BLOUNT | SiL | | | | |
| 55 | 0 | 58.2 | 6 | | BLOUNT | SiL | | | | |
| 56 | 0 | 58.2 | 7 | | BLOUNT | SiL | | | | |
| 57 | 29 | 63.6 | 0 | | BLOUNT | SiL | | | | |
| 58 | 22.2 | 85.8 | 0 | | BLOUNT | SiL | | | | |
| 59 | 30.6 | 116.4 | 0 | | BLOUNT | SiL | | | | |
| 60 | 0 | 116.4 | 1 | | BLOUNT | SiL | | | | |
| 61 | 0 | 116.4 | 2 | | BLOUNT | SiL | | | | |
| 62 | 0 | 116.4 | 3 | | BLOUNT | SiL | | | | |
| 63 | 0 | 116.4 | 4 | | BLOUNT | SiL | | | | |
| 64 | 0 | 116.4 | 5 | | BLOUNT | SiL | | | | |
| 65 | 0 | 116.4 | 6 | | BLOUNT | SiL | | | | |
| 66 | 0 | 116.4 | 7 | | BLOUNT | SiL | | | | |
| 67 | 57.8 | 127 | 0 | | BLOUNT | SiL | | | | |
| 68 | 44.4 | 171.4 | 0 | | BLOUNT | SiL | | | | |
| 69 | 61.1 | 232.5 | 0 | | BLOUNT | SiL | | | | |
| 70 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 71 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 72 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 73 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 74 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 38 | 0.9 | 6.9 | 0 | HCL-HF | 20 | 11.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 39 | 0.94 | 7.6 | 0 | HCL-HF | 28 | 9.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 40 | 0.93 | 7.6 | 0 | HCL-HF | 22 | 11.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 41 | 0.92 | 7.8 | 0 | HCL-HF | 24 | 7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 42 | 0.87 | 7.5 | 0 | HCL-HF | 21 | 10.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 43 | 0.9 | 7.6 | 0 | HCL-HF | 25 | 6.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 44 | 0.88 | 7.5 | 0 | HCL-HF | 26 | 3.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 45 | 0.73 | 7.6 | 0 | HCL-HF | 22 | 8.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 46 | 1 | 7.4 | 0 | HCL-HF | 28 | 8.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 47 | 1.06 | 7.7 | 51.5 | HCL-HF | 42 | 11.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 48 | 1.11 | 6.9 | 59.8 | HCL-HF | 28 | 12.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 49 | 1.18 | 7.5 | 70 | HCL-HF | 42 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 50 | 1.4 | 7.5 | 70 | HCL-HF | 40 | 9.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 51 | 1.16 | 7.6 | 70 | HCL-HF | 42 | 7.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 52 | 1.08 | 7.5 | 70 | HCL-HF | 38 | 7.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 53 | 1.18 | 7.7 | 70 | HCL-HF | 45 | 5.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 54 | 1.23 | 7.6 | 70 | HCL-HF | 44 | 3.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 55 | 1.09 | 7.5 | 70 | HCL-HF | 36 | 8.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 56 | 1.32 | 7.3 | 70 | HCL-HF | 45 | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 57 | 1.38 | 7.6 | 103 | HCL-HF | 60 | 11.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 58 | 1.12 | 7 | 119.6 | HCL-HF | 38 | 14 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 59 | 1.29 | 7.4 | 140 | HCL-HF | 57 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 60 | 1.83 | 7.3 | 140 | HCL-HF | 67 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 61 | 1.36 | 7.5 | 140 | HCL-HF | 56 | 9.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 62 | 1.34 | 7.2 | 140 | HCL-HF | 49 | 7.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 63 | 1.6 | 7.4 | 140 | HCL-HF | 64 | 6.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 64 | 1.31 | 7.3 | 140 | HCL-HF | 68 | 3.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 65 | 1.54 | 7.1 | 140 | HCL-HF | 48 | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 66 | 1.62 | 7.1 | 140 | HCL-HF | 67 | 8.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 67 | 1.62 | 7.6 | 206 | HCL-HF | 102 | 10.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 68 | 1.63 | 6.8 | 239 | HCL-HF | 65 | 14.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 69 | 1.94 | 7.3 | 280 | HCL-HF | 91 | 9.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 70 | 2.5 | 7.2 | 280 | HCL-HF | 116 | 11.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 71 | 1.83 | 7.3 | 280 | HCL-HF | 91 | 10.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 72 | 1.88 | 7.2 | 280 | HCL-HF | 88 | 9.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 73 | 2.03 | 7.3 | 280 | HCL-HF | 106 | 7.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 74 | 1.6 | 7.1 | 280 | HCL-HF | 94 | 4.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 38 | GRAIN | 0 | STOVER | NO |
| 39 | GRAIN | 0 | STOVER | NO |
| 40 | GRAIN | 0 | STOVER | NO |
| 41 | GRAIN | 0 | STOVER | NO |
| 42 | GRAIN | 0 | STOVER | NO |
| 43 | GRAIN | 0 | STOVER | NO |
| 44 | GRAIN | 0 | STOVER | NO |
| 45 | GRAIN | 0 | STOVER | NO |
| 46 | GRAIN | 0 | STOVER | NO |
| 47 | GRAIN | NA | STOVER | NO |
| 48 | GRAIN | 0 | STOVER | NO |
| 49 | GRAIN | 0 | STOVER | NO |
| 50 | GRAIN | 0 | STOVER | NO |
| 51 | GRAIN | 0 | STOVER | NO |
| 52 | GRAIN | 0 | STOVER | NO |
| 53 | GRAIN | 0 | STOVER | NO |
| 54 | GRAIN | 0 | STOVER | NO |
| 55 | GRAIN | 0 | STOVER | NO |
| 56 | GRAIN | 0 | STOVER | NO |
| 57 | GRAIN | NA | STOVER | NO |
| 58 | GRAIN | 0 | STOVER | NO |
| 59 | GRAIN | 0 | STOVER | NO |
| 60 | GRAIN | 0 | STOVER | NO |
| 61 | GRAIN | 0 | STOVER | NO |
| 62 | GRAIN | 0 | STOVER | NO |
| 63 | GRAIN | 0 | STOVER | NO |
| 64 | GRAIN | 0 | STOVER | NO |
| 65 | GRAIN | 0 | STOVER | NO |
| 66 | GRAIN | 0 | STOVER | NO |
| 67 | GRAIN | NA | STOVER | NO |
| 68 | GRAIN | 0 | STOVER | NO |
| 69 | GRAIN | 0 | STOVER | NO |
| 70 | GRAIN | 0 | STOVER | NO |
| 71 | GRAIN | 0 | STOVER | NO |
| 72 | GRAIN | 0 | STOVER | NO |
| 73 | GRAIN | 0 | STOVER | NO |
| 74 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 38 | | JOLIET, ILLINOIS |
| 39 | | JOLIET, ILLINOIS |
| 40 | | JOLIET, ILLINOIS |
| 41 | | JOLIET, ILLINOIS |
| 42 | | JOLIET, ILLINOIS |
| 43 | | JOLIET, ILLINOIS |
| 44 | | JOLIET, ILLINOIS |
| 45 | | JOLIET, ILLINOIS |
| 46 | | JOLIET, ILLINOIS |
| 47 | | JOLIET, ILLINOIS |
| 48 | | JOLIET, ILLINOIS |
| 49 | | JOLIET, ILLINOIS |
| 50 | | JOLIET, ILLINOIS |
| 51 | | JOLIET, ILLINOIS |
| 52 | | JOLIET, ILLINOIS |
| 53 | | JOLIET, ILLINOIS |
| 54 | | JOLIET, ILLINOIS |
| 55 | | JOLIET, ILLINOIS |
| 56 | | JOLIET, ILLINOIS |
| 57 | | JOLIET, ILLINOIS |
| 58 | | JOLIET, ILLINOIS |
| 59 | | JOLIET, ILLINOIS |
| 60 | | JOLIET, ILLINOIS |
| 61 | | JOLIET, ILLINOIS |
| 62 | | JOLIET, ILLINOIS |
| 63 | | JOLIET, ILLINOIS |
| 64 | | JOLIET, ILLINOIS |
| 65 | | JOLIET, ILLINOIS |
| 66 | | JOLIET, ILLINOIS |
| 67 | | JOLIET, ILLINOIS |
| 68 | | JOLIET, ILLINOIS |
| 69 | | JOLIET, ILLINOIS |
| 70 | | JOLIET, ILLINOIS |
| 71 | | JOLIET, ILLINOIS |
| 72 | | JOLIET, ILLINOIS |
| 73 | | JOLIET, ILLINOIS |
| 74 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 75 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 76 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 77 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 78 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 79 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 80 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 81 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 82 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 83 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 84 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 85 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 86 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 87 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 88 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 89 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 90 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 91 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 92 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 93 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 94 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 95 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 96 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 97 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 98 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 99 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 100 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 101 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 102 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 103 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 104 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 105 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 106 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 107 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 108 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 109 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 110 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 111 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 75 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 76 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 77 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 78 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 79 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 80 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 81 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 82 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 83 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 84 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 85 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 86 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 87 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 88 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 89 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 90 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 91 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 92 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 93 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 94 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 95 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 96 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 97 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 98 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 99 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 100 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION. | CENT POLY, FECL3 |
| 101 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 102 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 103 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 104 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 105 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 106 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 107 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 108 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 109 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 110 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 111 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 75 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 76 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | | |
| 77 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 78 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 79 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 80 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 81 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 82 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 83 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 84 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 85 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 86 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 87 | 14.5 | 31.8 | 0 | | ELLIOT | SiL | | | | |
| 88 | 11.1 | 42.9 | 0 | | ELLIOT | SiL | | | | |
| 89 | 15.3 | 58.2 | 0 | | ELLIOT | SiL | | | | |
| 90 | 0 | 58.2 | 1 | | ELLIOT | SiL | | | | |
| 91 | 0 | 58.2 | 2 | | ELLIOT | SiL | | | | |
| 92 | 0 | 58.2 | 3 | | ELLIOT | SiL | | | | |
| 93 | 0 | 58.2 | 4 | | ELLIOT | SiL | | | | |
| 94 | 0 | 58.2 | 5 | | ELLIOT | SiL | | | | |
| 95 | 0 | 58.2 | 6 | | ELLIOT | SiL | | | | |
| 96 | 0 | 58.2 | 7 | | ELLIOT | SiL | | | | |
| 97 | 29 | 63.6 | 0 | | ELLIOT | SiL | | | | |
| 98 | 22.2 | 85.8 | 0 | | ELLIOT | SiL | | | | |
| 99 | 30.6 | 116.4 | 0 | | ELLIOT | SiL | | | | |
| 100 | 0 | 116.4 | 1 | | ELLIOT | SiL | | | | |
| 101 | 0 | 116.4 | 2 | | ELLIOT | SiL | | | | |
| 102 | 0 | 116.4 | 3 | | ELLIOT | SiL | | | | |
| 103 | 0 | 116.4 | 4 | | ELLIOT | SiL | | | | |
| 104 | 0 | 116.4 | 5 | | ELLIOT | SiL | | | | |
| 105 | 0 | 116.4 | 6 | | ELLIOT | SiL | | | | |
| 106 | 0 | 116.4 | 7 | | ELLIOT | SiL | | | | |
| 107 | 57.8 | 127 | 0 | | ELLIOT | SiL | | | | |
| 108 | 44.4 | 171.4 | 0 | | ELLIOT | SiL | | | | |
| 109 | 61.1 | 232.5 | 0 | | ELLIOT | SiL | | | | |
| 110 | 69.8 | 302.3 | 0 | | ELLIOT | SiL | | | | |
| 111 | 54 | 356.3 | 0 | | ELLIOT | SiL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 75 | 1.54 | 7.1 | 280 | HCL-HF | 62 | 8.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 76 | 1.84 | 7 | 280 | HCL-HF | 86 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 77 | 1.64 | 7.6 | 0 | HCL-HF | 19 | 10.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 78 | 1.61 | 6.8 | 0 | HCL-HF | 27 | 11.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 79 | 1.54 | 7.2 | 0 | HCL-HF | 26 | 5.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 80 | 1.53 | 7.2 | 0 | HCL-HF | 20 | 11.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 81 | 1.54 | 7 | 0 | HCL-HF | 22 | 9.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 82 | 1.51 | 7 | 0 | HCL-HF | 18 | 8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 83 | 1.58 | 7.4 | 0 | HCL-HF | 23 | 5.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 84 | 1.54 | 7.2 | 0 | HCL-HF | 26 | 3.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 85 | 1.51 | 7 | 0 | HCL-HF | 19 | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 86 | 1.62 | 7 | 0 | HCL-HF | 26 | 7.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 87 | 1.64 | 7.3 | 51.5 | HCL-HF | 39 | 13.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 88 | 1.84 | 6.8 | 59.8 | HCL-HF | 32 | 9.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 89 | 1.74 | 7.1 | 70 | HCL-HF | 39 | 7.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 90 | 2.18 | 7.1 | 70 | HCL-HF | 32 | 9.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 91 | 1.86 | 7.2 | 70 | HCL-HF | 44 | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 92 | 1.67 | 7.2 | 70 | HCL-HF | 38 | 6.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 93 | 1.83 | 7.5 | 70 | HCL-HF | 49 | 6.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 94 | 1.55 | 7.2 | 70 | HCL-HF | 44 | 4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 95 | 1.68 | 7 | 70 | HCL-HF | 36 | 9.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 96 | 1.89 | 7.1 | 70 | HCL-HF | 51 | 7.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 97 | 1.97 | 7.8 | 103 | HCL-HF | 65 | 12.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 98 | 1.81 | 7 | 119.6 | HCL-HF | 41 | 12.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 99 | 1.88 | 7.3 | 140 | HCL-HF | 64 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 100 | 2.21 | 7.3 | 140 | HCL-HF | 62 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 101 | 1.99 | 7.4 | 140 | HCL-HF | 59 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 102 | 1.89 | 7.3 | 140 | HCL-HF | 56 | 8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 103 | 1.94 | 7.4 | 140 | HCL-HF | 61 | 7.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 104 | 1.72 | 7.4 | 140 | HCL-HF | 68 | 4.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 105 | 1.79 | 7.2 | 140 | HCL-HF | 50 | 8.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 106 | 1.87 | 7.2 | 140 | HCL-HF | 54 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 107 | 2.23 | 7.5 | 206 | HCL-HF | 150 | 6.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 108 | 2.22 | 6.4 | 239.2 | HCL-HF | 64 | 13.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 109 | 2.28 | 6.5 | 280 | HCL-HF | 92 | 5.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 110 | 2.61 | 6.5 | 397 | HCL-HF | 112 | 9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 111 | 2.74 | 6.5 | 482 | HCL-HF | 117 | 12.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| | | | | |
| 75 | GRAIN | 0 | STOVER | NO |
| 76 | GRAIN | 0 | STOVER | NO |
| 77 | GRAIN | 0 | STOVER | NO |
| 78 | GRAIN | 0 | STOVER | NO |
| 79 | GRAIN | 0 | STOVER | NO |
| 80 | GRAIN | 0 | STOVER | NO |
| 81 | GRAIN | 0 | STOVER | NO |
| 82 | GRAIN | 0 | STOVER | NO |
| 83 | GRAIN | 0 | STOVER | NO |
| 84 | GRAIN | 0 | STOVER | NO |
| 85 | GRAIN | 0 | STOVER | NO |
| 86 | GRAIN | 0 | STOVER | NO |
| 87 | GRAIN | NA | STOVER | NO |
| 88 | GRAIN | 0 | STOVER | NO |
| 89 | GRAIN | 0 | STOVER | NO |
| 90 | GRAIN | 0 | STOVER | NO |
| 91 | GRAIN | 0 | STOVER | NO |
| 92 | GRAIN | 0 | STOVER | NO |
| 93 | GRAIN | 0 | STOVER | NO |
| 94 | GRAIN | 0 | STOVER | NO |
| 95 | GRAIN | 0 | STOVER | NO |
| 96 | GRAIN | 0 | STOVER | NO |
| 97 | GRAIN | NA | STOVER | NO |
| 98 | GRAIN | 0 | STOVER | NO |
| 99 | GRAIN | 0 | STOVER | NO |
| 100 | GRAIN | 0 | STOVER | NO |
| 101 | GRAIN | 0 | STOVER | NO |
| 102 | GRAIN | 0 | STOVER | NO |
| 103 | GRAIN | 0 | STOVER | NO |
| 104 | GRAIN | 0 | STOVER | NO |
| 105 | GRAIN | 0 | STOVER | NO |
| 106 | GRAIN | 0 | STOVER | NO |
| 107 | GRAIN | NA | STOVER | NO |
| 108 | GRAIN | 0 | STOVER | NO |
| 109 | GRAIN | 0 | STOVER | NO |
| 110 | GRAIN | 0 | STOVER | NO |
| 111 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 75 | | JOLIET, ILLINOIS |
| 76 | | JOLIET, ILLINOIS |
| 77 | | JOLIET, ILLINOIS |
| 78 | | JOLIET, ILLINOIS |
| 79 | | JOLIET, ILLINOIS |
| 80 | | JOLIET, ILLINOIS |
| 81 | | JOLIET, ILLINOIS |
| 82 | | JOLIET, ILLINOIS |
| 83 | | JOLIET, ILLINOIS |
| 84 | | JOLIET, ILLINOIS |
| 85 | | JOLIET, ILLINOIS |
| 86 | | JOLIET, ILLINOIS |
| 87 | | JOLIET, ILLINOIS |
| 88 | | JOLIET, ILLINOIS |
| 89 | | JOLIET, ILLINOIS |
| 90 | | JOLIET, ILLINOIS |
| 91 | | JOLIET, ILLINOIS |
| 92 | | JOLIET, ILLINOIS |
| 93 | | JOLIET, ILLINOIS |
| 94 | | JOLIET, ILLINOIS |
| 95 | | JOLIET, ILLINOIS |
| 96 | | JOLIET, ILLINOIS |
| 97 | | JOLIET, ILLINOIS |
| 98 | | JOLIET, ILLINOIS |
| 99 | | JOLIET, ILLINOIS |
| 100 | | JOLIET, ILLINOIS |
| 101 | | JOLIET, ILLINOIS |
| 102 | | JOLIET, ILLINOIS |
| 103 | | JOLIET, ILLINOIS |
| 104 | | JOLIET, ILLINOIS |
| 105 | | JOLIET, ILLINOIS |
| 106 | | JOLIET, ILLINOIS |
| 107 | | JOLIET, ILLINOIS |
| 108 | | JOLIET, ILLINOIS |
| 109 | | JOLIET, ILLINOIS |
| 110 | | JOLIET, ILLINOIS |
| 111 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 112 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 113 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 114 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 115 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 116 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 117 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 118 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 119 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 120 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 121 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 122 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 123 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 124 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 125 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 126 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 127 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 128 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 129 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 130 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 131 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 132 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 133 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 134 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 135 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 136 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 137 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 138 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 139 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 140 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 141 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 142 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 143 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 144 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 145 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 146 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 147 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 148 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 112 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 113 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 114 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 115 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 116 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 117 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 118 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 119 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 120 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 121 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 122 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 123 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 124 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 125 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 126 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 127 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 128 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 129 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 130 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 131 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 132 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 133 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 134 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 135 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 136 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 137 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 138 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 139 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 140 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 141 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 142 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 143 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 144 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 145 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 146 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 147 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 148 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 112 | 72 | 428.3 | 0 | | ELLIOT | SiL | | | | |
| 113 | 0 | 428.3 | 1 | | ELLIOT | SiL | | | | |
| 114 | 0 | 428.3 | 2 | | ELLIOT | SiL | | | | |
| 115 | 0 | 428.3 | 3 | | ELLIOT | SiL | | | | |
| 116 | 0 | 428.3 | 4 | | ELLIOT | SiL | | | | |
| 117 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 118 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 119 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 120 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 121 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 122 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 123 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 124 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 125 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 126 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 127 | 14.5 | 31.8 | 0 | | PLAINFIELD | SL | | | | |
| 128 | 11.1 | 42.9 | 0 | | PLAINFIELD | SL | | | | |
| 129 | 15.3 | 58.2 | 0 | | PLAINFIELD | SL | | | | |
| 130 | 0 | 58.2 | 1 | | PLAINFIELD | SL | | | | |
| 131 | 0 | 58.2 | 2 | | PLAINFIELD | SL | | | | |
| 132 | 0 | 58.2 | 3 | | PLAINFIELD | SL | | | | |
| 133 | 0 | 58.2 | 4 | | PLAINFIELD | SL | | | | |
| 134 | 0 | 58.2 | 5 | | PLAINFIELD | SL | | | | |
| 135 | 0 | 58.2 | 6 | | PLAINFIELD | SL | | | | |
| 136 | 0 | 58.2 | 7 | | PLAINFIELD | SL | | | | |
| 137 | 29 | 63.6 | 0 | | PLAINFIELD | SL | | | | |
| 138 | 22.2 | 85.8 | 0 | | PLAINFIELD | SL | | | | |
| 139 | 30.6 | 116.4 | 0 | | PLAINFIELD | SL | | | | |
| 140 | 0 | 116.4 | 1 | | PLAINFIELD | SL | | | | |
| 141 | 0 | 116.4 | 2 | | PLAINFIELD | SL | | | | |
| 142 | 0 | 116.4 | 3 | | PLAINFIELD | SL | | | | |
| 143 | 0 | 116.4 | 4 | | PLAINFIELD | SL | | | | |
| 144 | 0 | 116.4 | 5 | | PLAINFIELD | SL | | | | |
| 145 | 0 | 116.4 | 6 | | PLAINFIELD | SL | | | | |
| 146 | 0 | 116.4 | 7 | | PLAINFIELD | SL | | | | |
| 147 | 57.8 | 127 | 0 | | PLAINFIELD | SL | | | | |
| 148 | 44.4 | 171.4 | 0 | | PLAINFIELD | SL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 112 | 2.94 | 5.9 | 609 | HCL-HF | 151 | 9.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 113 | 3.92 | 5.9 | 609 | HCL-HF | 22 | 8.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 114 | 3.77 | 5.8 | 609 | HCL-HF | 214 | 9.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 115 | 2.6 | 6.1 | 609 | HCL-HF | 125 | 10.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 116 | 3.2 | 6.1 | 609 | HCL-HF | 184 | 11.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 117 | 0.39 | 7.8 | 0 | HCL-HF | 10 | 5 | LEAF | SLUDGE, FIELD, MATURITY | NA |
| 118 | 0.17 | 7.1 | 0 | HCL-HF | 9 | 10.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 119 | 0.26 | 7.3 | 0 | HCL-HF | 12 | 7.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 120 | 0.27 | 6.8 | 0 | HCL-HF | 5 | 5.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 121 | 0.33 | 7.6 | 0 | HCL-HF | 12 | 5.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 122 | 0.27 | 7.5 | 0 | HCL-HF | 8 | 5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 123 | 0.29 | 7.5 | 0 | HCL-HF | 10 | 4.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 124 | 0.42 | 7.4 | 0 | HCL-HF | 12 | 2.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 125 | 0.49 | 7.4 | 0 | HCL-HF | 12 | 5.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 126 | 0.64 | 7.3 | 51.5 | HCL-HF | 21 | 5.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 127 | 0.36 | 7.6 | 59.8 | HCL-HF | 36 | 9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 128 | 0.28 | 7.1 | 70 | HCL-HF | 14 | 12.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 129 | 0.61 | 7.4 | 70 | HCL-HF | 27 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 130 | 0.91 | 7.3 | 70 | HCL-HF | 37 | 6.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 131 | 0.56 | 7.4 | 70 | HCL-HF | 28 | 4.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 132 | 0.58 | 7.1 | 70 | HCL-HF | 26 | 6.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 133 | 0.45 | 7.5 | 70 | HCL-HF | 25 | 3.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 134 | 0.34 | 7.7 | 70 | HCL-HF | 33 | 3.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 135 | 0.47 | 7.4 | 70 | HCL-HF | 36 | 7.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 136 | 0.83 | 7.4 | 70 | HCL-HF | 37 | 6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 137 | 0.58 | 7.5 | 103 | HCL-HF | 68 | 9 | LEAF | SLUDGE, FIELD, MATURITY | NA |
| 138 | 0.44 | 6.9 | 119.6 | HCL-HF | 36 | 16.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 139 | 0.81 | 7.1 | 140 | HCL-HF | 47 | 10.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 140 | 0.95 | 6.8 | 140 | HCL-HF | 47 | 10.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 141 | 0.75 | 7.1 | 140 | HCL-HF | 46 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 142 | 0.96 | 7.1 | 140 | HCL-HF | 37 | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 143 | 0.59 | 6.9 | 140 | HCL-HF | 52 | 5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 144 | 0.89 | 7 | 140 | HCL-HF | 50 | 3.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 145 | 0.81 | 7.1 | 140 | HCL-HF | 52 | 8.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 146 | 0.52 | 7.1 | 140 | HCL-HF | 36 | 5.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 147 | 0.9 | 7.6 | 206 | HCL-HF | 154 | 10.6 | LEAF | SLUDGE, FIELD, MATURITY | NA |
| 148 | 0.6 | 6.6 | 239 | HCL-HF | 42 | 12.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 112 | GRAIN | 0 | STOVER | NO |
| 113 | GRAIN | 0 | STOVER | NO |
| 114 | GRAIN | 0 | STOVER | NO |
| 115 | GRAIN | 0 | STOVER | NO |
| 116 | GRAIN | 0 | STOVER | NO |
| 117 | GRAIN | 0 | STOVER | NO |
| 118 | GRAIN | 0 | STOVER | NO |
| 119 | GRAIN | 0 | STOVER | NO |
| 120 | GRAIN | 0 | STOVER | NO |
| 121 | GRAIN | 0 | STOVER | NO |
| 122 | GRAIN | 0 | STOVER | NO |
| 123 | GRAIN | 0 | STOVER | NO |
| 124 | GRAIN | 0 | STOVER | NO |
| 125 | GRAIN | 0 | STOVER | NO |
| 126 | GRAIN | 0 | STOVER | NO |
| 127 | GRAIN | NA | STOVER | NO |
| 128 | GRAIN | 0 | STOVER | NO |
| 129 | GRAIN | 0 | STOVER | NO |
| 130 | GRAIN | 0 | STOVER | NO |
| 131 | GRAIN | 0 | STOVER | NO |
| 132 | GRAIN | 0 | STOVER | NO |
| 133 | GRAIN | 0 | STOVER | NO |
| 134 | GRAIN | 0 | STOVER | NO |
| 135 | GRAIN | 0 | STOVER | NO |
| 136 | GRAIN | 0 | STOVER | NO |
| 137 | GRAIN | NA | STOVER | NO |
| 138 | GRAIN | 0 | STOVER | NO |
| 139 | GRAIN | 0 | STOVER | NO |
| 140 | GRAIN | 0 | STOVER | NO |
| 141 | GRAIN | 0 | STOVER | NO |
| 142 | GRAIN | 0 | STOVER | NO |
| 143 | GRAIN | 0 | STOVER | NO |
| 144 | GRAIN | 0 | STOVER | NO |
| 145 | GRAIN | 0 | STOVER | NO |
| 146 | GRAIN | 0 | STOVER | NO |
| 147 | GRAIN | NA | STOVER | NO |
| 148 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 112 | | JOLIET, ILLINOIS |
| 113 | | JOLIET, ILLINOIS |
| 114 | | JOLIET, ILLINOIS |
| 115 | | JOLIET, ILLINOIS |
| 116 | | JOLIET, ILLINOIS |
| 117 | | JOLIET, ILLINOIS |
| 118 | | JOLIET, ILLINOIS |
| 119 | | JOLIET, ILLINOIS |
| 120 | | JOLIET, ILLINOIS |
| 121 | | JOLIET, ILLINOIS |
| 122 | | JOLIET, ILLINOIS |
| 123 | | JOLIET, ILLINOIS |
| 124 | | JOLIET, ILLINOIS |
| 125 | | JOLIET, ILLINOIS |
| 126 | | JOLIET, ILLINOIS |
| 127 | | JOLIET, ILLINOIS |
| 128 | | JOLIET, ILLINOIS |
| 129 | | JOLIET, ILLINOIS |
| 130 | | JOLIET, ILLINOIS |
| 131 | | JOLIET, ILLINOIS |
| 132 | | JOLIET, ILLINOIS |
| 133 | | JOLIET, ILLINOIS |
| 134 | | JOLIET, ILLINOIS |
| 135 | | JOLIET, ILLINOIS |
| 136 | | JOLIET, ILLINOIS |
| 137 | | JOLIET, ILLINOIS |
| 138 | | JOLIET, ILLINOIS |
| 139 | | JOLIET, ILLINOIS |
| 140 | | JOLIET, ILLINOIS |
| 141 | | JOLIET, ILLINOIS |
| 142 | | JOLIET, ILLINOIS |
| 143 | | JOLIET, ILLINOIS |
| 144 | | JOLIET, ILLINOIS |
| 145 | | JOLIET, ILLINOIS |
| 146 | | JOLIET, ILLINOIS |
| 147 | | JOLIET, ILLINOIS |
| 148 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 149 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 150 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 151 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 152 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 153 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 154 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 155 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 156 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 157 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 158 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 159 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 160 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 161 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 162 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 163 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 164 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 165 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 166 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 167 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 168 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 169 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 170 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 171 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 172 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 173 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 174 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 175 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 176 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 177 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 178 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 179 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 180 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 181 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 182 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 183 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 184 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 185 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 149 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 150 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 151 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 152 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 153 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 154 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 155 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 156 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 157 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 158 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 159 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 160 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 161 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 162 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 163 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 164 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 165 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 166 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 167 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 168 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 169 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 170 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 171 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 172 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 173 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 174 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 175 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 176 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 177 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 178 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 179 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 180 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 181 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 182 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 183 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 184 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 185 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 149 | 61.1 | 232.5 | 0 | | PLAINFIELD | SL | | | | |
| 150 | 69.8 | 302.3 | 0 | | PLAINFIELD | SL | | | | |
| 151 | 54 | 356.3 | 0 | | PLAINFIELD | SL | | | | |
| 152 | 72 | 428.3 | 0 | | PLAINFIELD | SL | | | | |
| 153 | 0 | 428.3 | 1 | | PLAINFIELD | SL | | | | |
| 154 | 0 | 428.3 | 2 | | PLAINFIELD | SL | | | | |
| 155 | 0 | 428.3 | 3 | | PLAINFIELD | SL | | | | |
| 156 | 0 | 428.3 | 4 | | PLAINFIELD | SL | | | | |
| 157 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 158 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 159 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 160 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 161 | 0 | 0 | NA | | BLOUNT | SiL | | | | |
| 162 | 26.2 | 40.1 | 0 | | BLOUNT | SiL | | | | |
| 163 | 8.1 | 48.2 | 0 | | BLOUNT | SiL | | | | |
| 164 | 14.7 | 62.9 | 0 | | BLOUNT | SiL | | | | |
| 165 | 17.7 | 80.6 | 0 | | BLOUNT | SiL | | | | |
| 166 | 13.1 | 93.7 | 0 | | BLOUNT | SiL | | | | |
| 167 | 52.4 | 80.2 | 0 | | BLOUNT | SiL | | | | |
| 168 | 16.2 | 96.4 | 0 | | BLOUNT | SiL | | | | |
| 169 | 29.4 | 125.8 | 0 | | BLOUNT | SiL | | | | |
| 170 | 35.4 | 161.2 | 0 | | BLOUNT | SiL | | | | |
| 171 | 26.2 | 187.4 | 0 | | BLOUNT | SiL | | | | |
| 172 | 104.8 | 160.4 | 0 | | BLOUNT | SiL | | | | |
| 173 | 32.4 | 192.8 | 0 | | BLOUNT | SiL | | | | |
| 174 | 58.8 | 251.6 | 0 | | BLOUNT | SiL | | | | |
| 175 | 70.8 | 322.4 | 0 | | BLOUNT | SiL | | | | |
| 176 | 52.4 | 374.8 | 0 | | BLOUNT | SiL | | | | |
| 177 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 178 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 179 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 180 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 181 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 182 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 183 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 184 | 0 | 0 | NA | | ELLIOT | SiL | | | | |
| 185 | 0 | 0 | NA | | ELLIOT | SiL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 149 | 2.4 | 6.8 | 397 | HCL-HF | 118 | 11.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 150 | 1.85 | 6.5 | 482 | HCL-HF | 60 | 11.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 151 | 1.78 | 6.1 | 609 | HCL-HF | 104 | 13.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 152 | 1.96 | 6.2 | 609 | HCL-HF | 116 | 15.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 153 | 2.84 | 6 | 609 | HCL-HF | 164 | 9.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 154 | 3.35 | 5.9 | 609 | HCL-HF | 245 | 5.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 155 | 2.1 | 6.2 | 609 | HCL-HF | 150 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 156 | 3.03 | 6.1 | 609 | HCL-HF | 224 | 7.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 157 | 1.19 | NA | 0 | HCL-HF | 20 | 8.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 158 | 1.01 | 7.1 | 0 | HCL-HF | 15 | 11.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 159 | 0.93 | 7.5 | 0 | HCL-HF | 19 | 10.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 160 | 1.05 | 7.7 | 0 | HCL-HF | 20 | 9.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 161 | 1.07 | 7.3 | 0 | HCL-HF | 22 | 10.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 162 | 1.29 | NA | 52 | HCL-HF | 30 | 9.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 163 | 1.06 | 7.2 | 58 | HCL-HF | 24 | 11.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 164 | 1.1 | 7.6 | 67 | HCL-HF | 35 | 6.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 165 | 1.29 | 7.6 | 96 | HCL-HF | 39 | 11.8 | LEAF | SLUDGE, FIELD, MATURITY | 60* |
| 166 | 1.17 | 7.6 | 117 | HCL-HF | 47 | 10.4 | LEAF | SLUDGE, FIELD, MATURITY | 28* |
| 167 | 1.38 | NA | 105 | HCL-HF | 44 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 168 | 1.15 | 7.1 | 116 | HCL-HF | 27 | 12.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 169 | 1.29 | 7.6 | 135 | HCL-HF | 45 | 6.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 170 | 1.58 | 7.6 | 192 | HCL-HF | 52 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 171 | 1.75 | 7.5 | 235 | HCL-HF | 75 | 11.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 172 | 1.63 | NA | 210 | HCL-HF | 66 | 9.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 173 | 1.28 | 6.9 | 232 | HCL-HF | 50 | 14.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 174 | 1.59 | 7.5 | 270 | HCL-HF | 76 | 6.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 175 | 1.9 | 7.5 | 384 | HCL-HF | 78 | 11.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 176 | 2.56 | 7.3 | 469 | HCL-HF | 133 | 13.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 177 | 1.51 | NA | 0 | HCL-HF | 19 | 9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 178 | 1.34 | 7 | 0 | HCL-HF | 13 | 10.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 179 | 1.29 | 7.2 | 0 | HCL-HF | 18 | 4.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 180 | 1.45 | 7.1 | 0 | HCL-HF | 19 | 10 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 181 | 1.3 | 7.6 | 0 | HCL-HF | 22 | 8.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 182 | 1.3 | 7 | 0 | HCL-HF | 19 | 8.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 183 | 1.41 | 7.2 | 0 | HCL-HF | 20 | 8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 184 | 1.32 | 6.7 | 0 | HCL-HF | 24 | 6.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 185 | 1.38 | 7 | 0 | HCL-HF | 23 | 8.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 149 | GRAIN | 0 | STOVER | NO |
| 150 | GRAIN | 0 | STOVER | NO |
| 151 | GRAIN | 0 | STOVER | NO |
| 152 | GRAIN | 0 | STOVER | NO |
| 153 | GRAIN | 0 | STOVER | NO |
| 154 | GRAIN | 0 | STOVER | NO |
| 155 | GRAIN | 0 | STOVER | NO |
| 156 | GRAIN | 0 | STOVER | NO |
| 157 | GRAIN | NA | STOVER | NO |
| 158 | GRAIN | 0 | STOVER | NO |
| 159 | GRAIN | 0 | STOVER | NO |
| 160 | GRAIN | 0 | STOVER | NO |
| 161 | GRAIN | 0 | STOVER | NO |
| 162 | GRAIN | NA | STOVER | NO |
| 163 | GRAIN | 0 | STOVER | NO |
| 164 | GRAIN | 37* | STOVER | *NO |
| 165 | GRAIN | 0 | STOVER | *NO |
| 166 | GRAIN | 0 | STOVER | *NO |
| 167 | GRAIN | NA | STOVER | NO |
| 168 | GRAIN | 0 | STOVER | NO |
| 169 | GRAIN | 22* | STOVER | *NO |
| 170 | GRAIN | 0 | STOVER | NO |
| 171 | GRAIN | 0 | STOVER | NO |
| 172 | GRAIN | NA | STOVER | NO |
| 173 | GRAIN | 0 | STOVER | NO |
| 174 | GRAIN | 0 | STOVER | NO |
| 175 | GRAIN | 0 | STOVER | NO |
| 176 | GRAIN | 0 | STOVER | NO |
| 177 | GRAIN | NA | STOVER | NO |
| 178 | GRAIN | 0 | STOVER | NO |
| 179 | GRAIN | 0 | STOVER | NO |
| 180 | GRAIN | 0 | STOVER | NO |
| 181 | GRAIN | 0 | STOVER | NO |
| 182 | GRAIN | 0 | STOVER | NO |
| 183 | GRAIN | 0 | STOVER | NO |
| 184 | GRAIN | 0 | STOVER | NO |
| 185 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 149 | | JOLIET, ILLINOIS |
| 150 | | JOLIET, ILLINOIS |
| 151 | | JOLIET, ILLINOIS |
| 152 | | JOLIET, ILLINOIS |
| 153 | | JOLIET, ILLINOIS |
| 154 | | JOLIET, ILLINOIS |
| 155 | | JOLIET, ILLINOIS |
| 156 | | JOLIET, ILLINOIS |
| 157 | | JOLIET, ILLINOIS |
| 158 | | JOLIET, ILLINOIS |
| 159 | | JOLIET, ILLINOIS |
| 160 | | JOLIET, ILLINOIS |
| 161 | | JOLIET, ILLINOIS |
| 162 | | JOLIET, ILLINOIS |
| 163 | | JOLIET, ILLINOIS |
| 164 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 165 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 166 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 167 | | JOLIET, ILLINOIS |
| 168 | | JOLIET, ILLINOIS |
| 169 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 170 | | JOLIET, ILLINOIS |
| 171 | | JOLIET, ILLINOIS |
| 172 | | JOLIET, ILLINOIS |
| 173 | | JOLIET, ILLINOIS |
| 174 | | JOLIET, ILLINOIS |
| 175 | | JOLIET, ILLINOIS |
| 176 | | JOLIET, ILLINOIS |
| 177 | | JOLIET, ILLINOIS |
| 178 | | JOLIET, ILLINOIS |
| 179 | | JOLIET, ILLINOIS |
| 180 | | JOLIET, ILLINOIS |
| 181 | | JOLIET, ILLINOIS |
| 182 | | JOLIET, ILLINOIS |
| 183 | | JOLIET, ILLINOIS |
| 184 | | JOLIET, ILLINOIS |
| 185 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 186 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 187 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 188 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 189 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 190 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 191 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 192 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 193 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 194 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 195 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 196 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 197 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 198 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 199 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 200 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 201 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 202 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 203 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 204 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 205 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 206 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 207 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 208 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 209 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 210 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 211 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 212 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 213 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 214 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 215 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 216 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 217 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 218 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 219 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 220 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 221 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 222 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 186 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 187 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 188 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 189 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 190 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 191 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 192 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 193 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 194 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 195 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 196 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 197 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 198 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 199 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 200 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 201 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 202 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 203 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 204 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 205 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 206 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 207 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 208 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 209 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 210 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 211 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 212 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 213 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 214 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 215 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 216 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 217 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 218 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 219 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 220 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 221 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 222 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 186 | 0 | 0 | NA | | ELLIOT | SIL | | | | |
| 187 | 0 | 0 | NA | | ELLIOT | SIL | | | | |
| 188 | 26.2 | 40.1 | 0 | | ELLIOT | SIL | | | | |
| 189 | 8.1 | 48.2 | 0 | | ELLIOT | SIL | | | | |
| 190 | 14.7 | 62.9 | 0 | | ELLIOT | SIL | | | | |
| 191 | 17.7 | 80.6 | 0 | | ELLIOT | SIL | | | | |
| 192 | 13.1 | 93.7 | 0 | | ELLIOT | SIL | | | | |
| 193 | 17.8 | 111.5 | 0 | | ELLIOT | SIL | | | | |
| 194 | 0 | 111.5 | 1 | | ELLIOT | SIL | | | | |
| 195 | 0 | 111.5 | 2 | | ELLIOT | SIL | | | | |
| 196 | 0 | 111.5 | 3 | | ELLIOT | SIL | | | | |
| 197 | 0 | 111.5 | 4 | | ELLIOT | SIL | | | | |
| 198 | 0 | 111.5 | 5 | | ELLIOT | SIL | | | | |
| 199 | 52.4 | 80.2 | 0 | | ELLIOT | SIL | | | | |
| 200 | 16.2 | 96.4 | 0 | | ELLIOT | SIL | | | | |
| 201 | 29.4 | 125.8 | 0 | | ELLIOT | SIL | | | | |
| 202 | 35.4 | 161.2 | 0 | | ELLIOT | SIL | | | | |
| 203 | 26.2 | 187.4 | 0 | | ELLIOT | SIL | | | | |
| 204 | 35.6 | 223 | 0 | | ELLIOT | SIL | | | | |
| 205 | 0 | 223 | 1 | | ELLIOT | SIL | | | | |
| 206 | 0 | 223 | 2 | | ELLIOT | SIL | | | | |
| 207 | 0 | 223 | 3 | | ELLIOT | SIL | | | | |
| 208 | 0 | 223 | 4 | | ELLIOT | SIL | | | | |
| 209 | 0 | 223 | 5 | | ELLIOT | SIL | | | | |
| 210 | 104.8 | 160.4 | 0 | | ELLIOT | SIL | | | | |
| 211 | 32.4 | 192.8 | 0 | | ELLIOT | SIL | | | | |
| 212 | 58.8 | 251.6 | 0 | | ELLIOT | SIL | | | | |
| 213 | 70.8 | 322.4 | 0 | | ELLIOT | SIL | | | | |
| 214 | 52.4 | 374.8 | 0 | | ELLIOT | SIL | | | | |
| 215 | 71.2 | 446 | 0 | | ELLIOT | SIL | | | | |
| 216 | 0 | 446 | 1 | | ELLIOT | SIL | | | | |
| 217 | 0 | 446 | 2 | | ELLIOT | SIL | | | | |
| 218 | 0 | 446 | 3 | | ELLIOT | SIL | | | | |
| 219 | 0 | 446 | 4 | | ELLIOT | SIL | | | | |
| 220 | 0 | 446 | 5 | | ELLIOT | SIL | | | | |
| 221 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 222 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 186 | 1.69 | 7 | 0 | HCL-HF | 23 | 8.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 187 | 1.48 | 7.4 | 0 | HCL-HF | 22 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 188 | 1.52 | NA | 52 | HCL-HF | 30 | 9.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 189 | 1.4 | 6.9 | 58 | HCL-HF | 20 | 10.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 190 | 1.35 | 7.2 | 67 | HCL-HF | 27 | 6.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 191 | 1.58 | 7.4 | 96 | HCL-HF | 36 | 9.8 | LEAF | SLUDGE, FIELD, MATURITY | 60* |
| 192 | 1.54 | 7.1 | 117 | HCL-HF | 52 | 13.2 | LEAF | SLUDGE, FIELD, MATURITY | 28* |
| 193 | 1.64 | 6.9 | 146 | HCL-HF | 50 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 194 | 1.69 | 6.9 | 146 | HCL-HF | 54 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 195 | 1.91 | 7 | 146 | HCL-HF | 45 | 4.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 196 | 1.66 | 7.3 | 146 | HCL-HF | 67 | 6.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 197 | 2.05 | 7.1 | 146 | HCL-HF | 63 | 6.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 198 | 1.95 | 7.2 | 146 | HCL-HF | 48 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 199 | 1.71 | NA | 105 | HCL-HF | 38 | 10.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 200 | 1.57 | 6.9 | 116 | HCL-HF | 28 | 12.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 201 | 1.57 | 7.3 | 135 | HCL-HF | 41 | 5.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 202 | 1.79 | 7.1 | 192 | HCL-HF | 46 | 10.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 203 | 1.93 | 6.9 | 235 | HCL-HF | 64 | 11.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 204 | 2.09 | 6.6 | 292 | HCL-HF | 80 | 14.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 205 | 2.37 | 6.4 | 292 | HCL-HF | 96 | 10.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 206 | 2.4 | 6.4 | 292 | HCL-HF | 101 | 6.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 207 | 2.4 | 6.8 | 292 | HCL-HF | 108 | 8.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 208 | 2.38 | 6.8 | 292 | HCL-HF | 91 | 6.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 209 | 2.48 | 7.2 | 292 | HCL-HF | 89 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 210 | 2.06 | NA | 210 | HCL-HF | 60 | 10.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 211 | 2 | 6.4 | 232 | HCL-HF | 50 | 11 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 212 | 1.76 | 6.4 | 270 | HCL-HF | 56 | 6.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 213 | 2.67 | 6.2 | 384 | HCL-HF | 90 | 11.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 214 | 2.72 | 6.1 | 469 | HCL-HF | 115 | 12.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 215 | 3.53 | 5.4 | 584 | HCL-HF | 171 | 11.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 216 | 3.35 | 5.5 | 584 | HCL-HF | 171 | 11.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 217 | 3.29 | 5.8 | 584 | HCL-HF | 148 | 8.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 218 | 2.68 | 6 | 584 | HCL-HF | 140 | 8.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 219 | 3.02 | 6 | 584 | HCL-HF | 188 | 8.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 220 | 2.2 | 6.3 | 584 | HCL-HF | 97 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 221 | 0.36 | NA | 0 | HCL-HF | 7 | 7.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 222 | 0.17 | 7 | 0 | HCL-HF | 7 | 10.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 186 | GRAIN | 0 | STOVER | NO |
| 187 | GRAIN | 0 | STOVER | NO |
| 188 | GRAIN | NA | STOVER | NO |
| 189 | GRAIN | 0 | STOVER | NO |
| 190 | GRAIN | 0 | STOVER | NO |
| 191 | GRAIN | 0 | STOVER | *NO |
| 192 | GRAIN | 0 | STOVER | *NO |
| 193 | GRAIN | 0 | STOVER | NO |
| 194 | GRAIN | 0 | STOVER | NO |
| 195 | GRAIN | 0 | STOVER | NO |
| 196 | GRAIN | 0 | STOVER | NO |
| 197 | GRAIN | 0 | STOVER | NO |
| 198 | GRAIN | 0 | STOVER | NO |
| 199 | GRAIN | NA | STOVER | NO |
| 200 | GRAIN | 0 | STOVER | NO |
| 201 | GRAIN | 0 | STOVER | NO |
| 202 | GRAIN | 0 | STOVER | NO |
| 203 | GRAIN | 0 | STOVER | NO |
| 204 | GRAIN | 0 | STOVER | NO |
| 205 | GRAIN | 0 | STOVER | NO |
| 206 | GRAIN | 0 | STOVER | NO |
| 207 | GRAIN | 0 | STOVER | NO |
| 208 | GRAIN | 0 | STOVER | NO |
| 209 | GRAIN | 0 | STOVER | NO |
| 210 | GRAIN | NA | STOVER | NO |
| 211 | GRAIN | 0 | STOVER | NO |
| 212 | GRAIN | 0 | STOVER | NO |
| 213 | GRAIN | 0 | STOVER | NO |
| 214 | GRAIN | 0 | STOVER | NO |
| 215 | GRAIN | 0 | STOVER | NO |
| 216 | GRAIN | 0 | STOVER | NO |
| 217 | GRAIN | 0 | STOVER | NO |
| 218 | GRAIN | 0 | STOVER | NO |
| 219 | GRAIN | 0 | STOVER | NO |
| 220 | GRAIN | 0 | STOVER | NO |
| 221 | GRAIN | NA | STOVER | NO |
| 222 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 186 | | JOLIET, ILLINOIS |
| 187 | | JOLIET, ILLINOIS |
| 188 | | JOLIET, ILLINOIS |
| 189 | | JOLIET, ILLINOIS |
| 190 | | JOLIET, ILLINOIS |
| 191 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 192 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 193 | | JOLIET, ILLINOIS |
| 194 | | JOLIET, ILLINOIS |
| 195 | | JOLIET, ILLINOIS |
| 196 | | JOLIET, ILLINOIS |
| 197 | | JOLIET, ILLINOIS |
| 198 | | JOLIET, ILLINOIS |
| 199 | | JOLIET, ILLINOIS |
| 200 | | JOLIET, ILLINOIS |
| 201 | | JOLIET, ILLINOIS |
| 202 | | JOLIET, ILLINOIS |
| 203 | | JOLIET, ILLINOIS |
| 204 | | JOLIET, ILLINOIS |
| 205 | | JOLIET, ILLINOIS |
| 206 | | JOLIET, ILLINOIS |
| 207 | | JOLIET, ILLINOIS |
| 208 | | JOLIET, ILLINOIS |
| 209 | | JOLIET, ILLINOIS |
| 210 | | JOLIET, ILLINOIS |
| 211 | | JOLIET, ILLINOIS |
| 212 | | JOLIET, ILLINOIS |
| 213 | | JOLIET, ILLINOIS |
| 214 | | JOLIET, ILLINOIS |
| 215 | | JOLIET, ILLINOIS |
| 216 | | JOLIET, ILLINOIS |
| 217 | | JOLIET, ILLINOIS |
| 218 | | JOLIET, ILLINOIS |
| 219 | | JOLIET, ILLINOIS |
| 220 | | JOLIET, ILLINOIS |
| 221 | | JOLIET, ILLINOIS |
| 222 | | JOLIET, ILLINOIS |



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TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 223 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 224 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 225 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 226 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 227 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 228 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 229 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 230 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 231 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 232 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 233 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 234 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 235 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 236 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 237 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 238 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 239 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 240 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 241 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 242 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 243 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 244 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 245 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 246 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 247 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 248 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 249 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 250 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 251 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 252 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 253 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 254 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 255 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 256 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 257 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 258 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 259 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 223 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 224 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 225 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 226 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 227 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 228 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 229 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 230 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 231 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 232 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 233 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 234 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 235 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 236 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 237 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 238 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 239 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 240 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 241 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 242 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 243 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 244 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 245 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 246 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 247 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 248 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 249 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 250 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 251 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 252 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 253 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 254 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 255 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 256 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 257 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 258 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 259 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 223 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 224 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 225 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 226 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 227 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 228 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 229 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 230 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 231 | 0 | 0 | NA | | PLAINFIELD | SL | | | | |
| 232 | 26.2 | 40.1 | 0 | | PLAINFIELD | SL | | | | |
| 233 | 8.1 | 48.2 | 0 | | PLAINFIELD | SL | | | | |
| 234 | 14.7 | 62.9 | 0 | | PLAINFIELD | SL | | | | |
| 235 | 17.7 | 80.6 | 0 | | PLAINFIELD | SL | | | | |
| 236 | 13.1 | 93.7 | 0 | | PLAINFIELD | SL | | | | |
| 237 | 17.8 | 111.5 | 0 | | PLAINFIELD | SL | | | | |
| 238 | 0 | 111.5 | 1 | | PLAINFIELD | SL | | | | |
| 239 | 0 | 111.5 | 2 | | PLAINFIELD | SL | | | | |
| 240 | 0 | 111.5 | 3 | | PLAINFIELD | SL | | | | |
| 241 | 0 | 111.5 | 4 | | PLAINFIELD | SL | | | | |
| 242 | 0 | 111.5 | 5 | | PLAINFIELD | SL | | | | |
| 243 | 52.4 | 80.2 | 0 | | PLAINFIELD | SL | | | | |
| 244 | 16.2 | 96.4 | 0 | | PLAINFIELD | SL | | | | |
| 245 | 29.4 | 125.8 | 0 | | PLAINFIELD | SL | | | | |
| 246 | 35.4 | 161.2 | 0 | | PLAINFIELD | SL | | | | |
| 247 | 26.2 | 187.4 | 0 | | PLAINFIELD | SL | | | | |
| 248 | 35.6 | 223 | 0 | | PLAINFIELD | SL | | | | |
| 249 | 0 | 223 | 1 | | PLAINFIELD | SL | | | | |
| 250 | 0 | 223 | 2 | | PLAINFIELD | SL | | | | |
| 251 | 0 | 223 | 3 | | PLAINFIELD | SL | | | | |
| 252 | 0 | 223 | 4 | | PLAINFIELD | SL | | | | |
| 253 | 0 | 223 | 5 | | PLAINFIELD | SL | | | | |
| 254 | 104.8 | 160.4 | 0 | | PLAINFIELD | SL | | | | |
| 255 | 32.4 | 192.8 | 0 | | PLAINFIELD | SL | | | | |
| 256 | 58.8 | 251.6 | 0 | | PLAINFIELD | SL | | | | |
| 257 | 70.8 | 322.4 | 0 | | PLAINFIELD | SL | | | | |
| 258 | 52.4 | 374.8 | 0 | | PLAINFIELD | SL | | | | |
| 259 | 71.2 | 446 | 0 | | PLAINFIELD | SL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 223 | 0.21 | 7.2 | 0 | HCL-HF | 6 | 7.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 224 | 0.42 | 7.1 | 0 | HCL-HF | 9 | 7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 225 | 0.44 | 7 | 0 | HCL-HF | 14 | 5.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 226 | 0.56 | 6.9 | 0 | HCL-HF | 6 | 7.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 227 | 0.48 | 7 | 0 | HCL-HF | 14 | 4.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 228 | 0.75 | 7 | 0 | HCL-HF | 7 | 4.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 229 | 0.76 | 7 | 0 | HCL-HF | 22 | 7.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 230 | 1.21 | 6.9 | 0 | HCL-HF | 24 | 5.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 231 | 0.84 | 7.1 | 0 | HCL-HF | 30 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 232 | 0.31 | NA | 52 | HCL-HF | 23 | 9.1 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 233 | 0.44 | 7.2 | 58 | HCL-HF | 23 | 12.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 234 | 0.63 | 7.3 | 67 | HCL-HF | 33 | 5.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 235 | 0.67 | 7.5 | 96 | HCL-HF | 28 | 8.1 | LEAF | SLUDGE, FIELD, MATURITY | 60* |
| 236 | 0.78 | 7 | 117 | HCL-HF | 45 | 11.1 | LEAF | SLUDGE, FIELD, MATURITY | 60* |
| 237 | 0.8 | 7 | 146 | HCL-HF | 42 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 238 | 0.99 | 6.6 | 146 | HCL-HF | 62 | 7.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 239 | 1.42 | 7.1 | 146 | HCL-HF | 71 | 3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 240 | 1.71 | 7.2 | 146 | HCL-HF | 92 | 6.5 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 241 | 1.82 | 7.2 | 146 | HCL-HF | 93 | 7.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 242 | 1.96 | 7.1 | 146 | HCL-HF | 69 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 243 | 0.43 | NA | 105 | HCL-HF | 35 | 9.6 | LEAF | SLUDGE, FIELD, MATURITY | NA |
| 244 | 0.51 | 7.1 | 116 | HCL-HF | 26 | 12.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 245 | 0.94 | 7 | 135 | HCL-HF | 53 | 7.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 246 | 1.16 | 7.2 | 192 | HCL-HF | 57 | 10 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 247 | 1.4 | 7 | 235 | HCL-HF | 65 | 10.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 248 | 1.75 | 6.4 | 292 | HCL-HF | 99 | 13 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 249 | 2 | 6.3 | 292 | HCL-HF | 111 | 9.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 250 | 2.16 | 6.8 | 292 | HCL-HF | 102 | 5.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 251 | 2.02 | 6.8 | 292 | HCL-HF | 151 | 8.4 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 252 | 2.33 | 7.1 | 292 | HCL-HF | 146 | 6.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 253 | 1.66 | 7 | 292 | HCL-HF | 124 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 254 | 0.73 | NA | 210 | HCL-HF | 61 | 9.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 255 | 0.57 | 6.8 | 232 | HCL-HF | 33 | 14.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 256 | 1.3 | 6.7 | 270 | HCL-HF | 73 | 8.8 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 257 | 1.42 | 6.6 | 384 | HCL-HF | 77 | 13.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 258 | 2.4 | 6.4 | 469 | HCL-HF | 162 | 14.7 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 259 | 2.76 | 6.1 | 584 | HCL-HF | 155 | 17.2 | LEAF | SLUDGE, FIELD, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 223 | GRAIN | 0 | STOVER | NO |
| 224 | GRAIN | 0 | STOVER | NO |
| 225 | GRAIN | 0 | STOVER | NO |
| 226 | GRAIN | 0 | STOVER | NO |
| 227 | GRAIN | 0 | STOVER | NO |
| 228 | GRAIN | 0 | STOVER | NO |
| 229 | GRAIN | 0 | STOVER | NO |
| 230 | GRAIN | 0 | STOVER | NO |
| 231 | GRAIN | 0 | STOVER | NO |
| 232 | GRAIN | NA | STOVER | NO |
| 233 | GRAIN | 0 | STOVER | NO |
| 234 | GRAIN | 0 | STOVER | NO |
| 235 | GRAIN | 0 | STOVER | *NO |
| 236 | GRAIN | 0 | STOVER | *NO |
| 237 | GRAIN | 0 | STOVER | NO |
| 238 | GRAIN | 0 | STOVER | NO |
| 239 | GRAIN | 0 | STOVER | NO |
| 240 | GRAIN | 0 | STOVER | NO |
| 241 | GRAIN | 0 | STOVER | NO |
| 242 | GRAIN | 0 | STOVER | NO |
| 243 | GRAIN | NA | STOVER | NO |
| 244 | GRAIN | 0 | STOVER | NO |
| 245 | GRAIN | 0 | STOVER | NO |
| 246 | GRAIN | 0 | STOVER | NO |
| 247 | GRAIN | 0 | STOVER | NO |
| 248 | GRAIN | 0 | STOVER | NO |
| 249 | GRAIN | 0 | STOVER | NO |
| 250 | GRAIN | 0 | STOVER | NO |
| 251 | GRAIN | 0 | STOVER | NO |
| 252 | GRAIN | 0 | STOVER | NO |
| 253 | GRAIN | 0 | STOVER | NO |
| 254 | GRAIN | NA | STOVER | NO |
| 255 | GRAIN | 0 | STOVER | NO |
| 256 | GRAIN | 0 | STOVER | NO |
| 257 | GRAIN | 0 | STOVER | NO |
| 258 | GRAIN | 0 | STOVER | NO |
| 259 | GRAIN | 0 | STOVER | NO |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 223 | | JOLIET, ILLINOIS |
| 224 | | JOLIET, ILLINOIS |
| 225 | | JOLIET, ILLINOIS |
| 226 | | JOLIET, ILLINOIS |
| 227 | | JOLIET, ILLINOIS |
| 228 | | JOLIET, ILLINOIS |
| 229 | | JOLIET, ILLINOIS |
| 230 | | JOLIET, ILLINOIS |
| 231 | | JOLIET, ILLINOIS |
| 232 | | JOLIET, ILLINOIS |
| 233 | | JOLIET, ILLINOIS |
| 234 | | JOLIET, ILLINOIS |
| 235 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 236 | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 237 | | JOLIET, ILLINOIS |
| 238 | | JOLIET, ILLINOIS |
| 239 | | JOLIET, ILLINOIS |
| 240 | | JOLIET, ILLINOIS |
| 241 | | JOLIET, ILLINOIS |
| 242 | | JOLIET, ILLINOIS |
| 243 | | JOLIET, ILLINOIS |
| 244 | | JOLIET, ILLINOIS |
| 245 | | JOLIET, ILLINOIS |
| 246 | | JOLIET, ILLINOIS |
| 247 | | JOLIET, ILLINOIS |
| 248 | | JOLIET, ILLINOIS |
| 249 | | JOLIET, ILLINOIS |
| 250 | | JOLIET, ILLINOIS |
| 251 | | JOLIET, ILLINOIS |
| 252 | | JOLIET, ILLINOIS |
| 253 | | JOLIET, ILLINOIS |
| 254 | | JOLIET, ILLINOIS |
| 255 | | JOLIET, ILLINOIS |
| 256 | | JOLIET, ILLINOIS |
| 257 | | JOLIET, ILLINOIS |
| 258 | | JOLIET, ILLINOIS |
| 259 | | JOLIET, ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 260 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 261 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 262 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 263 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 264 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 265 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 266 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 267 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 268 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 269 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 270 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 271 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 272 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 273 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 274 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 275 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 276 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 277 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 278 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 279 | DAVIS 1981 | HERBAGE | | | | | | | | 1040 |
| 280 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 281 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 282 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 283 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 284 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 285 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 286 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 287 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 288 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 289 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 290 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 291 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 292 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 293 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 294 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 295 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 296 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 260 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 261 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 262 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 263 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 264 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 265 | | | | | | | | DIGESTED | |
| 266 | | | | | | | | DIGESTED | |
| 267 | | | | | | | | DIGESTED | |
| 268 | | | | | | | | DIGESTED | |
| 269 | | | | | | | | DIGESTED | |
| 270 | | | | | | | | DIGESTED | |
| 271 | | | | | | | | DIGESTED | |
| 272 | | | | | | | | DIGESTED | |
| 273 | | | | | | | | DIGESTED | |
| 274 | | | | | | | | DIGESTED | |
| 275 | | | | | | | | DIGESTED | |
| 276 | | | | | | | | DIGESTED | |
| 277 | | | | | | | | DIGESTED | |
| 278 | | | | | | | | DIGESTED | |
| 279 | | | | | | | | DIGESTED | |
| 280 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 281 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 282 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 283 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 284 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 285 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 286 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 287 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 288 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 289 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 290 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 291 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 292 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 293 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 294 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 295 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 296 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 260 | 0 | 446 | 1 | | PLAINFIELD | SL | | | | |
| 261 | 0 | 446 | 2 | | PLAINFIELD | SL | | | | |
| 262 | 0 | 446 | 3 | | PLAINFIELD | SL | | | | |
| 263 | 0 | 446 | 4 | | PLAINFIELD | SL | | | | |
| 264 | 0 | 446 | 5 | | PLAINFIELD | SL | | | | |
| 265 | 0 | 0 | 0 | LANDFILL CAP | | CLAY | | | | |
| 266 | 53 | 53 | 0 | LANDFILL CAP | | CLAY | | | | |
| 267 | 107 | 107 | 0 | LANDFILL CAP | | CLAY | | | | |
| 268 | 213 | 213 | 0 | LANDFILL CAP | | CLAY | | | | |
| 269 | 426 | 426 | 0 | LANDFILL CAP | | CLAY | | | | |
| 270 | 0 | 0 | 1 | LANDFILL CAP | | CLAY | | | | |
| 271 | 53 | 53 | 1 | LANDFILL CAP | | CLAY | | | | |
| 272 | 107 | 107 | 1 | LANDFILL CAP | | CLAY | | | | |
| 273 | 213 | 213 | 1 | LANDFILL CAP | | CLAY | | | | |
| 274 | 426 | 426 | 1 | LANDFILL CAP | | CLAY | | | | |
| 275 | 0 | 0 | 2 | LANDFILL CAP | | CLAY | | | | |
| 276 | 53 | 53 | 2 | LANDFILL CAP | | CLAY | | | | |
| 277 | 107 | 107 | 2 | LANDFILL CAP | | CLAY | | | | |
| 278 | 213 | 213 | 2 | LANDFILL CAP | | CLAY | | | | |
| 279 | 426 | 426 | 2 | LANDFILL CAP | | CLAY | | | | |
| 280 | 0 | 0 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 281 | 25 | 25 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 282 | 50 | 50 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 283 | 100 | 100 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 284 | 200 | 200 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 285 | 0 | 0 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 286 | 25 | 25 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 287 | 50 | 50 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 288 | 100 | 100 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 289 | 200 | 200 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL | | | | |
| 290 | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 291 | 26.5 | 26.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 292 | 52.5 | 52.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 293 | 60 | 60 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 294 | 120 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 295 | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 296 | 15.1 | 41.6 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 260 | 3.44 | 5.8 | 584 | HCL-HF | 199 | 13.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 261 | 3.16 | 5.9 | 584 | HCL-HF | 17: | 8.6 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 262 | 3.28 | 6.2 | 584 | HCL-HF | 202 | 10.9 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 263 | 3.1 | 6.4 | 584 | HCL-HF | 236 | 8.3 | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 264 | 3.15 | 6.5 | 584 | HCL-HF | 236 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 |
| 265 | | 7.9 | 0 | | | 4.8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 266 | | 7.9 | 55 | | | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 267 | | 7.9 | 111 | | | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 268 | | 7.9 | 222 | | | 7 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 269 | | 7.9 | 443 | | | 6.5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 270 | | 7.9 | 0 | | | 7.4 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 271 | | 7.9 | 55 | | | 7.3 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 272 | | 7.9 | 111 | | | 6.2 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 273 | | 7.9 | 222 | | | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 274 | | 7.9 | 443 | | | 5.5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 275 | | 7.9 | 0 | | | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 276 | | 7.9 | 55 | | | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 277 | | 7.9 | 111 | | | 4.9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 278 | | 7.9 | 222 | | | 4.8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 279 | | 7.9 | 443 | | | 5.3 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 280 | | 6.5 | 0 | | N.L. | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 281 | | 6.5 | 50 | | N.L. | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 282 | | 6.5 | 100 | | N.L. | 9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 283 | | 6.5 | 200 | | N.L. | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 284 | | 6.5 | 400 | | N.L. | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 285 | | 6.5 | 0 | | N.L. | 17 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 286 | | 6.5 | 50 | | N.L. | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 287 | | 6.5 | 100 | | N.L. | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 288 | | 6.5 | 200 | | N.L. | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 289 | | 6.5 | 400 | | N.L. | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 290 | | 5.2 | 0 | | NR | NR | | FIELD, SLUDGE, MATURITY | 0 |
| 291 | | NR | 13 | | NR | NR | | FIELD, SLUDGE, MATURITY | 34* |
| 292 | | NR | 26 | | NR | NR | | FIELD, SLUDGE, MATURITY | 0 |
| 293 | | NR | 34 | | NR | NR | | FIELD, SLUDGE, MATURITY | 0 |
| 294 | | NR | 68 | | NR | NR | | FIELD, SLUDGE, MATURITY | 0 |
| 295 | | 5.2 | 0 | | NR | 10 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 296 | | 5.1 | 32 | | NR | 11 | FORAGE | FIELD, SLUDGE, MATURITY | 41* |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 260 | GRAIN | 0 | STOVER | NO |
| 261 | GRAIN | 0 | STOVER | NO |
| 262 | GRAIN | 0 | STOVER | NO |
| 263 | GRAIN | 0 | STOVER | NO |
| 264 | GRAIN | 0 | STOVER | NO |
| 265 | BIOMASS | | | |
| 266 | BIOMASS | | | |
| 267 | BIOMASS | | | |
| 268 | BIOMASS | | | |
| 269 | BIOMASS | | | |
| 270 | BIOMASS | | | |
| 271 | BIOMASS | | | |
| 272 | BIOMASS | | | |
| 273 | BIOMASS | | | |
| 274 | BIOMASS | | | |
| 275 | BIOMASS | | | |
| 276 | BIOMASS | | | |
| 277 | BIOMASS | | | |
| 278 | BIOMASS | | | |
| 279 | BIOMASS | | | |
| 280 | GRAIN | | | |
| 281 | GRAIN | | | |
| 282 | GRAIN | | | |
| 283 | GRAIN | | | |
| 284 | GRAIN | | | |
| 285 | GRAIN | | | |
| 286 | GRAIN | | | |
| 287 | GRAIN | | | |
| 288 | GRAIN | | | |
| 289 | GRAIN | | | |
| 290 | FORAGE | | | NO |
| 291 | FORAGE | | | NO* |
| 292 | FORAGE | | | NO |
| 293 | FORAGE | | | NO |
| 294 | FORAGE | | | NO |
| 295 | FORAGE | | | NO |
| 296 | FORAGE | | | NO* |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 260 | | JOLIET, ILLINOIS |
| 261 | | JOLIET, ILLINOIS |
| 262 | | JOLIET, ILLINOIS |
| 263 | | JOLIET, ILLINOIS |
| 264 | | JOLIET, ILLINOIS |
| 265 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 266 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 267 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 268 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 269 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 270 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 271 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 272 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 273 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 274 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 275 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 276 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 277 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 278 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 279 | YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE=OATS/RYE) | UNITED KINGDOM |
| 280 | | MINNESOTA |
| 281 | | MINNESOTA |
| 282 | | MINNESOTA |
| 283 | | MINNESOTA |
| 284 | | MINNESOTA |
| 285 | | MINNESOTA |
| 286 | | MINNESOTA |
| 287 | | MINNESOTA |
| 288 | | MINNESOTA |
| 289 | | MINNESOTA |
| 290 | | GEORGIA |
| 291 | *DOSE RESPONSE NOT CONSISTENT | GEORGIA |
| 292 | | GEORGIA |
| 293 | | GEORGIA |
| 294 | | GEORGIA |
| 295 | | GEORGIA |
| 296 | *DOSE RESPONSE & TISSUE CU CONCENTRATION ARE NOT CONSISTENT, PH<5.5 | GEORGIA |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 297 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 298 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 299 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 300 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 301 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 302 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 303 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 304 | KING & MORRIS 1972 | RYE | | | | | 1.42 | | | 453 |
| 305 | WEBBER 1972 | RED BEET | | | | | | | | |
| 306 | WEBBER 1972 | RED BEET | | | | | | | 240 | 1100 |
| 307 | WEBBER 1972 | RED BEET | | | | | | | 175 | 11300 |
| 308 | WEBBER 1972 | RED BEET | | | | | | | 175 | 11300 |
| 309 | WEBBER 1972 | RED BEET | | | | | | | 240 | 1100 |
| 310 | WEBBER 1972 | RED BEET | | | | | | | 175 | 11300 |
| 311 | WEBBER 1972 | CELERY | | | | | | | | |
| 312 | WEBBER 1972 | CELERY | | | | | | | 240 | 1100 |
| 313 | WEBBER 1972 | CELERY | | | | | | | 175 | 11300 |
| 314 | WEBBER 1972 | CELERY | | | | | | | 175 | 11300 |
| 315 | WEBBER 1972 | CELERY | | | | | | | 240 | 1100 |
| 316 | WEBBER 1972 | CELERY | | | | | | | 175 | 11300 |
| 317 | WEBBER 1972 | CELERY | | | | | | | | |
| 318 | WEBBER 1972 | | | | | | | | | |
| 319 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 320 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 321 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 322 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 323 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 324 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 325 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 326 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 327 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 328 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 329 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 330 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 331 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 332 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 333 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 297 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 298 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 299 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 300 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 301 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 302 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 303 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 304 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED | |
| 305 | | | | | | | | | |
| 306 | | | 210 | | | 3000 | | | |
| 307 | | | 104 | | | 3900 | | | |
| 308 | | | 104 | | | 3900 | | | |
| 309 | | | 210 | | | 3000 | | | |
| 310 | | | 104 | | | 3900 | | | |
| 311 | | | | | | | | | |
| 312 | | | 210 | | | 3000 | | | |
| 313 | | | 104 | | | 3900 | | | |
| 314 | | | 104 | | | 3900 | | | |
| 315 | | | 210 | | | 3000 | | | |
| 316 | | | 104 | | | 3900 | | | |
| 317 | | | | | | | | | |
| 318 | | | | | | | | | |
| 319 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 320 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 321 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 322 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 323 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 324 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 325 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 326 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 327 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 328 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 329 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 330 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 331 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 332 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 333 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 297 | 30 | 82.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 298 | 60 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 299 | 120 | 240 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 300 | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 301 | 15.1 | 41.6 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 302 | 30 | 82.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 303 | 60 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 304 | 120 | 240 | 0 | TYPIC HAPLUDULT | CECIL | SCL | | | | |
| 305 | 0 | 0 | 0 | | | | | | | |
| 306 | 125.5 | 125.5 | 2 | | | | | | | |
| 307 | 125.5 | 125.5 | 2 | | | | | | | |
| 308 | 125.5 | 125.5 | 2 | | | | | | | |
| 309 | 31.4 | 94.2 | 0 | | | | | | | |
| 310 | 31.4 | 94.2 | 0 | | | | | | | |
| 311 | 0 | 0 | 0 | | | | | | | |
| 312 | 125.5 | 125.5 | 2 | | | | | | | |
| 313 | 125.5 | 125.5 | 2 | | | | | | | |
| 314 | 125.5 | 125.5 | 2 | | | | | | | |
| 315 | 31.4 | 94.2 | 0 | | | | | | | |
| 316 | 31.4 | 94.2 | 0 | | | | | | | |
| 317 | | | | | | | | | | |
| 318 | | | | | | | | | | |
| 319 | 0 | 0 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 320 | 0 | 0 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 321 | 0 | 0 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 322 | 0 | 0 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 323 | 0 | 0 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 324 | 3 | 3 | | STRIP MINE SPOIL | | | | | | 12.6 |
| 325 | 12.8 | 15.8 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 326 | 12.4 | 28.1 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 327 | 14.3 | 42.4 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 328 | 19.5 | 61.9 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 329 | 6 | 6 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 330 | 25.5 | 31.5 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 331 | 29.8 | 61.3 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 332 | 28.6 | 89.9 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 333 | 39 | 128.9 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |

TABLE F-2 (cont.)

| | SOIL | | CUMM CU | | SOIL CU | PLANT CU | PLANT | | YIELD |
|---|---|---|---|---|---|---|---|---|---|
| | OC | SOIL | LOADING | SOIL | CONCENTRTN | CONCENTRTN | TISSUE | DESCRIPTION OF | REDUCTION |
| | % | pH | RATE (kg/ha) | EXTRACTANT | mg/kg | mg/kg | SAMPLED | EXPERIMENTAL DESIGN | % |
| | | | | | | | | | |
| 297 | | NR | 64 | | NR | 12.5 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 298 | | 4.5 | 102 | | NR | 14.5 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 299 | | 4.2 | 184 | | NR | 20 | FORAGE | FIELD, SLUDGE, MATURITY | 80 |
| 300 | | LIMED | 0 | | NR | 10.2 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 301 | | LIMED | 32 | | NR | 10.2 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 302 | | LIMED | 64 | | NR | 11.5 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 303 | | LIMED | 102 | | NR | 12 | FORAGE | FIELD, SLUDGE, MATURITY | 0 |
| 304 | | LIMED | 184 | | NR | 16 | FORAGE | FIELD, SLUDGE, MATURITY | 58 |
| 305 | | 6.1 | 0 | .5 M HOAC | 1.1 | | | SLUDGE, FIELD, MATURITY | 0 |
| 306 | | NR | 138 | .5 M HOAC | 7.3 | | | SLUDGE, FIELD, MATURITY | 0 |
| 307 | | NR | 502 | .5 M HOAC | 36 | | | SLUDGE, FIELD, MATURITY | 0 |
| 308 | | NR | 1004 | .5 M HOAC | 76 | | | SLUDGE, FIELD, MATURITY | 64 |
| 309 | | NR | 104 | .5 M HOAC | 6 | | | SLUDGE, FIELD, MATURITY | 0 |
| 310 | | NR | 502 | .5 M HOAC | 14.5 | | | SLUDGE, FIELD, MATURITY | 0 |
| 311 | | 6.1 | 0 | .5 M HOAC | 1.1 | | | SLUDGE, FIELD, MATURITY | 0 |
| 312 | | NR | 138 | .5 M HOAC | 7.3 | | | SLUDGE, FIELD, MATURITY | 0 |
| 313 | | NR | 502 | .5 M HOAC | 36 | | | SLUDGE, FIELD, MATURITY | 0 |
| 314 | | NR | 1004 | .5 M HOAC | 76 | | | SLUDGE, FIELD, MATURITY | 0 |
| 315 | | NR | 104 | .5 M HOAC | 6 | | | SLUDGE, FIELD, MATURITY | 0 |
| 316 | | NR | 502 | .5 M HOAC | 14.5 | | | SLUDGE, FIELD, MATURITY | 0 |
| 317 | | | | | | | | | |
| 318 | | | | | | | | | |
| 319 | 0.25 | 7.8 | 0 | 0.1 M HCl | 3.3 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 320 | 0.25 | 7.8 | 0 | 0.1 M HCl | 3.6 | 16 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 321 | 0.33 | 7.8 | 0 | 0.1 M HCl | 2.3 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 322 | 0.33 | 7.8 | 0 | 0.1 M HCl | 6.8 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 323 | 0.33 | 7.8 | 0 | 0.1 M HCl | 4 | 9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 324 | 0.33 | 7.8 | 2.8 | 0.1 M HCl | 2.7 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 325 | 0.27 | 7.8 | 25 | 0.1 M HCl | 5.3 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 326 | 0.41 | 7.8 | 48 | 0.1 M HCl | 7.8 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 327 | 0.41 | 7.8 | 73 | 0.1 M HCl | 14.6 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 328 | 0.59 | 7.8 | 107 | 0.1 M HCl | 9.4 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 329 | 0.35 | 7.8 | 5.6 | 0.1 M HCl | 3.3 | 16 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 330 | 0.3 | 7.8 | 50 | 0.1 M HCl | 5.6 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 331 | 0.3 | 7.8 | 96 | 0.1 M HCl | 19.4 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 332 | 0.5 | 7.8 | 146 | 0.1 M HCl | 19.5 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 333 | 0.5 | 7.8 | 214 | 0.1 M HCl | 14 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| | | | | |
| 297 | FORAGE | | | NO |
| 298 | FORAGE | | | NO |
| 299 | FORAGE | | | POSSIBLE |
| 300 | FORAGE | | | NO |
| 301 | FORAGE | | | NO |
| 302 | FORAGE | | | NO |
| 303 | FORAGE | | | NO |
| 304 | FORAGE | | | POSSIBLE |
| 305 | TOTAL BIOMASS | | | NO |
| 306 | TOTAL BIOMASS | | | NO |
| 307 | TOTAL BIOMASS | | | NO |
| 308 | TOTAL BIOMASS | | | POSSIBLE |
| 309 | TOTAL BIOMASS | | | NO |
| 310 | TOTAL BIOMASS | | | NO |
| 311 | STALKS | | | NO |
| 312 | STALKS | | | NO |
| 313 | STALKS | | | NO |
| 314 | STALKS | | | NO |
| 315 | STALKS | | | NO |
| 316 | STALKS | | | NO |
| 317 | | | | |
| 318 | | | | |
| 319 | GRAIN | 0 | STOVER | |
| 320 | GRAIN | 0 | STOVER | |
| 321 | GRAIN | 0 | STOVER | |
| 322 | GRAIN | 0 | STOVER | |
| 323 | GRAIN | 0 | STOVER | |
| 324 | GRAIN | 0 | STOVER | |
| 325 | GRAIN | 0 | STOVER | |
| 326 | GRAIN | 0 | STOVER | |
| 327 | GRAIN | 0 | STOVER | |
| 328 | GRAIN | 0 | STOVER | |
| 329 | GRAIN | 0 | STOVER | |
| 330 | GRAIN | 0 | STOVER | |
| 331 | GRAIN | 0 | STOVER | |
| 332 | GRAIN | 0 | STOVER | |
| 333 | GRAIN | 0 | STOVER | |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 297 | | GEORGIA |
| 298 | | GEORGIA |
| 299 | PH<5.5 (=4.2) | GEORGIA |
| 300 | | GEORGIA |
| 301 | | GEORGIA |
| 302 | | GEORGIA |
| 303 | | GEORGIA |
| 304 | LOADING IN EXCESS OF AGRONOMIC RATES, PH UNKNOWN AND QUESTIONABLE | GEORGIA |
| 305 | | LEEDS, U.K. |
| 306 | | LEEDS, U.K. |
| 307 | | LEEDS, U.K. |
| 308 | HIGH CU SLUDGE (11300 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED | LEEDS, U.K. |
| 309 | | LEEDS, U.K. |
| 310 | | LEEDS, U.K. |
| 311 | | LEEDS, U.K. |
| 312 | | LEEDS, U.K. |
| 313 | | LEEDS, U.K. |
| 314 | | LEEDS, U.K. |
| 315 | | LEEDS, U.K. |
| 316 | | LEEDS, U.K. |
| 317 | | |
| 318 | | |
| 319 | | FULTON CO., ILLINOIS |
| 320 | | FULTON CO., ILLINOIS |
| 321 | | FULTON CO., ILLINOIS |
| 322 | | FULTON CO., ILLINOIS |
| 323 | | FULTON CO., ILLINOIS |
| 324 | | FULTON CO., ILLINOIS |
| 325 | | FULTON CO., ILLINOIS |
| 326 | | FULTON CO., ILLINOIS |
| 327 | | FULTON CO., ILLINOIS |
| 328 | | FULTON CO., ILLINOIS |
| 329 | | FULTON CO., ILLINOIS |
| 330 | | FULTON CO., ILLINOIS |
| 331 | | FULTON CO., ILLINOIS |
| 332 | | FULTON CO., ILLINOIS |
| 333 | | FULTON CO., ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 334 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 335 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 336 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 337 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 338 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 339 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 340 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 341 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 342 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 343 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 344 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 345 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 346 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 347 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 348 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 349 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 350 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 351 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 352 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 353 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 354 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 355 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 356 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 357 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 358 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 359 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 360 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 361 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 362 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 363 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 364 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 365 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 366 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 367 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 368 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 369 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 370 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 334 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 335 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 336 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 337 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 338 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 339 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 340 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 341 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 342 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 343 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 344 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 345 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 346 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 347 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 348 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 349 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 350 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 351 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 352 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 353 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 354 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 355 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 356 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 357 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 358 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 359 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 360 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 361 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 362 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 363 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 364 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 365 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 366 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 367 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 368 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 369 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 370 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 334 | 11.9 | 11.9 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 335 | 51 | 62.9 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 336 | 59.6 | 122.5 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 337 | 57.1 | 179.6 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 338 | 78 | 257.6 | 0 | STRIP MINE SPOIL | | | | | | 12.6 |
| 339 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 340 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 341 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 342 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 343 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 344 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 345 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 346 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 347 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 348 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 349 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | | |
| 350 | 16.1 | 78 | 0 | STRIP MINE SPOIL | | | | | | |
| 351 | 19.9 | 97.9 | 0 | STRIP MINE SPOIL | | | | | | |
| 352 | 17.4 | 115.3 | 0 | STRIP MINE SPOIL | | | | | | |
| 353 | 11.4 | 126.7 | 0 | STRIP MINE SPOIL | | | | | | |
| 354 | 16.8 | 143.5 | 0 | STRIP MINE SPOIL | | | | | | |
| 355 | 17.9 | 161.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 356 | 16.8 | 178.2 | 0 | STRIP MINE SPOIL | | | | | | |
| 357 | 16.8 | 195 | 0 | STRIP MINE SPOIL | | | | | | |
| 358 | 16.8 | 211.8 | 0 | STRIP MINE SPOIL | | | | | | |
| 359 | 16.8 | 228.6 | 0 | STRIP MINE SPOIL | | | | | | |
| 360 | 16.8 | 245.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 361 | 32.2 | 161.1 | 0 | STRIP MINE SPOIL | | | | | | |
| 362 | 39.8 | 200.9 | 0 | STRIP MINE SPOIL | | | | | | |
| 363 | 34.8 | 235.7 | 0 | STRIP MINE SPOIL | | | | | | |
| 364 | 22.8 | 258.5 | 0 | STRIP MINE SPOIL | | | | | | |
| 365 | 34.9 | 293.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 366 | 35.8 | 329.2 | 0 | STRIP MINE SPOIL | | | | | | |
| 367 | 33.6 | 362.8 | 0 | STRIP MINE SPOIL | | | | | | |
| 368 | 33.6 | 396.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 369 | 33.6 | 430 | 0 | STRIP MINE SPOIL | | | | | | |
| 370 | 33.6 | 463.6 | 0 | STRIP MINE SPOIL | | | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 334 | 0.33 | 7.8 | 11.2 | 0.1 M HCl | 3.7 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 335 | 0.33 | 7.8 | 100 | 0.1 M HCl | 6. | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 336 | 0.76 | 7.8 | 192 | 0.1 M HCl | 39.6 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 337 | 0.76 | 7.8 | 292 | 0.1 M HCl | 32.6 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 338 | 1.22 | 7.8 | 428 | 0.1 M HCl | 29.8 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 339 | 0.33 | 7.5 | 0 | 0.1 M HCl | 11.7 | 8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 340 | 0.44 | 7.5 | 0 | 0.1 M HCl | 9.5 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 341 | 0.44 | 7.5 | 0 | 0.1 M HCl | 11.5 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 342 | 0.36 | 7.5 | 0 | 0.1 M HCl | 13.3 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 343 | 0.36 | 7.5 | 0 | 0.1 M HCl | 11.9 | 9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 344 | 0.46 | 7.5 | 0 | 0.1 M HCl | 14.3 | 8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 345 | 0.46 | 7.5 | 0 | 0.1 M HCl | 16.4 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 346 | 0.73 | 7.5 | 0 | 0.1 M HCl | 18.8 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 347 | 0.73 | 7.5 | 0 | 0.1 M HCl | 24.6 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 348 | 0.7 | 7.5 | 0 | 0.1 M HCl | 26.2 | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 349 | 0.7 | 7.5 | 0 | 0.1 M HCl | 29.3 | 9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 350 | 0.59 | 7.5 | 140 | 0.1 M HCl | 19.8 | 8 | LEAF | FIELD, SLUDGE, MATURITY | 29.5 |
| 351 | 0.94 | 7.5 | 175 | 0.1 M HCl | 23.4 | 9 | LEAF | FIELD, SLUDGE, MATURITY | NA |
| 352 | 0.94 | 7.5 | 206 | 0.1 M HCl | 51 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 353 | 0.67 | 7.5 | 228 | 0.1 M HCl | 41.5 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 354 | 0.67 | 7.5 | 264 | 0.1 M HCl | 38.2 | 7 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 355 | 0.87 | 7.5 | 289 | 0.1 M HCl | 50.6 | 8 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 356 | 0.87 | 7.5 | 313 | 0.1 M HCl | 51.2 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 357 | 1.41 | 7.5 | 334 | 0.1 M HCl | 72.1 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 358 | 1.41 | 7.5 | 351 | 0.1 M HCl | 80.1 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 359 | 1.25 | 7.5 | 373 | 0.1 M HCl | 76.2 | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 360 | 1.25 | 7.5 | 387 | 0.1 M HCl | 69.7 | 9 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 361 | 0.94 | 7.5 | 280 | 0.1 M HCl | 40.5 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 21.5 |
| 362 | 0.94 | 7.5 | 350 | 0.1 M HCl | 37.2 | 13 | LEAF | FIELD, SLUDGE, MATURITY | NA |
| 363 | 1.56 | 7.5 | 412 | 0.1 M HCl | 103 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 364 | 1.56 | 7.5 | 456 | 0.1 M HCl | 89 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 365 | 1.04 | 7.5 | 528 | 0.1 M HCl | 84.4 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 366 | 1.04 | 7.5 | 578 | 0.1 M HCl | 106 | 10 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 367 | 1.48 | 7.5 | 626 | 0.1 M HCl | 112 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 368 | 1.48 | 7.5 | 668 | 0.1 M HCl | 128 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 369 | 2.15 | 7.5 | 702 | 0.1 M HCl | 148 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 370 | 2.15 | 7.5 | 746 | 0.1 M HCl | 123 | 5 | LEAF | FIELD, SLUDGE, MATURITY | 0 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| 334 | GRAIN | 0 | STOVER | |
| 335 | GRAIN | 0 | STOVER | |
| 336 | GRAIN | 0 | STOVER | |
| 337 | GRAIN | 0 | STOVER | |
| 338 | GRAIN | 0 | STOVER | |
| 339 | GRAIN | 0 | STOVER | |
| 340 | GRAIN | 0 | STOVER | |
| 341 | GRAIN | 0 | STOVER | |
| 342 | GRAIN | 0 | STOVER | |
| 343 | GRAIN | 0 | STOVER | |
| 344 | GRAIN | 0 | STOVER | |
| 345 | GRAIN | 0 | STOVER | |
| 346 | GRAIN | 0 | STOVER | |
| 347 | GRAIN | 0 | STOVER | |
| 348 | GRAIN | 0 | STOVER | |
| 349 | GRAIN | 0 | STOVER | |
| 350 | GRAIN | 0 | STOVER | |
| 351 | GRAIN | NA | STOVER | |
| 352 | GRAIN | 0 | STOVER | |
| 353 | GRAIN | 0 | STOVER | |
| 354 | GRAIN | 0 | STOVER | |
| 355 | GRAIN | 0 | STOVER | |
| 356 | GRAIN | 0 | STOVER | |
| 357 | GRAIN | 0 | STOVER | |
| 358 | GRAIN | 0 | STOVER | |
| 359 | GRAIN | 0 | STOVER | |
| 360 | GRAIN | 0 | STOVER | |
| 361 | GRAIN | 0 | STOVER | |
| 362 | GRAIN | NA | STOVER | |
| 363 | GRAIN | 0 | STOVER | |
| 364 | GRAIN | 0 | STOVER | |
| 365 | GRAIN | 0 | STOVER | |
| 366 | GRAIN | 0 | STOVER | |
| 367 | GRAIN | 0 | STOVER | |
| 368 | GRAIN | 0 | STOVER | |
| 369 | GRAIN | 0 | STOVER | |
| 370 | GRAIN | 0 | STOVER | |

TABLE F-2 (cont.)

| | COMMENTS | LOCATION |
|---|---|---|
| 334 | | FULTON CO., ILLINOIS |
| 335 | | FULTON CO., ILLINOIS |
| 336 | | FULTON CO., ILLINOIS |
| 337 | | FULTON CO., ILLINOIS |
| 338 | | FULTON CO., ILLINOIS |
| 339 | | FULTON CO., ILLINOIS |
| 340 | | FULTON CO., ILLINOIS |
| 341 | | FULTON CO., ILLINOIS |
| 342 | | FULTON CO., ILLINOIS |
| 343 | | FULTON CO., ILLINOIS |
| 344 | | FULTON CO., ILLINOIS |
| 345 | | FULTON CO., ILLINOIS |
| 346 | | FULTON CO., ILLINOIS |
| 347 | | FULTON CO., ILLINOIS |
| 348 | | FULTON CO., ILLINOIS |
| 349 | | FULTON CO., ILLINOIS |
| 350 | | FULTON CO., ILLINOIS |
| 351 | | FULTON CO., ILLINOIS |
| 352 | | FULTON CO., ILLINOIS |
| 353 | | FULTON CO., ILLINOIS |
| 354 | | FULTON CO., ILLINOIS |
| 355 | | FULTON CO., ILLINOIS |
| 356 | | FULTON CO., ILLINOIS |
| 357 | | FULTON CO., ILLINOIS |
| 358 | | FULTON CO., ILLINOIS |
| 359 | | FULTON CO., ILLINOIS |
| 360 | | FULTON CO., ILLINOIS |
| 361 | | FULTON CO., ILLINOIS |
| 362 | | FULTON CO., ILLINOIS |
| 363 | | FULTON CO., ILLINOIS |
| 364 | | FULTON CO., ILLINOIS |
| 365 | | FULTON CO., ILLINOIS |
| 366 | | FULTON CO., ILLINOIS |
| 367 | | FULTON CO., ILLINOIS |
| 368 | | FULTON CO., ILLINOIS |
| 369 | | FULTON CO., ILLINOIS |
| 370 | | FULTON CO., ILLINOIS |

TABLE F-2 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 371 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 372 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 373 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 374 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 375 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 376 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 377 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 378 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 379 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 380 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 381 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 382 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |

TABLE F-2 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 371 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 372 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 373 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 374 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 375 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 376 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 377 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 378 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 379 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 380 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 381 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 382 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-2 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 371 | 33.6 | 497.2 | 0 | STRIP MINE SPOIL | | | | | | |
| 372 | 64.3 | 321.9 | 0 | STRIP MINE SPOIL | | | | | | |
| 373 | 79.7 | 401.6 | 0 | STRIP MINE SPOIL | | | | | | |
| 374 | 69.8 | 471.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 375 | 45.5 | 516.9 | 0 | STRIP MINE SPOIL | | | | | | |
| 376 | 68.8 | 585.7 | 0 | STRIP MINE SPOIL | | | | | | |
| 377 | 71.7 | 657.4 | 0 | STRIP MINE SPOIL | | | | | | |
| 378 | 67.2 | 724.6 | 0 | STRIP MINE SPOIL | | | | | | |
| 379 | 67.2 | 791.8 | 0 | STRIP MINE SPOIL | | | | | | |
| 380 | 67.2 | 859 | 0 | STRIP MINE SPOIL | | | | | | |
| 381 | 67.2 | 926.2 | 0 | STRIP MINE SPOIL | | | | | | |
| 382 | 67.2 | 993.4 | 0 | STRIP MINE SPOIL | | | | | | |

TABLE F-2 (cont.)

| | SOIL OC % | SOIL pH | CUMM CU LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL CU CONCENTRTN mg/kg | PLANT CU CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % |
|---|---|---|---|---|---|---|---|---|---|
| 371 | 1.9 | 7.5 | 774 | 0.1 M HCl | 131 | 8 | LEAF | FIELD, SLUDGE, MATURITY | 43.7 |
| 372 | 1.22 | 7.5 | 560 | 0.1 M HCl | 63.7 | 11 | LEAF | FIELD, SLUDGE, MATURITY | 23 |
| 373 | 3.02 | 7.5 | 700 | 0.1 M HCl | 74.2 | 18 | LEAF | FIELD, SLUDGE, MATURITY | NA |
| 374 | 3.02 | 7.5 | 824 | 0.1 M HCl | 203 | 19 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 375 | 1.58 | 7.5 | 912 | 0.1 M HCl | 176 | 17 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 376 | 1.58 | 7.5 | 1056 | 0.1 M HCl | 140 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 377 | 2.38 | 7.5 | 1156 | 0.1 M HCl | 204 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 378 | 2.38 | 7.5 | 1252 | 0.1 M HCl | 200 | 17 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 379 | 3.47 | 7.5 | 1336 | 0.1 M HCl | 262 | 12 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 380 | 3.47 | 7.5 | 1404 | 0.1 M HCl | 240 | 14 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 381 | 2.77 | 7.5 | 1492 | 0.1 M HCl | 229 | 6 | LEAF | FIELD, SLUDGE, MATURITY | 0 |
| 382 | 2.77 | 7.5 | 1548 | 0.1 M HCl | 201 | 7 | LEAF | FIELD, SLUDGE, MATURITY | 59.2 |

TABLE F-2 (cont.)

| | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|
| | | | | |
| 371 | GRAIN | 0 | STOVER | |
| 372 | GRAIN | 0 | STOVER | |
| 373 | GRAIN | NA | STOVER | |
| 374 | GRAIN | 0 | STOVER | |
| 375 | GRAIN | 0 | STOVER | |
| 376 | GRAIN | 0 | STOVER | |
| 377 | GRAIN | 0 | STOVER | |
| 378 | GRAIN | 0 | STOVER | |
| 379 | GRAIN | 0 | STOVER | |
| 380 | GRAIN | 0 | STOVER | |
| 381 | GRAIN | 0 | STOVER | |
| 382 | GRAIN | 0 | STOVER | |

TABLE F-2 (cont.)

| | | |
|---|---|---|
| | | |
| | COMMENTS | LOCATION |
| | | |
| 371 | | FULTON CO., ILLINOIS |
| 372 | | FULTON CO., ILLINOIS |
| 373 | | FULTON CO., ILLINOIS |
| 374 | | FULTON CO., ILLINOIS |
| 375 | | FULTON CO., ILLINOIS |
| 376 | | FULTON CO., ILLINOIS |
| 377 | | FULTON CO., ILLINOIS |
| 378 | | FULTON CO., ILLINOIS |
| 379 | | FULTON CO., ILLINOIS |
| 380 | | FULTON CO., ILLINOIS |
| 381 | | FULTON CO., ILLINOIS |
| 382 | | FULTON CO., ILLINOIS |

TABLE F-3. NICKEL DATA

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 2 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 3 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 4 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 5 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 6 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 7 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 8 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 9 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 10 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 11 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 12 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 13 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 14 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 15 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 16 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 17 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 18 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 19 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 20 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 21 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 22 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 23 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 24 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 25 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 26 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 27 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 28 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 29 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 30 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 31 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 32 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 33 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 34 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 35 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 36 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 37 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 38 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 1 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 2 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 3 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 4 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 5 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 6 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 7 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 8 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 9 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 10 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 11 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 12 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 13 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 14 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 15 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 16 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 17 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 18 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 19 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 20 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 21 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 22 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 23 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 24 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 25 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 26 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 27 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 28 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 29 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 30 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 31 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 32 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 33 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 34 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 35 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 36 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 37 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 38 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | | | SANGO | SiL | | | |
| 2 | 50 | 50 | 0 | | SANGO | SiL | | | |
| 3 | 100 | 100 | 0 | | SANGO | SiL | | | |
| 4 | 200 | 200 | 0 | | SANGO | SiL | | | |
| 5 | 0 | 0 | | | SANGO | SiL | | | |
| 6 | 0 | 0 | | | SANGO | SiL | | | |
| 7 | 50 | 50 | 1 | | SANGO | SiL | | | |
| 8 | 100 | 100 | 1 | | SANGO | SiL | | | |
| 9 | 200 | 200 | 1 | | SANGO | SiL | | | |
| 10 | 50 | 100 | 0 | | SANGO | SiL | | | |
| 11 | 100 | 200 | 0 | | SANGO | SiL | | | |
| 12 | 200 | 400 | 0 | | SANGO | SiL | | | |
| 13 | 0 | 0 | | | SANGO | SiL | | | |
| 14 | 0 | 0 | | | SANGO | SiL | | | |
| 15 | 50 | 50 | 2 | | SANGO | SiL | | | |
| 16 | 100 | 100 | 2 | | SANGO | SiL | | | |
| 17 | 200 | 200 | 2 | | SANGO | SiL | | | |
| 18 | 50 | 150 | 0 | | SANGO | SiL | | | |
| 19 | 100 | 300 | 0 | | SANGO | SiL | | | |
| 20 | 200 | 600 | 0 | | SANGO | SiL | | | |
| 21 | 0 | 0 | | | SANGO | SiL | | | |
| 22 | 0 | 0 | | | SANGO | SiL | | | |
| 23 | 50 | 50 | 3 | | SANGO | SiL | | | |
| 24 | 100 | 100 | 3 | | SANGO | SiL | | | |
| 25 | 200 | 200 | 3 | | SANGO | SiL | | | |
| 26 | 50 | 200 | 0 | | SANGO | SiL | | | |
| 27 | 100 | 400 | 0 | | SANGO | SiL | | | |
| 28 | 200 | 800 | 0 | | SANGO | SiL | | | |
| 29 | 0 | 0 | | | SANGO | SiL | | | |
| 30 | 50 | 50 | 0 | | SANGO | SiL | | | |
| 31 | 100 | 100 | 0 | | SANGO | SiL | | | |
| 32 | 200 | 200 | 0 | | SANGO | SiL | | | |
| 33 | 0 | 0 | | | SANGO | SiL | | | |
| 34 | 0 | 0 | | | SANGO | SiL | | | |
| 35 | 50 | 50 | 1 | | SANGO | SiL | | | |
| 36 | 100 | 100 | 1 | | SANGO | SiL | | | |
| 37 | 200 | 200 | 1 | | SANGO | SiL | | | |
| 38 | 50 | 100 | 0 | | SANGO | SiL | | | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 4.9 | 0 | 0.5 M HCl | 1.1 | 4.4 | FORAGE | FIELD, SLUDGE, MATURITY |
| 2 | | | 5.3 | 2 | 0.5 M HCl | 1.8 | 2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 3 | | | 5.3 | 4 | 0.5 M HCl | 1.4 | 4.5 | FORAGE | FIELD, SLUDGE, MATURITY |
| 4 | | | 5.6 | 8 | 0.5 M HCl | 2.1 | 3.1 | FORAGE | FIELD, SLUDGE, MATURITY |
| 5 | | | 4.9 | 0 | 0.5 M HCl | 0.8 | 1.5 | FORAGE | FIELD, SLUDGE, MATURITY |
| 6 | | | 4.9 | 0 | 0.5 M HCl | 0.7 | 1.4 | FORAGE | FIELD, SLUDGE, MATURITY |
| 7 | | | 5.3 | 2 | 0.5 M HCl | 1 | 2.3 | FORAGE | FIELD, SLUDGE, MATURITY |
| 8 | | | 5.3 | 4 | 0.5 M HCl | 1.5 | 1.7 | FORAGE | FIELD, SLUDGE, MATURITY |
| 9 | | | 5.6 | 8 | 0.5 M HCl | 1.8 | 2.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 10 | | | 5.6 | 4 | 0.5 M HCl | 1.9 | 2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 11 | | | 5.6 | 8 | 0.5 M HCl | 1.9 | 1.7 | FORAGE | FIELD, SLUDGE, MATURITY |
| 12 | | | 5.6 | 16 | 0.5 M HCl | 4.5 | 1.6 | FORAGE | FIELD, SLUDGE, MATURITY |
| 13 | | | 6.5 | 0 | 0.5 M HCl | 1.2 | 1.1 | FORAGE | FIELD, SLUDGE, MATURITY |
| 14 | | | 6.5 | 0 | 0.5 M HCl | 1.3 | 1.4 | FORAGE | FIELD, SLUDGE, MATURITY |
| 15 | | | 5.2 | 2 | 0.5 M HCl | 1.7 | 1.3 | FORAGE | FIELD, SLUDGE, MATURITY |
| 16 | | | 5.6 | 4 | 0.5 M HCl | 1.9 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 17 | | | 5.9 | 8 | 0.5 M HCl | 2.3 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 18 | | | 6 | 6 | 0.5 M HCl | 2.3 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 19 | | | 5.9 | 12 | 0.5 M HCl | 3 | 1.6 | FORAGE | FIELD, SLUDGE, MATURITY |
| 20 | | | 6.3 | 24 | 0.5 M HCl | 6.3 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 21 | | | 6.3 | 0 | DTPA | 0.1 | 0.8 | FORAGE | FIELD, SLUDGE, MATURITY |
| 22 | | | 5.8 | 0 | DTPA | 0.1 | 0.8 | FORAGE | FIELD, SLUDGE, MATURITY |
| 23 | | | 5.5 | 2 | DTPA | 0.3 | 0.9 | FORAGE | FIELD, SLUDGE, MATURITY |
| 24 | | | 5.7 | 4 | DTPA | 0.4 | 1 | FORAGE | FIELD, SLUDGE, MATURITY |
| 25 | | | 6.1 | 8 | DTPA | 0.5 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 26 | | | 5 | 8 | DTPA | 0.6 | 0.8 | FORAGE | FIELD, SLUDGE, MATURITY |
| 27 | | | 5.3 | 16 | DTPA | 0.7 | 0.9 | FORAGE | FIELD, SLUDGE, MATURITY |
| 28 | | | 5.7 | 32 | DTPA | 1.5 | 1.2 | FORAGE | FIELD, SLUDGE, MATURITY |
| 29 | | | 4.9 | 0 | 0.5 M HCl | 1.1 | 5 | VINES | FIELD, SLUDGE, MATURITY |
| 30 | | | 5.3 | 2 | 0.5 M HCl | 1.8 | 6.7 | VINES | FIELD, SLUDGE, MATURITY |
| 31 | | | 5.3 | 4 | 0.5 M HCl | 1.4 | 5.5 | VINES | FIELD, SLUDGE, MATURITY |
| 32 | | | 5.6 | 8 | 0.5 M HCl | 2.1 | 5.8 | VINES | FIELD, SLUDGE, MATURITY |
| 33 | | | 4.9 | 0 | 0.5 M HCl | 0.8 | 2.9 | VINES | FIELD, SLUDGE, MATURITY |
| 34 | | | 4.9 | 0 | 0.5 M HCl | 0.7 | 2 | VINES | FIELD, SLUDGE, MATURITY |
| 35 | | | 5.3 | 2 | 0.5 M HCl | 1 | 6.7 | VINES | FIELD, SLUDGE, MATURITY |
| 36 | | | 5.3 | 4 | 0.5 M HCl | 1.5 | 6.4 | VINES | FIELD, SLUDGE, MATURITY |
| 37 | | | 5.6 | 8 | 0.5 M HCl | 1.8 | 5.3 | VINES | FIELD, SLUDGE, MATURITY |
| 38 | | | 5.6 | 4 | 0.5 M HCl | 1.9 | 4.5 | VINES | FIELD, SLUDGE, MATURITY |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| | | | | | |
| 1 | 0 | STOVER | | | NO |
| 2 | 0 | STOVER | | | NO |
| 3 | 0 | STOVER | | | NO |
| 4 | 0 | STOVER | | | NO |
| 5 | 0 | STOVER | | | NO |
| 6 | 0 | STOVER | | | NO |
| 7 | 0 | STOVER | | | NO |
| 8 | 0 | STOVER | | | NO |
| 9 | 0 | STOVER | | | NO |
| 10 | 0 | STOVER | | | NO |
| 11 | 0 | STOVER | | | NO |
| 12 | 0 | STOVER | | | NO |
| 13 | 0 | STOVER | | | NO |
| 14 | 0 | STOVER | | | NO |
| 15 | 0 | STOVER | | | NO |
| 16 | 0 | STOVER | | | NO |
| 17 | 0 | STOVER | | | NO |
| 18 | 0 | STOVER | | | NO |
| 19 | 0 | STOVER | | | NO |
| 20 | 0 | STOVER | | | NO |
| 21 | 0 | STOVER | | | NO |
| 22 | 0 | STOVER | | | NO |
| 23 | 11.3* | STOVER | | | *NO |
| 24 | 0 | STOVER | | | NO |
| 25 | 0 | STOVER | | | NO |
| 26 | 14.2* | STOVER | | | *NO |
| 27 | 17.6* | STOVER | | | *NO |
| 28 | 0 | STOVER | | | NO |
| 29 | 0 | VINES | 0 | PODS | NO |
| 30 | 0 | VINES | 17.7* | PODS | *NO |
| 31 | 0 | VINES | 35.3* | PODS | *NO |
| 32 | 0 | VINES | 55* | PODS | *NO |
| 33 | 0 | VINES | 0 | PODS | NO |
| 34 | 0 | VINES | 0 | PODS | NO |
| 35 | 0 | VINES | 25.4* | PODS | *NO |
| 36 | 0 | VINES | 0 | PODS | NO |
| 37 | 0 | VINES | 28.5* | PODS | *NO |
| 38 | 0 | VINES | 0 | PODS | NO |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 1 | | MUSCLE SCHOALES, AL |
| 2 | | MUSCLE SCHOALES, AL |
| 3 | | MUSCLE SCHOALES, AL |
| 4 | | MUSCLE SCHOALES, AL |
| 5 | | MUSCLE SCHOALES, AL |
| 6 | | MUSCLE SCHOALES, AL |
| 7 | | MUSCLE SCHOALES, AL |
| 8 | | MUSCLE SCHOALES, AL |
| 9 | | MUSCLE SCHOALES, AL |
| 10 | | MUSCLE SCHOALES, AL |
| 11 | | MUSCLE SCHOALES, AL |
| 12 | | MUSCLE SCHOALES, AL |
| 13 | | MUSCLE SCHOALES, AL |
| 14 | | MUSCLE SCHOALES, AL |
| 15 | | MUSCLE SCHOALES, AL |
| 16 | | MUSCLE SCHOALES, AL |
| 17 | | MUSCLE SCHOALES, AL |
| 18 | | MUSCLE SCHOALES, AL |
| 19 | | MUSCLE SCHOALES, AL |
| 20 | | MUSCLE SCHOALES, AL |
| 21 | | MUSCLE SCHOALES, AL |
| 22 | | MUSCLE SCHOALES, AL |
| 23 | * DOSE RESPONSE & TISSUE NI NOT CONSISTENT | MUSCLE SCHOALES, AL |
| 24 | | MUSCLE SCHOALES, AL |
| 25 | | MUSCLE SCHOALES, AL |
| 26 | *TISSUE NI INCONSISTENT, ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5 | MUSCLE SCHOALES, AL |
| 27 | *TISSUE NI INCONSISTENT, ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5 | MUSCLE SCHOALES, AL |
| 28 | | MUSCLE SCHOALES, AL |
| 29 | | MUSCLE SCHOALES, AL |
| 30 | *TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA | MUSCLE SCHOALES, AL |
| 31 | *TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA | MUSCLE SCHOALES, AL |
| 32 | *TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA | MUSCLE SCHOALES, AL |
| 33 | | MUSCLE SCHOALES, AL |
| 34 | | MUSCLE SCHOALES, AL |
| 35 | *DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT | MUSCLE SCHOALES, AL |
| 36 | | MUSCLE SCHOALES, AL |
| 37 | *DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT | MUSCLE SCHOALES, AL |
| 38 | | MUSCLE SCHOALES, AL |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 39 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 40 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 41 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 42 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 43 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 44 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 45 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 46 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 47 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 48 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 49 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 50 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 51 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 52 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 53 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 54 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 55 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 56 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 57 | GIORDANO & MAYS 1977 | BEANS | | | | | | | | |
| 58 | GIORDANO & MAYS 1977 | BEANS | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 59 | GIORDANO & MAYS 1977 | BEANS | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 60 | GIORDANO & MAYS 1977 | OKRA | | | | | | | | |
| 61 | GIORDANO & MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 62 | GIORDANO & MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 63 | GIORDANO & MAYS 1977 | PEPPERS | | | | | | | | |
| 64 | GIORDANO & MAYS 1977 | PEPPERS | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 65 | GIORDANO & MAYS 1977 | PEPPERS | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 66 | GIORDANO & MAYS 1977 | TOMATO | | | | | | | | |
| 67 | GIORDANO & MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 68 | GIORDANO & MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 69 | GIORDANO & MAYS 1977 | SQUASH | | | | | | | | |
| 70 | GIORDANO & MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 71 | GIORDANO & MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 72 | GIORDANO & MAYS 1977 | TURNIP | | | | | | | | |
| 73 | GIORDANO & MAYS 1977 | TURNIP | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 74 | GIORDANO & MAYS 1977 | TURNIP | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 75 | GIORDANO & MAYS 1977 | KALE | | | | | | | | |
| 76 | GIORDANO & MAYS 1977 | KALE | | 6.6 | | | 2.5 | 50 | 350 | 730 |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 39 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 40 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 41 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 42 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 43 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 44 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 45 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 46 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 47 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 48 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 49 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 50 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 51 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 52 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 53 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 54 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 55 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 56 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 57 | | | | | | | | | |
| 58 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 59 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 60 | | | | | | | | | |
| 61 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 62 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 63 | | | | | | | | | |
| 64 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 65 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 66 | | | | | | | | | |
| 67 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 68 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 69 | | | | | | | | | |
| 70 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 71 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 72 | | | | | | | | | |
| 73 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 74 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 75 | | | | | | | | | |
| 76 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 39 | 100 | 200 | 0 | | SANGO | SiL | | | |
| 40 | 200 | 400 | 0 | | SANGO | SiL | | | |
| 41 | 0 | 0 | | | SANGO | SiL | | | |
| 42 | 0 | 0 | | | SANGO | SiL | | | |
| 43 | 50 | 50 | 2 | | SANGO | SiL | | | |
| 44 | 100 | 100 | 2 | | SANGO | SiL | | | |
| 45 | 200 | 200 | 2 | | SANGO | SiL | | | |
| 46 | 50 | 150 | 0 | | SANGO | SiL | | | |
| 47 | 100 | 300 | 0 | | SANGO | SiL | | | |
| 48 | 200 | 600 | 0 | | SANGO | SiL | | | |
| 49 | 0 | 0 | | | SANGO | SiL | | | |
| 50 | 0 | 0 | | | SANGO | SiL | | | |
| 51 | 50 | 50 | 3 | | SANGO | SiL | | | |
| 52 | 100 | 100 | 3 | | SANGO | SiL | | | |
| 53 | 200 | 200 | 3 | | SANGO | SiL | | | |
| 54 | 50 | 200 | 0 | | SANGO | SiL | | | |
| 55 | 100 | 400 | 0 | | SANGO | SiL | | | |
| 56 | 200 | 800 | 0 | | SANGO | SiL | | | |
| 57 | 0 | 0 | | | SANGO | SiL | | | |
| 58 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 59 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 60 | 0 | 0 | | | SANGO | SiL | | | |
| 61 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 62 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 63 | 0 | 0 | | | SANGO | SiL | | | |
| 64 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 65 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 66 | 0 | 0 | | | SANGO | SiL | | | |
| 67 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 68 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 69 | 0 | 0 | | | SANGO | SiL | | | |
| 70 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 71 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 72 | 0 | 0 | | | SANGO | SiL | | | |
| 73 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 74 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 75 | 0 | 0 | | | SANGO | SiL | | | |
| 76 | 112 | 112 | 0 | | SANGO | SiL | | | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 39 | | | 5.6 | 8 | 0.5 M HCl | 1.9 | 4.8 | VINES | FIELD, SLUDGE, MATURITY |
| 40 | | | 5.6 | 16 | 0.5 M HCl | 4.5 | 7. | VINES | FIELD, SLUDGE, MATURITY |
| 41 | | | 6.5 | 0 | 0.5 M HCl | 1.2 | 2.9 | VINES | FIELD, SLUDGE, MATURITY |
| 42 | | | 6.5 | 0 | 0.5 M HCl | 1.3 | 2.5 | VINES | FIELD, SLUDGE, MATURITY |
| 43 | | | 5.2 | 2 | 0.5 M HCl | 1.7 | 5.3 | VINES | FIELD, SLUDGE, MATURITY |
| 44 | | | 5.6 | 4 | 0.5 M HCl | 1.9 | 4.7 | VINES | FIELD, SLUDGE, MATURITY |
| 45 | | | 5.9 | 8 | 0.5 M HCl | 2.3 | 5 | VINES | FIELD, SLUDGE, MATURITY |
| 46 | | | 6 | 6 | 0.5 M HCl | 2.3 | 5.5 | VINES | FIELD, SLUDGE, MATURITY |
| 47 | | | 5.9 | 12 | 0.5 M HCl | 3 | 5.9 | VINES | FIELD, SLUDGE, MATURITY |
| 48 | | | 6.3 | 24 | 0.5 M HCl | 6.3 | 5.7 | VINES | FIELD, SLUDGE, MATURITY |
| 49 | | | 6.3 | 0 | DTPA | 0.1 | 2.2 | VINES | FIELD, SLUDGE, MATURITY |
| 50 | | | 5.8 | 0 | DTPA | 0.1 | 2.2 | VINES | FIELD, SLUDGE, MATURITY |
| 51 | | | 5.5 | 2 | DTPA | 0.3 | 4.5 | VINES | FIELD, SLUDGE, MATURITY |
| 52 | | | 5.7 | 4 | DTPA | 0.4 | 4.9 | VINES | FIELD, SLUDGE, MATURITY |
| 53 | | | 6.1 | 8 | DTPA | 0.5 | 3.7 | VINES | FIELD, SLUDGE, MATURITY |
| 54 | | | 5 | 8 | DTPA | 0.6 | 4.4 | VINES | FIELD, SLUDGE, MATURITY |
| 55 | | | 5.3 | 16 | DTPA | 0.7 | 4.6 | VINES | FIELD, SLUDGE, MATURITY |
| 56 | | | 5.7 | 32 | DTPA | 1.5 | 5.5 | VINES | FIELD, SLUDGE, MATURITY |
| 57 | | | 6.4 | 0 | 0.5 M HCL | 1 | 2.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 58 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 3.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 59 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 2.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 60 | | | 6.4 | 0 | 0.5 M HCL | 1 | 1.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 61 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 2.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 62 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 63 | | | 6.4 | 0 | 0.5 M HCL | 1 | 1.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 64 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 2.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 65 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 2.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 66 | | | 6.4 | 0 | 0.5 M HCL | 1 | 1.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 67 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 2.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 68 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 1.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 69 | | | 6.4 | 0 | 0.5 M HCL | 1 | 1.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 70 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 4 | LEAF | FIELD, SLUDGE, MATURITY |
| 71 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 72 | | | 6.4 | 0 | 0.5 M HCL | 1 | 2.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 73 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 4 | LEAF | FIELD, SLUDGE, MATURITY |
| 74 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 2.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 75 | | | 6.4 | 0 | 0.5 M HCL | 1 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 76 | | | 6.4 | 2.2 | 0.5 M HCL | 2.7 | 3.5 | LEAF | FIELD, SLUDGE, MATURITY |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| | | | | | |
| 39 | 0 | VINES | 0 | PODS | NO |
| 40 | 0 | VINES | 60.4* | PODS | *NO |
| 41 | 0 | VINES | 0 | PODS | NO |
| 42 | 0 | VINES | 0 | PODS | NO |
| 43 | 30.8* | VINES | 37.5* | PODS | *NO |
| 44 | 0 | VINES | 0 | PODS | NO |
| 45 | 0 | VINES | 0 | PODS | NO |
| 46 | 0 | VINES | 0 | PODS | NO |
| 47 | 0 | VINES | 0 | PODS | NO |
| 48 | 0 | VINES | 0 | PODS | NO |
| 49 | 0 | VINES | 0 | PODS | NO |
| 50 | 0 | VINES | 0 | PODS | NO |
| 51 | 26.2* | VINES | 0 | PODS | *NO |
| 52 | 14.5* | VINES | 0 | PODS | *NO |
| 53 | 0 | VINES | 0 | PODS | NO |
| 54 | 27* | VINES | 0 | PODS | *NO |
| 55 | 36* | VINES | 36.8* | PODS | *NO |
| 56 | 32.8* | VINES | 42.8* | PODS | *NO |
| 57 | 0 | EDIBLE PART | | | NO |
| 58 | 0 | EDIBLE PART | | | NO |
| 59 | 14.3* | EDIBLE PART | | | *NO |
| 60 | 0 | EDIBLE PART | | | NO |
| 61 | 8.3* | EDIBLE PART | | | *NO |
| 62 | 8.3* | EDIBLE PART | | | *NO |
| 63 | 0 | EDIBLE PART | | | NO |
| 64 | 0 | EDIBLE PART | | | NO |
| 65 | 13* | EDIBLE PART | | | *NO |
| 66 | 0 | EDIBLE PART | | | NO |
| 67 | 0 | EDIBLE PART | | | NO |
| 68 | 0 | EDIBLE PART | | | NO |
| 69 | 0 | EDIBLE PART | | | NO |
| 70 | 0 | EDIBLE PART | | | NO |
| 71 | 0 | EDIBLE PART | | | NO |
| 72 | 0 | EDIBLE PART | | | NO |
| 73 | 0 | EDIBLE PART | | | NO |
| 74 | 0 | EDIBLE PART | | | NO |
| 75 | 0 | EDIBLE PART | | | NO |
| 76 | 0 | EDIBLE PART | | | NO |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 381 | | | NO | |
| 382 | | | NO | |
| 383 | | | NO | |
| 384 | | | NO | |
| 385 | | | NO | |
| 386 | | | NO | |
| 387 | | | NO | |
| 388 | | | NO | |
| 389 | | | NO | |
| 390 | | | NO | |
| 391 | | | NO | |
| 392 | | | NO | |
| 393 | | | NO | |
| 394 | | | NO | |
| 395 | | | NO | |
| 396 | | | NO | |
| 397 | | | NO | |
| 398 | | | NO | |
| 399 | | | NO | |
| 400 | | | NO | |
| 401 | | | NO | |
| 402 | | | NO | |
| 403 | | | NO | |
| 404 | | | NO | |
| 405 | | | NO | |
| 406 | | | NO | |
| 407 | | | NO | |
| 408 | | | NO | |
| 409 | | | NO | |
| 410 | | | NO | |
| 411 | | | NO | |
| 412 | | | NO | |
| 413 | | | NO | |
| 414 | | | NO | |
| 415 | | | NO | |
| 416 | | | NO | |
| 417 | | | NO | |
| 418 | | | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 381 | | | 212 | Leaf | SLUDGE, FIELD, MATURITY | 0 | Grain |
| 382 | | 68 | 14.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 383 | | 68 | 18 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 384 | | 68 | 18.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 385 | | 68 | 16 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 386 | | 68 | 28.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 387 | | 68 | 14.6 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 388 | | 68 | 22.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 389 | | 68 | 17.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 390 | | 68 | 17.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 391 | | 68 | 20 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 392 | | 68 | 19.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 393 | | 68 | 17.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 394 | | 68 | 16.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 395 | | 68 | 17.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 396 | | 68 | 16.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 397 | | 68 | 18.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 398 | | 68 | 15.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 399 | | 68 | 12.9 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 400 | | 68 | 16 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 401 | | 68 | 15.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 402 | | 188 | 78.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 403 | | 188 | 84.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 404 | | 188 | 63.6 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 405 | | 188 | 43.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 406 | | 188 | 64.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 407 | | 188 | 50.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 408 | | 188 | 54.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 409 | | 188 | 58.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 410 | | 188 | 51.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 411 | | 188 | 40.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 412 | | 188 | 48.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 413 | | 188 | 48.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 414 | | 188 | 37.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 415 | | 188 | 32.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 416 | | 188 | 35.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 417 | | 188 | 40.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 418 | | 188 | 35.6 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 381 | | | | | | | 1201 |
| 382 | | | | | | | |
| 383 | | | | | | | |
| 384 | | | | | | | |
| 385 | | | | | | | |
| 386 | | | | | | | |
| 387 | | | | | | | |
| 388 | | | | | | | |
| 389 | | | | | | | |
| 390 | | | | | | | |
| 391 | | | | | | | |
| 392 | | | | | | | |
| 393 | | | | | | | |
| 394 | | | | | | | |
| 395 | | | | | | | |
| 396 | | | | | | | |
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| 398 | | | | | | | |
| 399 | | | | | | | |
| 400 | | | | | | | |
| 401 | | | | | | | |
| 402 | | | | | | | |
| 403 | | | | | | | |
| 404 | | | | | | | |
| 405 | | | | | | | |
| 406 | | | | | | | |
| 407 | | | | | | | |
| 408 | | | | | | | |
| 409 | | | | | | | |
| 410 | | | | | | | |
| 411 | | | | | | | |
| 412 | | | | | | | |
| 413 | | | | | | | |
| 414 | | | | | | | |
| 415 | | | | | | | |
| 416 | | | | | | | |
| 417 | | | | | | | |
| 418 | | | | | | | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 381 | | 53 | 153 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 382 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 383 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 384 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 385 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 386 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 387 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 388 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 389 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 390 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 391 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 392 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 393 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 394 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 395 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 396 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 397 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 398 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 399 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 400 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 401 | | 0 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 402 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 403 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 404 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 405 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 406 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 407 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 408 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 409 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 410 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 411 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 412 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 413 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 414 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 415 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 416 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 417 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 418 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 381 | | | | | | | | | | Liquid digested sludge |
| 382 | | | | | | | | | | Control |
| 383 | | | | | | | | | | Control |
| 384 | | | | | | | | | | Control |
| 385 | | | | | | | | | | Control |
| 386 | | | | | | | | | | Control |
| 387 | | | | | | | | | | Control |
| 388 | | | | | | | | | | Control |
| 389 | | | | | | | | | | Control |
| 390 | | | | | | | | | | Control |
| 391 | | | | | | | | | | Control |
| 392 | | | | | | | | | | Control |
| 393 | | | | | | | | | | Control |
| 394 | | | | | | | | | | Control |
| 395 | | | | | | | | | | Control |
| 396 | | | | | | | | | | Control |
| 397 | | | | | | | | | | Control |
| 398 | | | | | | | | | | Control |
| 399 | | | | | | | | | | Control |
| 400 | | | | | | | | | | Control |
| 401 | | | | | | | | | | Control |
| 402 | | | | | | | | | | One-quarter maximum |
| 403 | | | | | | | | | | One-quarter maximum |
| 404 | | | | | | | | | | One-quarter maximum |
| 405 | | | | | | | | | | One-quarter maximum |
| 406 | | | | | | | | | | One-quarter maximum |
| 407 | | | | | | | | | | One-quarter maximum |
| 408 | | | | | | | | | | One-quarter maximum |
| 409 | | | | | | | | | | One-quarter maximum |
| 410 | | | | | | | | | | One-quarter maximum |
| 411 | | | | | | | | | | One-quarter maximum |
| 412 | | | | | | | | | | One-quarter maximum |
| 413 | | | | | | | | | | One-quarter maximum |
| 414 | | | | | | | | | | One-quarter maximum |
| 415 | | | | | | | | | | One-quarter maximum |
| 416 | | | | | | | | | | One-quarter maximum |
| 417 | | | | | | | | | | One-quarter maximum |
| 418 | | | | | | | | | | One-quarter maximum |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 381 | Hinesly, T.D. et al., 1977. #94 | Corn | | | | | | |
| 382 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh43 | | | | | |
| 383 | Hinesly, T.D. et al., 1978. #95 | Corn | R806 | | | | | |
| 384 | Hinesly, T.D. et al., 1978. #95 | Corn | H98 | | | | | |
| 385 | Hinesly, T.D. et al., 1978. #95 | Corn | A619 | | | | | |
| 386 | Hinesly, T.D. et al., 1978. #95 | Corn | Mo17 | | | | | |
| 387 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh545 | | | | | |
| 388 | Hinesly, T.D. et al., 1978. #95 | Corn | B37 | | | | | |
| 389 | Hinesly, T.D. et al., 1978. #95 | Corn | R805 | | | | | |
| 390 | Hinesly, T.D. et al., 1978. #95 | Corn | Va26 | | | | | |
| 391 | Hinesly, T.D. et al., 1978. #95 | Corn | H100 | | | | | |
| 392 | Hinesly, T.D. et al., 1978. #95 | Corn | B73 | | | | | |
| 393 | Hinesly, T.D. et al., 1978. #95 | Corn | B14 | | | | | |
| 394 | Hinesly, T.D. et al., 1978. #95 | Corn | A632 | | | | | |
| 395 | Hinesly, T.D. et al., 1978. #95 | Corn | N28 | | | | | |
| 396 | Hinesly, T.D. et al., 1978. #95 | Corn | W64A | | | | | |
| 397 | Hinesly, T.D. et al., 1978. #95 | Corn | R802A | | | | | |
| 398 | Hinesly, T.D. et al., 1978. #95 | Corn | H99 | | | | | |
| 399 | Hinesly, T.D. et al., 1978. #95 | Corn | H96 | | | | | |
| 400 | Hinesly, T.D. et al., 1978. #95 | Corn | R177 | | | | | |
| 401 | Hinesly, T.D. et al., 1978. #95 | Corn | B77 | | | | | |
| 402 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh43 | | | | | |
| 403 | Hinesly, T.D. et al., 1978. #95 | Corn | R806 | | | | | |
| 404 | Hinesly, T.D. et al., 1978. #95 | Corn | H98 | | | | | |
| 405 | Hinesly, T.D. et al., 1978. #95 | Corn | A619 | | | | | |
| 406 | Hinesly, T.D. et al., 1978. #95 | Corn | Mo17 | | | | | |
| 407 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh545 | | | | | |
| 408 | Hinesly, T.D. et al., 1978. #95 | Corn | B37 | | | | | |
| 409 | Hinesly, T.D. et al., 1978. #95 | Corn | R805 | | | | | |
| 410 | Hinesly, T.D. et al., 1978. #95 | Corn | Va26 | | | | | |
| 411 | Hinesly, T.D. et al., 1978. #95 | Corn | H100 | | | | | |
| 412 | Hinesly, T.D. et al., 1978. #95 | Corn | B73 | | | | | |
| 413 | Hinesly, T.D. et al., 1978. #95 | Corn | B14 | | | | | |
| 414 | Hinesly, T.D. et al., 1978. #95 | Corn | A632 | | | | | |
| 415 | Hinesly, T.D. et al., 1978. #95 | Corn | N28 | | | | | |
| 416 | Hinesly, T.D. et al., 1978. #95 | Corn | W64A | | | | | |
| 417 | Hinesly, T.D. et al., 1978. #95 | Corn | R802A | | | | | |
| 418 | Hinesly, T.D. et al., 1978. #95 | Corn | H99 | | | | | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 343 | India |
| 344 | Canada |
| 345 | Canada |
| 346 | Canada |
| 347 | Canada |
| 348 | Canada |
| 349 | Canada |
| 350 | Canada |
| 351 | Beltsville, MD |
| 352 | Beltsville, MD |
| 353 | Beltsville, MD |
| 354 | Beltsville, MD |
| 355 | Beltsville, MD |
| 356 | Beltsville, MD |
| 357 | Beltsville, MD |
| 358 | Beltsville, MD |
| 359 | Beltsville, MD |
| 360 | Beltsville, MD |
| 361 | Beltsville, MD |
| 362 | Beltsville, MD |
| 363 | Beltsville, MD |
| 364 | Beltsville, MD |
| 365 | Beltsville, MD |
| 366 | Beltsville, MD |
| 367 | Beltsville, MD |
| 368 | Beltsville, MD |
| 369 | Beltsville, MD |
| 370 | |
| 371 | |
| 372 | |
| 373 | |
| 374 | |
| 375 | |
| 376 | |
| 377 | |
| 378 | |
| 379 | Joliet, Ill. |
| 380 | Joliet, Ill. |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 343 | 0 | GRAIN | NO | |
| 344 | | | NO | |
| 345 | | | NO | |
| 346 | | | NO | |
| 347 | | | NO | |
| 348 | | | NO | |
| 349 | | | NO | |
| 350 | | | NO | |
| 351 | | | NO | |
| 352 | | | NO | |
| 353 | | | NO | |
| 354 | | | NO | |
| 355 | | | NO | |
| 356 | | | NO | |
| 357 | | | NO | |
| 358 | | | NO | |
| 359 | | | NO | |
| 360 | | | NO | |
| 361 | | | NO | |
| 362 | | | NO | |
| 363 | | | NO | |
| 364 | | | NO | |
| 365 | | | NO | |
| 366 | | | NO | |
| 367 | | | NO | |
| 368 | | | NO | |
| 369 | | | NO | |
| 370 | | | NO | |
| 371 | | | NO | |
| 372 | | | NO | |
| 373 | | | NO | |
| 374 | | | NO | |
| 375 | | | NO | |
| 376 | | | NO | |
| 377 | | | NO | |
| 378 | | | NO | |
| 379 | | | NO | |
| 380 | | | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 343 | HCL04/HNO3 | 81.8 | 88.14 | Earhead | SLUDGE, FIELD, MATURITY | 0 | Whole Plant |
| 344 | | 42.8 | 30 | Stem | | 0 | GRAIN |
| 345 | | 81.4 | 43 | Stem | | 0 | GRAIN |
| 346 | | 25.2 | 15 | Stem | | 0 | GRAIN |
| 347 | | | 28.4 | Leaf | | 0 | Leaf |
| 348 | | | 42.6 | Leaf | | 0 | Leaf |
| 349 | | | 51.9 | Leaf | | 0 | Leaf |
| 350 | | | 78.7 | Leaf | | 0 | Leaf |
| 351 | | | 46 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 352 | | | 40 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 353 | | | 35 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 354 | | | 45 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 355 | | | 44 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 356 | | | 34 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 357 | | | 31 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 358 | | | 37 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 359 | | | 54 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 360 | | | 50 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 361 | | | 46 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 362 | | | 40 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 363 | | | 48 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 364 | | | 57 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 365 | | | 62 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 366 | | | 62 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 367 | | | 85 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 368 | | | 106 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 369 | | | 153 | Shoots | SLUDGE, FIELD, MATURITY | 0 | Shoots |
| 370 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 371 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 372 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 373 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 374 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 375 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 376 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 377 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 378 | | | | | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 379 | | | | | SLUDGE, FIELD, MATURITY | 0 | Grain |
| 380 | | | | | SLUDGE, FIELD, MATURITY | 0 | Grain |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 343 | | | | | 0.7 | 8 | |
| 344 | | | | 36.7 | | | |
| 345 | | | | 35.7 | | | |
| 346 | | | | 28 | | | |
| 347 | | | | | 2-2.5 | 5.9-6.2 | 6.7 |
| 348 | | | | | 2-2.5 | 5.9-6.2 | 20.1 |
| 349 | | | | | 2-2.5 | 5.9-6.2 | 26.8 |
| 350 | | | | | 2-2.5 | 5.9-6.2 | 40.2 |
| 351 | | | | | | 7 | |
| 352 | | | | | | 7.4 | |
| 353 | | | | | | 7.6 | |
| 354 | | | | | | 7.7 | |
| 355 | | | | | | 7.6 | |
| 356 | | | | | | 6.9 | |
| 357 | | | | | | 7.4 | |
| 358 | | | | | | 7.6 | |
| 359 | | | | | | 5.8 | |
| 360 | | | | | | 6.1 | |
| 361 | | | | | | 6.8 | |
| 362 | | | | | | 7 | |
| 363 | | | | | | 7.1 | |
| 364 | | | | | | 5.8 | |
| 365 | | | | | | 5.7 | |
| 366 | | | | | | 6 | |
| 367 | | | | | | 5.2 | |
| 368 | | | | | | 5.3 | |
| 369 | | | | | | 5.1 | |
| 370 | | | | | | | 0 |
| 371 | | | | | | | 0 |
| 372 | | | | | | | 0 |
| 373 | | | | | | | 80 |
| 374 | | | | | | | 197 |
| 375 | | | | | | | 300 |
| 376 | | | | | | | 159 |
| 377 | | | | | | | 394 |
| 378 | | | | | | | 600 |
| 379 | | | | | | | 317 |
| 380 | | | | | | | 787 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 343 | | 20 | 20 | 0 | | | Clayey |
| 344 | | 75 | 75 | | | | |
| 345 | | 150 | 150 | | | | |
| 346 | | 0 | 0 | | | | |
| 347 | | | | 1981 | Orthic Podzol | Lyndale | Sandy Loam |
| 348 | | | | 1981 | Orthic Podzol | Lyndale | Sandy Loam |
| 349 | | | | 1981 | Orthic Podzol | Lyndale | Sandy Loam |
| 350 | | | | 1981 | Orthic Podzol | Lyndale | Sandy Loam |
| 351 | | 56 | 56 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 352 | | 112 | 112 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 353 | | 224 | 224 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 354 | | 336 | 336 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 355 | | 448 | 448 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 356 | | 56 | 56 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 357 | | 112 | 112 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 358 | | 224 | 224 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 359 | | 56 | 56 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 360 | | 112 | 112 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 361 | | 224 | 224 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 362 | | 448 | 448 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 363 | | 672 | 672 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 364 | | 56 | 56 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 365 | | 112 | 112 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 366 | | 224 | 224 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 367 | | 56 | 56 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 368 | | 112 | 112 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 369 | | 224 | 224 | 1976 | Typic Paleudults | Christiana | fine sandy loam |
| 370 | | 0 | 0 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 371 | | 0 | 0 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 372 | | 0 | 0 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 373 | | 13 | 13 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 374 | | 12 | 25 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 375 | | 14 | 38 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 376 | | 26 | 26 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 377 | | 24 | 50 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 378 | | 27 | 77 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 379 | | 52 | 52 | 0 | Aeric Ochraqualf | Blount | silt loam |
| 380 | | 48 | 100 | 0 | Aeric Ochraqualf | Blount | silt loam |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 343 | 45 | 428 | | | | | | 562 | | Well Water + 20 t/ha sludge |
| 344 | 191 | 143 | | | 26.3 | 27200 | 194 | 420 | | Sludge |
| 345 | 191 | 143 | | | 26.3 | 27200 | 194 | 420 | | Sludge |
| 346 | 0.05 | 0.073 | | | 0.086 | 23.8 | 0.094 | 0.313 | | Irrigation Water |
| 347 | | | | | | | | | | N.P.K.S. Fertilizer |
| 348 | | | | | | | | | | N.P.K.S. Fertilizer |
| 349 | | | | | | | | | | N.P.K.S. Fertilizer |
| 350 | | | | | | | | | | N.P.K.S. Fertilizer |
| 351 | | 259 | | | 15 | | 217 | 639 | | Limed-digested |
| 352 | | 259 | | | 15 | | 217 | 639 | | Limed-digested |
| 353 | | 259 | | | 15 | | 217 | 639 | | Limed-digested |
| 354 | | 259 | | | 15 | | 217 | 639 | | Limed-digested |
| 355 | | 259 | | | 15 | | 217 | 639 | | Limed-digested |
| 356 | | 277 | | | 17 | | 215 | 599 | | Limed-Raw |
| 357 | | 277 | | | 17 | | 215 | 599 | | Limed-Raw |
| 358 | | 277 | | | 17 | | 215 | 599 | | Limed-Raw |
| 359 | | 274 | | | 201 | | 272 | 731 | | Limed-Compost |
| 360 | | 274 | | | 201 | | 272 | 731 | | Limed-Compost |
| 361 | | 274 | | | 201 | | 272 | 731 | | Limed-Compost |
| 362 | | 274 | | | 201 | | 272 | 731 | | Limed-Compost |
| 363 | | 274 | | | 201 | | 272 | 731 | | Limed-Compost |
| 364 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, High pH |
| 365 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, High pH |
| 366 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, High pH |
| 367 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, Low pH |
| 368 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, Low pH |
| 369 | | 404 | | | 37 | | 360 | 1330 | | Heat-Treated, Low pH |
| 370 | | | | | | | | | | Liquid digested sludge |
| 371 | | | | | | | | | | Liquid digested sludge |
| 372 | | | | | | | | | | Liquid digested sludge |
| 373 | | | | | | | | | | Liquid digested sludge |
| 374 | | | | | | | | | | Liquid digested sludge |
| 375 | | | | | | | | | | Liquid digested sludge |
| 376 | | | | | | | | | | Liquid digested sludge |
| 377 | | | | | | | | | | Liquid digested sludge |
| 378 | | | | | | | | | | Liquid digested sludge |
| 379 | | | | | | | | | | Liquid digested sludge |
| 380 | | | | | | | | | | Liquid digested sludge |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 343 | Chakrabarti, C. and T. Chakrabarti, 1988. #29 | Wheat | HDM 1553 | | | | | |
| 344 | Gillies, J.A. et al., 1989. #73 | Oat | Harmon | | | | | 4.6 |
| 345 | Gillies, J.A. et al., 1989. #73 | Oat | Harmon | | | | | 4.6 |
| 346 | Gillies, J.A. et al., 1989. #73 | Oat | Harmon | | | | | 0.014 |
| 347 | Gupta, Umesh C., and W.J. Arsenault, 1986. #80 | Tobacco | | | | | | |
| 348 | Gupta, Umesh C., and W.J. Arsenault, 1986. #80 | Tobacco | | | | | | |
| 349 | Gupta, Umesh C., and W.J. Arsenault, 1986. #80 | Tobacco | | | | | | |
| 350 | Gupta, Umesh C., and W.J. Arsenault, 1986. #80 | Tobacco | | | | | | |
| 351 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 5.9 |
| 352 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 5.9 |
| 353 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 5.9 |
| 354 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 5.9 |
| 355 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 5.9 |
| 356 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 4.9 |
| 357 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 4.9 |
| 358 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 4.9 |
| 359 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 7.2 |
| 360 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 7.2 |
| 361 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 7.2 |
| 362 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 7.2 |
| 363 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 7.2 |
| 364 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 365 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 366 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 367 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 368 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 369 | Heckman, J.R. et al., 1987. #89 | Soybean | Merr. | | | | | 8.3 |
| 370 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 371 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 372 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 373 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 374 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 375 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 376 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 377 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 378 | Hinesly, T.D. et al., 1977. #94 | CORN | | | | | | |
| 379 | Hinesly, T.D. et al., 1977. #94 | Corn | | | | | | |
| 380 | Hinesly, T.D. et al., 1977. #94 | Corn | | | | | | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 305 | JOLIET, ILLINOIS |
| 306 | JOLIET, ILLINOIS |
| 307 | JOLIET, ILLINOIS |
| 308 | JOLIET, ILLINOIS |
| 309 | JOLIET, ILLINOIS |
| 310 | JOLIET, ILLINOIS |
| 311 | JOLIET, ILLINOIS |
| 312 | JOLIET, ILLINOIS |
| 313 | JOLIET, ILLINOIS |
| 314 | JOLIET, ILLINOIS |
| 315 | JOLIET, ILLINOIS |
| 316 | JOLIET, ILLINOIS |
| 317 | JOLIET, ILLINOIS |
| 318 | JOLIET, ILLINOIS |
| 319 | JOLIET, ILLINOIS |
| 320 | JOLIET, ILLINOIS |
| 321 | JOLIET, ILLINOIS |
| 322 | JOLIET, ILLINOIS |
| 323 | JOLIET, ILLINOIS |
| 324 | JOLIET, ILLINOIS |
| 325 | JOLIET, ILLINOIS |
| 326 | JOLIET, ILLINOIS |
| 327 | JOLIET, ILLINOIS |
| 328 | JOLIET, ILLINOIS |
| 329 | JOLIET, ILLINOIS |
| 330 | JOLIET, ILLINOIS |
| 331 | JOLIET, ILLINOIS |
| 332 | JOLIET, ILLINOIS |
| 333 | JOLIET, ILLINOIS |
| 334 | JOLIET, ILLINOIS |
| 335 | JOLIET, ILLINOIS |
| 336 | JOLIET, ILLINOIS |
| 337 | JOLIET, ILLINOIS |
| 338 | JOLIET, ILLINOIS |
| 339 | JOLIET, ILLINOIS |
| 340 | JOLIET, ILLINOIS |
| 341 | India |
| 342 | India |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 305 | 0 | STOVER | NO | |
| 306 | 0 | STOVER | NO | |
| 307 | 0 | STOVER | NO | |
| 308 | NA | STOVER | NO | |
| 309 | 0 | STOVER | NO | |
| 310 | 0 | STOVER | NO | |
| 311 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 312 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 313 | 0 | STOVER | NO | |
| 314 | 0 | STOVER | NO | |
| 315 | 0 | STOVER | NO | |
| 316 | 0 | STOVER | NO | |
| 317 | 0 | STOVER | NO | |
| 318 | 0 | STOVER | NO | |
| 319 | NA | STOVER | NO | |
| 320 | 0 | STOVER | NO | |
| 321 | 0 | STOVER | NO | |
| 322 | 0 | STOVER | NO | |
| 323 | 0 | STOVER | NO | |
| 324 | 0 | STOVER | NO | |
| 325 | 0 | STOVER | NO | |
| 326 | 0 | STOVER | NO | |
| 327 | 0 | STOVER | NO | |
| 328 | 0 | STOVER | NO | |
| 329 | 0 | STOVER | NO | |
| 330 | NA | STOVER | NO | |
| 331 | 0 | STOVER | NO | |
| 332 | 0 | STOVER | NO | |
| 333 | 0 | STOVER | NO | |
| 334 | 0 | STOVER | NO | |
| 335 | 0 | STOVER | NO | |
| 336 | 0 | STOVER | NO | |
| 337 | 0 | STOVER | NO | |
| 338 | 0 | STOVER | NO | |
| 339 | 0 | STOVER | NO | |
| 340 | 0 | STOVER | NO | |
| 341 | 0 | GRAIN | NO | |
| 342 | 0 | GRAIN | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 305 | HCL-HF | 77 | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 306 | HCL-HF | 81 | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 307 | HCL-HF | 90 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 308 | HCL-HF | 61 | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 309 | HCL-HF | 88 | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 310 | HCL-HF | 125 | 94 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 311 | HCL-HF | 111 | 92 | LEAF | SLUDGE, FIELD, MATURITY | 60* | GRAIN |
| 312 | HCL-HF | 165 | 11 | LEAF | SLUDGE, FIELD, MATURITY | 60* | GRAIN |
| 313 | HCL-HF | 149 | 151 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 314 | HCL-HF | 193 | 102 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 315 | HCL-HF | 238 | 76 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 316 | HCL-HF | 314 | 93 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 317 | HCL-HF | 305 | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 318 | HCL-HF | 234 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 319 | HCL-HF | 60 | 52 | LEAF | SLUDGE, FIELD, MATURITY | NA | GRAIN |
| 320 | HCL-HF | 122 | 80 * | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 321 | HCL-HF | 192 | 171 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 322 | HCL-HF | 243 | 96 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 323 | HCL-HF | 238 | 176 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 324 | HCL-HF | 336 | 435 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 325 | HCL-HF | 335 | 188 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 326 | HCL-HF | 320 | 154 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 327 | HCL-HF | 544 | 153 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 328 | HCL-HF | 462 | 119 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 329 | HCL-HF | 431 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 330 | HCL-HF | 265 | 87 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 331 | HCL-HF | 133 | 124 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 332 | HCL-HF | 227 | 133 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 333 | HCL-HF | 293 | 136 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 334 | HCL-HF | 506 | 396 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 335 | HCL-HF | 500 | 540 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 336 | HCL-HF | 589 | 356 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 337 | HCL-HF | 623 | 192 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 338 | HCL-HF | 623 | 310 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 339 | HCL-HF | 723 | 225 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 340 | HCL-HF | 753 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 341 | HCL04/HNO3 | 22.2 | 43.32 | Earhead | SLUDGE, FIELD, MATURITY | 0 | Whole Plant |
| 342 | HCL04/HNO3 | 47 | 60.54 | Earhead | SLUDGE, FIELD, MATURITY | 0 | Whole Plant |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 305 | | | | | 0.76 | 7 | 0 |
| 306 | | | | | 1.21 | 6.9 | 0 |
| 307 | | | | | 0.84 | 7.1 | 0 |
| 308 | | | | | 0.31 | NA | 225 |
| 309 | | | | | 0.44 | 7.2 | 259 |
| 310 | | | | | 0.63 | 7.3 | 314 |
| 311 | | | | | 0.67 | 7.5 | 402 |
| 312 | | | | | 0.78 | 7 | 463 |
| 313 | | | | | 0.8 | 7 | 531 |
| 314 | | | | | 0.99 | 6.6 | 531 |
| 315 | | | | | 1.42 | 7.1 | 531 |
| 316 | | | | | 1.71 | 7.2 | 531 |
| 317 | | | | | 1.82 | 7.2 | 531 |
| 318 | | | | | 1.96 | 7.1 | 531 |
| 319 | | | | | 0.43 | NA | 449 |
| 320 | | | | | 0.51 | 7.1 | 517 |
| 321 | | | | | 0.94 | 7 | 628 |
| 322 | | | | | 1.16 | 7.2 | 804 |
| 323 | | | | | 1.4 | 7 | 926 |
| 324 | | | | | 1.75 | 6.4 | 1063 |
| 325 | | | | | 2 | 6.3 | 1063 |
| 326 | | | | | 2.16 | 6.8 | 1063 |
| 327 | | | | | 2.02 | 6.8 | 1063 |
| 328 | | | | | 2.33 | 7.1 | 1063 |
| 329 | | | | | 1.66 | 7 | 1063 |
| 330 | | | | | 0.73 | NA | 898 |
| 331 | | | | | 0.57 | 6.8 | 1033 |
| 332 | | | | | 1.3 | 6.7 | 1257 |
| 333 | | | | | 1.42 | 6.6 | 1607 |
| 334 | | | | | 2.4 | 6.4 | 1852 |
| 335 | | | | | 2.76 | 6.1 | 2130 |
| 336 | | | | | 3.44 | 5.8 | 2130 |
| 337 | | | | | 3.16 | 5.9 | 2130 |
| 338 | | | | | 3.28 | 6.2 | 2130 |
| 339 | | | | | 3.1 | 6.4 | 2130 |
| 340 | | | | | 3.15 | 6.5 | 2130 |
| 341 | | | | | 0.7 | 8 | |
| 342 | | | | | 0.7 | 8 | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 305 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 306 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 307 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 308 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | PLAINFIELD | LS |
| 309 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | PLAINFIELD | LS |
| 310 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | PLAINFIELD | LS |
| 311 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | PLAINFIELD | LS |
| 312 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | PLAINFIELD | LS |
| 313 | CENT POLY, FECL3 | 17.8 | 111.5 | 0 | | PLAINFIELD | LS |
| 314 | CENT POLY, FECL3 | 0 | 111.5 | 1 | | PLAINFIELD | LS |
| 315 | CENT POLY, FECL3 | 0 | 111.5 | 2 | | PLAINFIELD | LS |
| 316 | CENT POLY, FECL3 | 0 | 111.5 | 3 | | PLAINFIELD | LS |
| 317 | CENT POLY, FECL3 | 0 | 111.5 | 4 | | PLAINFIELD | LS |
| 318 | CENT POLY, FECL3 | 0 | 111.5 | 5 | | PLAINFIELD | LS |
| 319 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | PLAINFIELD | LS |
| 320 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | PLAINFIELD | LS |
| 321 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | PLAINFIELD | LS |
| 322 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | PLAINFIELD | LS |
| 323 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | PLAINFIELD | LS |
| 324 | CENT POLY, FECL3 | 35.6 | 223 | 0 | | PLAINFIELD | LS |
| 325 | CENT POLY, FECL3 | 0 | 223 | 1 | | PLAINFIELD | LS |
| 326 | CENT POLY, FECL3 | 0 | 223 | 2 | | PLAINFIELD | LS |
| 327 | CENT POLY, FECL3 | 0 | 223 | 3 | | PLAINFIELD | LS |
| 328 | CENT POLY, FECL3 | 0 | 223 | 4 | | PLAINFIELD | LS |
| 329 | CENT POLY, FECL3 | 0 | 223 | 5 | | PLAINFIELD | LS |
| 330 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | PLAINFIELD | LS |
| 331 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | PLAINFIELD | LS |
| 332 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | PLAINFIELD | LS |
| 333 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | PLAINFIELD | LS |
| 334 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | PLAINFIELD | LS |
| 335 | CENT POLY, FECL3 | 71.2 | 446 | 0 | | PLAINFIELD | LS |
| 336 | CENT POLY, FECL3 | 0 | 446 | 1 | | PLAINFIELD | LS |
| 337 | CENT POLY, FECL3 | 0 | 446 | 2 | | PLAINFIELD | LS |
| 338 | CENT POLY, FECL3 | 0 | 446 | 3 | | PLAINFIELD | LS |
| 339 | CENT POLY, FECL3 | 0 | 446 | 4 | | PLAINFIELD | LS |
| 340 | CENT POLY, FECL3 | 0 | 446 | 5 | | PLAINFIELD | LS |
| 341 | | | | | | | Clayey |
| 342 | | 10 | 10 | 0 | | | Clayey |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 305 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 306 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 307 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 308 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 309 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 310 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 311 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 312 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 313 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 314 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 315 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 316 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 317 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 318 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 319 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 320 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 321 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 322 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 323 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 324 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 325 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 326 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 327 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 328 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 329 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 330 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 331 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 332 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 333 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 334 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 335 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 336 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 337 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 338 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 339 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 340 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 341 | N/D | 10 | | | | | | 30 | | Well Water(Control) |
| 342 | 45 | 428 | | | | | | 562 | | Well Water + 10 t/ha sludge |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 305 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 306 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 307 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 308 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 309 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 310 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 311 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 312 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 313 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 314 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 315 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 316 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 317 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 318 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 319 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 320 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 321 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 322 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 323 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 324 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 325 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 326 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 327 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 328 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 329 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 330 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 331 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 332 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 333 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 334 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 335 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 336 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 337 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 338 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 339 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 340 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 341 | Chakrabarti, C. and T. Chakrabarti, 1988. #29 | Wheat | HDM 1553 | 8.4 | | | | |
| 342 | Chakrabarti, C. and T. Chakrabarti, 1988. #29 | Wheat | HDM 1553 | | | | | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 267 | JOLIET, ILLINOIS |
| 268 | JOLIET, ILLINOIS |
| 269 | JOLIET, ILLINOIS |
| 270 | JOLIET, ILLINOIS |
| 271 | JOLIET, ILLINOIS |
| 272 | JOLIET, ILLINOIS |
| 273 | JOLIET, ILLINOIS |
| 274 | JOLIET, ILLINOIS |
| 275 | JOLIET, ILLINOIS |
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| 278 | JOLIET, ILLINOIS |
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| 282 | JOLIET, ILLINOIS |
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| 284 | JOLIET, ILLINOIS |
| 285 | JOLIET, ILLINOIS |
| 286 | JOLIET, ILLINOIS |
| 287 | JOLIET, ILLINOIS |
| 288 | JOLIET, ILLINOIS |
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| 293 | JOLIET, ILLINOIS |
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| 295 | JOLIET, ILLINOIS |
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| 298 | JOLIET, ILLINOIS |
| 299 | JOLIET, ILLINOIS |
| 300 | JOLIET, ILLINOIS |
| 301 | JOLIET, ILLINOIS |
| 302 | JOLIET, ILLINOIS |
| 303 | JOLIET, ILLINOIS |
| 304 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 267 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 268 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 269 | 0 | STOVER | NO | |
| 270 | 0 | STOVER | NO | |
| 271 | 0 | STOVER | NO | |
| 272 | 0 | STOVER | NO | |
| 273 | 0 | STOVER | NO | |
| 274 | 0 | STOVER | NO | |
| 275 | NA | STOVER | NO | |
| 276 | 0 | STOVER | NO | |
| 277 | 0 | STOVER | NO | |
| 278 | 0 | STOVER | NO | |
| 279 | 0 | STOVER | NO | |
| 280 | 0 | STOVER | NO | |
| 281 | 0 | STOVER | NO | |
| 282 | 0 | STOVER | NO | |
| 283 | 0 | STOVER | NO | |
| 284 | 0 | STOVER | NO | |
| 285 | 0 | STOVER | NO | |
| 286 | NA | STOVER | NO | |
| 287 | 0 | STOVER | NO | |
| 288 | 0 | STOVER | NO | |
| 289 | 0 | STOVER | NO | |
| 290 | 0 | STOVER | NO | |
| 291 | 0 | STOVER | NO | |
| 292 | 0 | STOVER | NO | |
| 293 | 0 | STOVER | NO | |
| 294 | 0 | STOVER | NO | |
| 295 | 0 | STOVER | NO | |
| 296 | 0 | STOVER | NO | |
| 297 | NA | STOVER | NO | |
| 298 | 0 | STOVER | NO | |
| 299 | 0 | STOVER | NO | |
| 300 | 0 | STOVER | NO | |
| 301 | 0 | STOVER | NO | |
| 302 | 0 | STOVER | NO | |
| 303 | 0 | STOVER | NO | |
| 304 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 267 | HCL-HF | 138 | 70 | LEAF | SLUDGE, FIELD, MATURITY | 60* | GRAIN |
| 268 | HCL-HF | 156 | 192 | LEAF | SLUDGE, FIELD, MATURITY | 28* | GRAIN |
| 269 | HCL-HF | 206 | 92 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 270 | HCL-HF | 180 | 89 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 271 | HCL-HF | 202 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 272 | HCL-HF | 215 | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 273 | HCL-HF | 219 | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 274 | HCL-HF | 167 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 275 | HCL-HF | 159 | 72 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 276 | HCL-HF | 131 | 97 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 277 | HCL-HF | 143 | 89 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 278 | HCL-HF | 171 | 112 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 279 | HCL-HF | 216 | 139 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 280 | HCL-HF | 270 | 191 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 281 | HCL-HF | 294 | 163 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 282 | HCL-HF | 394 | 115 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 283 | HCL-HF | 351 | 107 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 284 | HCL-HF | 287 | 70 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 285 | HCL-HF | 303 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 286 | HCL-HF | 215 | 97 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 287 | HCL-HF | 215 | 160 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 288 | HCL-HF | 193 | 175 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 289 | HCL-HF | 333 | 149 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 290 | HCL-HF | 368 | 268 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 291 | HCL-HF | 553 | 294 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 292 | HCL-HF | 543 | 278 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 293 | HCL-HF | 594 | 204 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 294 | HCL-HF | 442 | 171 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 295 | HCL-HF | 482 | 141 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 296 | HCL-HF | 331 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 297 | HCL-HF | 55 | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 298 | HCL-HF | 24 | 17 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 299 | HCL-HF | 22 | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 300 | HCL-HF | 32 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 301 | HCL-HF | 43 | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 302 | HCL-HF | 46 | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 303 | HCL-HF | 55 | 17 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 304 | HCL-HF | 75 | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 267 | | | | | 1.58 | 7.4 | 402 |
| 268 | | | | | 1.54 | 7.1 | 463 |
| 269 | | | | | 1.64 | 6.9 | 531 |
| 270 | | | | | 1.69 | 6.9 | 531 |
| 271 | | | | | 1.91 | 7 | 531 |
| 272 | | | | | 1.66 | 7.3 | 531 |
| 273 | | | | | 2.05 | 7.1 | 531 |
| 274 | | | | | 1.95 | 7.2 | 531 |
| 275 | | | | | 1.71 | NA | 449 |
| 276 | | | | | 1.57 | 6.9 | 517 |
| 277 | | | | | 1.57 | 7.3 | 628 |
| 278 | | | | | 1.79 | 7.1 | 804 |
| 279 | | | | | 1.93 | 6.9 | 926 |
| 280 | | | | | 2.09 | 6.6 | 1063 |
| 281 | | | | | 2.37 | 6.4 | 1063 |
| 282 | | | | | 2.4 | 6.4 | 1063 |
| 283 | | | | | 2.4 | 6.8 | 1063 |
| 284 | | | | | 2.38 | 6.8 | 1063 |
| 285 | | | | | 2.48 | 7.2 | 1063 |
| 286 | | | | | 2.06 | NA | 898 |
| 287 | | | | | 2 | 6.4 | 1033 |
| 288 | | | | | 1.76 | 6.4 | 1257 |
| 289 | | | | | 2.67 | 6.2 | 1607 |
| 290 | | | | | 2.72 | 6.1 | 1852 |
| 291 | | | | | 3.53 | 5.4 | 2130 |
| 292 | | | | | 3.35 | 5.5 | 2130 |
| 293 | | | | | 3.29 | 5.8 | 2130 |
| 294 | | | | | 2.68 | 6 | 2130 |
| 295 | | | | | 3.02 | 6 | 2130 |
| 296 | | | | | 2.2 | 6.3 | 2130 |
| 297 | | | | | 0.36 | NA | 0 |
| 298 | | | | | 0.17 | 7 | 0 |
| 299 | | | | | 0.21 | 7.2 | 0 |
| 300 | | | | | 0.42 | 7.1 | 0 |
| 301 | | | | | 0.44 | 7 | 0 |
| 302 | | | | | 0.56 | 6.9 | 0 |
| 303 | | | | | 0.48 | 7 | 0 |
| 304 | | | | | 0.75 | 7 | 0 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 267 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | ELLIOT | SiL |
| 268 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | ELLIOT | SiL |
| 269 | CENT POLY, FECL3 | 17.8 | 111.5 | 0 | | ELLIOT | SiL |
| 270 | CENT POLY, FECL3 | 0 | 111.5 | 1 | | ELLIOT | SiL |
| 271 | CENT POLY, FECL3 | 0 | 111.5 | 2 | | ELLIOT | SiL |
| 272 | CENT POLY, FECL3 | 0 | 111.5 | 3 | | ELLIOT | SiL |
| 273 | CENT POLY, FECL3 | 0 | 111.5 | 4 | | ELLIOT | SiL |
| 274 | CENT POLY, FECL3 | 0 | 111.5 | 5 | | ELLIOT | SiL |
| 275 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | ELLIOT | SiL |
| 276 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | ELLIOT | SiL |
| 277 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | ELLIOT | SiL |
| 278 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | ELLIOT | SiL |
| 279 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | ELLIOT | SiL |
| 280 | CENT POLY, FECL3 | 35.6 | 223 | 0 | | ELLIOT | SiL |
| 281 | CENT POLY, FECL3 | 0 | 223 | 1 | | ELLIOT | SiL |
| 282 | CENT POLY, FECL3 | 0 | 223 | 2 | | ELLIOT | SiL |
| 283 | CENT POLY, FECL3 | 0 | 223 | 3 | | ELLIOT | SiL |
| 284 | CENT POLY, FECL3 | 0 | 223 | 4 | | ELLIOT | SiL |
| 285 | CENT POLY, FECL3 | 0 | 223 | 5 | | ELLIOT | SiL |
| 286 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | ELLIOT | SiL |
| 287 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | ELLIOT | SiL |
| 288 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | ELLIOT | SiL |
| 289 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | ELLIOT | SiL |
| 290 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | ELLIOT | SiL |
| 291 | CENT POLY, FECL3 | 71.2 | 446 | 0 | | ELLIOT | SiL |
| 292 | CENT POLY, FECL3 | 0 | 446 | 1 | | ELLIOT | SiL |
| 293 | CENT POLY, FECL3 | 0 | 446 | 2 | | ELLIOT | SiL |
| 294 | CENT POLY, FECL3 | 0 | 446 | 3 | | ELLIOT | SiL |
| 295 | CENT POLY, FECL3 | 0 | 446 | 4 | | ELLIOT | SiL |
| 296 | CENT POLY, FECL3 | 0 | 446 | 5 | | ELLIOT | SiL |
| 297 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 298 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 299 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 300 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 301 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 302 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 303 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 304 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 267 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 268 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 269 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 270 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 271 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 272 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 273 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 274 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 275 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 276 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 277 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 278 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 279 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 280 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 281 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 282 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 283 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 284 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 285 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 286 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 287 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 288 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 289 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 290 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 291 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 292 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 293 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 294 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 295 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 296 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 297 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 298 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 299 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 300 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 301 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 302 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 303 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 304 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 267 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 268 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 269 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 270 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 271 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 272 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 273 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 274 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 275 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 276 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 277 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 278 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 279 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 280 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 281 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 282 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 283 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 284 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 285 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 286 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 287 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 288 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 289 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 290 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 291 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 292 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 293 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 294 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 295 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 296 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 297 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 298 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 299 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 300 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 301 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 302 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 303 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 304 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 229 | JOLIET, ILLINOIS |
| 230 | JOLIET, ILLINOIS |
| 231 | JOLIET, ILLINOIS |
| 232 | JOLIET, ILLINOIS |
| 233 | JOLIET, ILLINOIS |
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| 266 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 229 | 0 | STOVER | NO | |
| 230 | 0 | STOVER | NO | |
| 231 | 0 | STOVER | NO | |
| 232 | 0 | STOVER | NO | |
| 233 | NA | STOVER | NO | |
| 234 | 0 | STOVER | NO | |
| 235 | 0 | STOVER | NO | |
| 236 | 0 | STOVER | NO | |
| 237 | 0 | STOVER | NO | |
| 238 | NA | STOVER | NO | |
| 239 | 0 | STOVER | NO | |
| 240 | 37* | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 241 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 242 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 243 | NA | STOVER | NO | |
| 244 | 0 | STOVER | NO | |
| 245 | 22* | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT |
| 246 | 0 | STOVER | NO | |
| 247 | 0 | STOVER | NO | |
| 248 | NA | STOVER | NO | |
| 249 | 0 | STOVER | NO | |
| 250 | 0 | STOVER | NO | |
| 251 | 0 | STOVER | NO | |
| 252 | 0 | STOVER | NO | |
| 253 | NA | STOVER | NO | |
| 254 | 0 | STOVER | NO | |
| 255 | 0 | STOVER | NO | |
| 256 | 0 | STOVER | NO | |
| 257 | 0 | STOVER | NO | |
| 258 | 0 | STOVER | NO | |
| 259 | 0 | STOVER | NO | |
| 260 | 0 | STOVER | NO | |
| 261 | 0 | STOVER | NO | |
| 262 | 0 | STOVER | NO | |
| 263 | 0 | STOVER | NO | |
| 264 | NA | STOVER | NO | |
| 265 | 0 | STOVER | NO | |
| 266 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 229 | HCL-HF | 472 | 260 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 230 | HCL-HF | 804 | 246 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 231 | HCL-HF | 442 | 382 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 232 | HCL-HF | 639 | 124 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 233 | HCL-HF | 73 | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 234 | HCL-HF | 72 | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 235 | HCL-HF | 67 | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 236 | HCL-HF | 72 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 237 | HCL-HF | 69 | 14 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 238 | HCL-HF | 106 | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 239 | HCL-HF | 103 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 240 | HCL-HF | 113 | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 241 | HCL-HF | 147 | 64 | LEAF | SLUDGE, FIELD, MATURITY | 60* | GRAIN |
| 242 | HCL-HF | 150 | 70 | LEAF | SLUDGE, FIELD, MATURITY | 28* | GRAIN |
| 243 | HCL-HF | 174 | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 244 | HCL-HF | 122 | 67* | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 245 | HCL-HF | 166 | 88 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 246 | HCL-HF | 196 | 83 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 247 | HCL-HF | 250 | 112 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 248 | HCL-HF | 241 | 72 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 249 | HCL-HF | 220 | 115 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 250 | HCL-HF | 270 | 130 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 251 | HCL-HF | 308 | 117 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 252 | HCL-HF | 432 | 179 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 253 | HCL-HF | 85 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 254 | HCL-HF | 68 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 255 | HCL-HF | 84 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 256 | HCL-HF | 70 | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 257 | HCL-HF | 74 | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 258 | HCL-HF | 79 | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 259 | HCL-HF | 80 | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 260 | HCL-HF | 74 | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 261 | HCL-HF | 81 | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 262 | HCL-HF | 77 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 263 | HCL-HF | 81 | NA | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 264 | HCL-HF | 102 | 55 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 265 | HCL-HF | 105 | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 266 | HCL-HF | 96 | 63 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 229 | | | | | 2.84 | 6 | 2167 |
| 230 | | | | | 3.35 | 5.9 | 2167 |
| 231 | | | | | 2.1 | 6.2 | 2167 |
| 232 | | | | | 3.03 | 6.1 | 2167 |
| 233 | | | | | 1.19 | NA | 0 |
| 234 | | | | | 1.01 | 7.1 | 0 |
| 235 | | | | | 0.93 | 7.5 | 0 |
| 236 | | | | | 1.05 | 7.7 | 0 |
| 237 | | | | | 1.07 | 7.3 | 0 |
| 238 | | | | | 1.29 | NA | 225 |
| 239 | | | | | 1.08 | 7.2 | 259 |
| 240 | | | | | 1.1 | 7.6 | 314 |
| 241 | | | | | 1.29 | 7.6 | 402 |
| 242 | | | | | 1.17 | 7.6 | 463 |
| 243 | | | | | 1.38 | NA | 449 |
| 244 | | | | | 1.15 | 7.1 | 517 |
| 245 | | | | | 1.29 | 7.6 | 628 |
| 246 | | | | | 1.58 | 7.6 | 804 |
| 247 | | | | | 1.75 | 7.5 | 926 |
| 248 | | | | | 1.63 | NA | 898 |
| 249 | | | | | 1.28 | 6.9 | 1033 |
| 250 | | | | | 1.59 | 7.5 | 1257 |
| 251 | | | | | 1.9 | 7.5 | 1607 |
| 252 | | | | | 2.56 | 7.3 | 1852 |
| 253 | | | | | 1.51 | NA | 0 |
| 254 | | | | | 1.34 | 7 | 0 |
| 255 | | | | | 1.29 | 7.2 | 0 |
| 256 | | | | | 1.45 | 7.1 | 0 |
| 257 | | | | | 1.3 | 7.6 | 0 |
| 258 | | | | | 1.3 | 7 | 0 |
| 259 | | | | | 1.41 | 7.2 | 0 |
| 260 | | | | | 1.32 | 6.7 | 0 |
| 261 | | | | | 1.38 | 7 | 0 |
| 262 | | | | | 1.69 | 7 | 0 |
| 263 | | | | | 1.48 | 7.4 | 0 |
| 264 | | | | | 1.52 | NA | 225 |
| 265 | | | | | 1.4 | 6.9 | 259 |
| 266 | | | | | 1.35 | 7.2 | 314 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 229 | CENT POLY, FECL3 | 0 | 428.3 | 1 | | PLAINFIELD | LS |
| 230 | CENT POLY, FECL3 | 0 | 428.3 | 2 | | PLAINFIELD | LS |
| 231 | CENT POLY, FECL3 | 0 | 428.3 | 3 | | PLAINFIELD | LS |
| 232 | CENT POLY, FECL3 | 0 | 428.3 | 4 | | PLAINFIELD | LS |
| 233 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 234 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 235 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 236 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 237 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 238 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | BLOUNT | SiL |
| 239 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | BLOUNT | SiL |
| 240 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | BLOUNT | SiL |
| 241 | CENT POLY, FECL3 | 17.7 | 80.6 | 0 | | BLOUNT | SiL |
| 242 | CENT POLY, FECL3 | 13.1 | 93.7 | 0 | | BLOUNT | SiL |
| 243 | CENT POLY, FECL3 | 52.4 | 80.2 | 0 | | BLOUNT | SiL |
| 244 | CENT POLY, FECL3 | 16.2 | 96.4 | 0 | | BLOUNT | SiL |
| 245 | CENT POLY, FECL3 | 29.4 | 125.8 | 0 | | BLOUNT | SiL |
| 246 | CENT POLY, FECL3 | 35.4 | 161.2 | 0 | | BLOUNT | SiL |
| 247 | CENT POLY, FECL3 | 26.2 | 187.4 | 0 | | BLOUNT | SiL |
| 248 | CENT POLY, FECL3 | 104.8 | 160.4 | 0 | | BLOUNT | SiL |
| 249 | CENT POLY, FECL3 | 32.4 | 192.8 | 0 | | BLOUNT | SiL |
| 250 | CENT POLY, FECL3 | 58.8 | 251.6 | 0 | | BLOUNT | SiL |
| 251 | CENT POLY, FECL3 | 70.8 | 322.4 | 0 | | BLOUNT | SiL |
| 252 | CENT POLY, FECL3 | 52.4 | 374.8 | 0 | | BLOUNT | SiL |
| 253 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 254 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 255 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 256 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 257 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 258 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 259 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 260 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 261 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 262 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 263 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 264 | CENT POLY, FECL3 | 26.2 | 40.1 | 0 | | ELLIOT | SiL |
| 265 | CENT POLY, FECL3 | 8.1 | 48.2 | 0 | | ELLIOT | SiL |
| 266 | CENT POLY, FECL3 | 14.7 | 62.9 | 0 | | ELLIOT | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 229 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 230 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 231 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 232 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 233 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 234 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 235 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 236 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 237 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 238 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 239 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 240 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 241 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 242 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 243 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 244 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 245 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 246 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 247 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 248 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 249 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 250 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 251 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 252 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 253 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 254 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 255 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 256 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 257 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 258 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 259 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 260 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 261 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 262 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 263 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 264 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 265 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 266 | 2846 | 1311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 229 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 230 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 231 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 232 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 233 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 234 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 235 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 236 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 237 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 238 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 239 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 240 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 241 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 242 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 243 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 244 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 245 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 246 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 247 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 248 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 249 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 250 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 251 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 252 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 253 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 254 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 255 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 256 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 257 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 258 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 259 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 260 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 261 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 262 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 263 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 264 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 265 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |
| 266 | HINESLY 1985 | CORN | | | | | 3.2 | 265 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 191 | JOLIET, ILLINOIS |
| 192 | JOLIET, ILLINOIS |
| 193 | JOLIET, ILLINOIS |
| 194 | JOLIET, ILLINOIS |
| 195 | JOLIET, ILLINOIS |
| 196 | JOLIET, ILLINOIS |
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| 199 | JOLIET, ILLINOIS |
| 200 | JOLIET, ILLINOIS |
| 201 | JOLIET, ILLINOIS |
| 202 | JOLIET, ILLINOIS |
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| 212 | JOLIET, ILLINOIS |
| 213 | JOLIET, ILLINOIS |
| 214 | JOLIET, ILLINOIS |
| 215 | JOLIET, ILLINOIS |
| 216 | JOLIET, ILLINOIS |
| 217 | JOLIET, ILLINOIS |
| 218 | JOLIET, ILLINOIS |
| 219 | JOLIET, ILLINOIS |
| 220 | JOLIET, ILLINOIS |
| 221 | JOLIET, ILLINOIS |
| 222 | JOLIET, ILLINOIS |
| 223 | JOLIET, ILLINOIS |
| 224 | JOLIET, ILLINOIS |
| 225 | JOLIET, ILLINOIS |
| 226 | JOLIET, ILLINOIS |
| 227 | JOLIET, ILLINOIS |
| 228 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 191 | 0 | STOVER | NO | |
| 192 | 0 | STOVER | NO | |
| 193 | 0 | STOVER | NO | |
| 194 | 0 | STOVER | NO | |
| 195 | 0 | STOVER | NO | |
| 196 | 0 | STOVER | NO | |
| 197 | 0 | STOVER | NO | |
| 198 | 0 | STOVER | NO | |
| 199 | 0 | STOVER | NO | |
| 200 | 0 | STOVER | NO | |
| 201 | 0 | STOVER | NO | |
| 202 | 0 | STOVER | NO | |
| 203 | NA | STOVER | NO | |
| 204 | 0 | STOVER | NO | |
| 205 | 0 | STOVER | NO | |
| 206 | 0 | STOVER | NO | |
| 207 | 0 | STOVER | NO | |
| 208 | 0 | STOVER | NO | |
| 209 | 0 | STOVER | NO | |
| 210 | 0 | STOVER | NO | |
| 211 | 0 | STOVER | NO | |
| 212 | 0 | STOVER | NO | |
| 213 | NA | STOVER | NO | |
| 214 | 0 | STOVER | NO | |
| 215 | 0 | STOVER | NO | |
| 216 | 0 | STOVER | NO | |
| 217 | 0 | STOVER | NO | |
| 218 | 0 | STOVER | NO | |
| 219 | 0 | STOVER | NO | |
| 220 | 0 | STOVER | NO | |
| 221 | 0 | STOVER | NO | |
| 222 | 0 | STOVER | NO | |
| 223 | NA | STOVER | NO | |
| 224 | 0 | STOVER | NO | |
| 225 | 0 | STOVER | NO | |
| 226 | 0 | STOVER | NO | |
| 227 | 0 | STOVER | NO | |
| 228 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 191 | HCL-HF | 428 | 212 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 192 | HCL-HF | 551 | 148 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 193 | HCL-HF | 40 | 22 | LEAF | SLUDGE, FIELD, MATURITY | NA | GRAIN |
| 194 | HCL-HF | 30 | 14 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 195 | HCL-HF | 33 | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 196 | HCL-HF | 23 | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 197 | HCL-HF | 33 | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 198 | HCL-HF | 21 | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 199 | HCL-HF | 24 | 15 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 200 | HCL-HF | 35 | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 201 | HCL-HF | 51 | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 202 | HCL-HF | 58 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 203 | HCL-HF | 130 | 70 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 204 | HCL-HF | 70 | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 205 | HCL-HF | 102 | 66 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 206 | HCL-HF | 158 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 207 | HCL-HF | 104 | 36 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 208 | HCL-HF | 104 | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 209 | HCL-HF | 93 | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 210 | HCL-HF | 137 | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 211 | HCL-HF | 143 | 73 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 212 | HCL-HF | 129 | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 213 | HCL-HF | 244 | 111 | LEAF | SLUDGE, FIELD, MATURITY | NA | GRAIN |
| 214 | HCL-HF | 117 | 80 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 215 | HCL-HF | 168 | 164 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 216 | HCL-HF | 175 | 103 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 217 | HCL-HF | 165 | 66 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 218 | HCL-HF | 139 | 90 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 219 | HCL-HF | 166 | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 220 | HCL-HF | 199 | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 221 | HCL-HF | 203 | 100 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 222 | HCL-HF | 139 | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 223 | HCL-HF | 500 | 138 | LEAF | SLUDGE, FIELD, MATURITY | NA | GRAIN |
| 224 | HCL-HF | 180 | 155 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 225 | HCL-HF | 449 | 239 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 226 | HCL-HF | 248 | 143 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 227 | HCL-HF | 323 | 307 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 228 | HCL-HF | 374 | 513 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 191 | | | | | 2.6 | 6.1 | 2167 |
| 192 | | | | | 3.2 | 6.1 | 2167 |
| 193 | | | | | 0.39 | 7.8 | 0 |
| 194 | | | | | 0.17 | 7.1 | 0 |
| 195 | | | | | 0.26 | 7.3 | 0 |
| 196 | | | | | 0.27 | 6.8 | 0 |
| 197 | | | | | 0.33 | 7.6 | 0 |
| 198 | | | | | 0.27 | 7.5 | 0 |
| 199 | | | | | 0.29 | 7.5 | 0 |
| 200 | | | | | 0.42 | 7.4 | 0 |
| 201 | | | | | 0.49 | 7.4 | 0 |
| 202 | | | | | 0.64 | 7.3 | 0 |
| 203 | | | | | 0.36 | 7.6 | 213 |
| 204 | | | | | 0.28 | 7.1 | 261 |
| 205 | | | | | 0.61 | 7.4 | 323 |
| 206 | | | | | 0.91 | 7.3 | 323 |
| 207 | | | | | 0.56 | 7.4 | 323 |
| 208 | | | | | 0.58 | 7.1 | 323 |
| 209 | | | | | 0.45 | 7.5 | 323 |
| 210 | | | | | 0.34 | 7.7 | 323 |
| 211 | | | | | 0.47 | 7.4 | 323 |
| 212 | | | | | 0.83 | 7.4 | 323 |
| 213 | | | | | 0.58 | 7.5 | 425 |
| 214 | | | | | 0.44 | 6.9 | 521 |
| 215 | | | | | 0.81 | 7.1 | 645 |
| 216 | | | | | 0.95 | 6.8 | 645 |
| 217 | | | | | 0.75 | 7.1 | 645 |
| 218 | | | | | 0.96 | 7.1 | 645 |
| 219 | | | | | 0.59 | 6.9 | 645 |
| 220 | | | | | 0.89 | 7 | 645 |
| 221 | | | | | 0.81 | 7.1 | 645 |
| 222 | | | | | 0.52 | 7.1 | 645 |
| 223 | | | | | 0.9 | 7.6 | 850 |
| 224 | | | | | 0.6 | 6.6 | 1042 |
| 225 | | | | | 2.4 | 6.8 | 1290 |
| 226 | | | | | 1.85 | 6.5 | 1649 |
| 227 | | | | | 1.78 | 6.1 | 1894 |
| 228 | | | | | 1.98 | 6.2 | 2167 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 191 | CENT POLY, FECL3 | 0 | 428.3 | 3 | | ELLIOT | SiL |
| 192 | CENT POLY, FECL3 | 0 | 428.3 | 4 | | ELLIOT | SiL |
| 193 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 194 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 195 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 196 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 197 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 198 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 199 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 200 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 201 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 202 | CENT POLY, FECL3 | 0 | 0 | NA | | PLAINFIELD | LS |
| 203 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | PLAINFIELD | LS |
| 204 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | PLAINFIELD | LS |
| 205 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | PLAINFIELD | LS |
| 206 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | PLAINFIELD | LS |
| 207 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | PLAINFIELD | LS |
| 208 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | PLAINFIELD | LS |
| 209 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | PLAINFIELD | LS |
| 210 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | PLAINFIELD | LS |
| 211 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | PLAINFIELD | LS |
| 212 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | PLAINFIELD | LS |
| 213 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | PLAINFIELD | LS |
| 214 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | PLAINFIELD | LS |
| 215 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | PLAINFIELD | LS |
| 216 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | PLAINFIELD | LS |
| 217 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | PLAINFIELD | LS |
| 218 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | PLAINFIELD | LS |
| 219 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | PLAINFIELD | LS |
| 220 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | PLAINFIELD | LS |
| 221 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | PLAINFIELD | LS |
| 222 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | PLAINFIELD | LS |
| 223 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | PLAINFIELD | LS |
| 224 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | PLAINFIELD | LS |
| 225 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | PLAINFIELD | LS |
| 226 | CENT POLY, FECL3 | 69.8 | 302.3 | 0 | | PLAINFIELD | LS |
| 227 | CENT POLY, FECL3 | 54 | 356.3 | 0 | | PLAINFIELD | LS |
| 228 | CENT POLY, FECL3 | 72 | 428.3 | 0 | | PLAINFIELD | LS |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 191 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 192 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 193 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 194 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 195 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 196 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 197 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 198 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 199 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 200 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 201 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 202 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 203 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 204 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 205 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 206 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 207 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 208 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 209 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 210 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 211 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 212 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 213 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 214 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 215 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 216 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 217 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 218 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 219 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 220 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 221 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 222 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 223 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 224 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 225 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 226 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 227 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 228 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 191 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 192 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 193 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 194 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 195 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 196 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 197 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 198 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 199 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 200 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 201 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 202 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 203 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 204 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 205 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 206 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 207 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 208 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 209 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 210 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 211 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 212 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 213 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 214 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 215 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 216 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 217 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 218 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 219 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 220 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 221 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 222 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 223 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 224 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 225 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 226 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 227 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 228 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 153 | JOLIET, ILLINOIS |
| 154 | JOLIET, ILLINOIS |
| 155 | JOLIET, ILLINOIS |
| 156 | JOLIET, ILLINOIS |
| 157 | JOLIET, ILLINOIS |
| 158 | JOLIET, ILLINOIS |
| 159 | JOLIET, ILLINOIS |
| 160 | JOLIET, ILLINOIS |
| 161 | JOLIET, ILLINOIS |
| 162 | JOLIET, ILLINOIS |
| 163 | JOLIET, ILLINOIS |
| 164 | JOLIET, ILLINOIS |
| 165 | JOLIET, ILLINOIS |
| 166 | JOLIET, ILLINOIS |
| 167 | JOLIET, ILLINOIS |
| 168 | JOLIET, ILLINOIS |
| 169 | JOLIET, ILLINOIS |
| 170 | JOLIET, ILLINOIS |
| 171 | JOLIET, ILLINOIS |
| 172 | JOLIET, ILLINOIS |
| 173 | JOLIET, ILLINOIS |
| 174 | JOLIET, ILLINOIS |
| 175 | JOLIET, ILLINOIS |
| 176 | JOLIET, ILLINOIS |
| 177 | JOLIET, ILLINOIS |
| 178 | JOLIET, ILLINOIS |
| 179 | JOLIET, ILLINOIS |
| 180 | JOLIET, ILLINOIS |
| 181 | JOLIET, ILLINOIS |
| 182 | JOLIET, ILLINOIS |
| 183 | JOLIET, ILLINOIS |
| 184 | JOLIET, ILLINOIS |
| 185 | JOLIET, ILLINOIS |
| 186 | JOLIET, ILLINOIS |
| 187 | JOLIET, ILLINOIS |
| 188 | JOLIET, ILLINOIS |
| 189 | JOLIET, ILLINOIS |
| 190 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 153 | 0 | STOVER | NO | |
| 154 | 0 | STOVER | NO | |
| 155 | 0 | STOVER | NO | |
| 156 | 0 | STOVER | NO | |
| 157 | 0 | STOVER | NO | |
| 158 | 0 | STOVER | NO | |
| 159 | 0 | STOVER | NO | |
| 160 | 0 | STOVER | NO | |
| 161 | 0 | STOVER | NO | |
| 162 | 0 | STOVER | NO | |
| 163 | NA | STOVER | NO | |
| 164 | 0 | STOVER | NO | |
| 165 | 0 | STOVER | NO | |
| 166 | 0 | STOVER | NO | |
| 167 | 0 | STOVER | NO | |
| 168 | 0 | STOVER | NO | |
| 169 | 0 | STOVER | NO | |
| 170 | 0 | STOVER | NO | |
| 171 | 0 | STOVER | NO | |
| 172 | 0 | STOVER | NO | |
| 173 | NA | STOVER | NO | |
| 174 | 0 | STOVER | NO | |
| 175 | 0 | STOVER | NO | |
| 176 | 0 | STOVER | NO | |
| 177 | 0 | STOVER | NO | |
| 178 | 0 | STOVER | NO | |
| 179 | 0 | STOVER | NO | |
| 180 | 0 | STOVER | NO | |
| 181 | 0 | STOVER | NO | |
| 182 | 0 | STOVER | NO | |
| 183 | NA | STOVER | NO | |
| 184 | 0 | STOVER | NO | |
| 185 | 0 | STOVER | NO | |
| 186 | 0 | STOVER | NO | |
| 187 | 0 | STOVER | NO | |
| 188 | 0 | STOVER | NO | |
| 189 | 0 | STOVER | NO | |
| 190 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 153 | HCL-HF | 64 | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 154 | HCL-HF | 81 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 155 | HCL-HF | 75 | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 156 | HCL-HF | 75 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 157 | HCL-HF | 73 | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 158 | HCL-HF | 70 | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 159 | HCL-HF | 66 | 16 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 160 | HCL-HF | 79 | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 161 | HCL-HF | 80 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 162 | HCL-HF | 84 | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 163 | HCL-HF | 127 | 105 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 164 | HCL-HF | 136 | 67 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 165 | HCL-HF | 132 | 40 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 166 | HCL-HF | 185 | 63 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 167 | HCL-HF | 152 | 68 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 168 | HCL-HF | 143 | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 169 | HCL-HF | 151 | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 170 | HCL-HF | 187 | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 171 | HCL-HF | 144 | 72 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 172 | HCL-HF | 187 | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 173 | HCL-HF | 226 | 124 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 174 | HCL-HF | 179 | 102 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 175 | HCL-HF | 207 | 84 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 176 | HCL-HF | 228 | 64 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 177 | HCL-HF | 210 | 78 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 178 | HCL-HF | 214 | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 179 | HCL-HF | 200 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 180 | HCL-HF | 263 | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 181 | HCL-HF | 196 | 67 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 182 | HCL-HF | 184 | 56 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 183 | HCL-HF | 418 | 168 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 184 | HCL-HF | 259 | 187 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 185 | HCL-HF | 315 | 147 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 186 | HCL-HF | 386 | 95 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 187 | HCL-HF | 375 | 205 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 188 | HCL-HF | 468 | 323 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 189 | HCL-HF | 582 | 193 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 190 | HCL-HF | 673 | 279 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 153 | | | | | 1.64 | 7.6 | 0 |
| 154 | | | | | 1.61 | 6.8 | 0 |
| 155 | | | | | 1.54 | 7.2 | 0 |
| 156 | | | | | 1.53 | 7.2 | 0 |
| 157 | | | | | 1.54 | 7 | 0 |
| 158 | | | | | 1.51 | 7 | 0 |
| 159 | | | | | 1.58 | 7.4 | 0 |
| 160 | | | | | 1.54 | 7.2 | 0 |
| 161 | | | | | 1.51 | 7 | 0 |
| 162 | | | | | 1.62 | 7 | 0 |
| 163 | | | | | 1.64 | 7.3 | 213 |
| 164 | | | | | 1.84 | 6.8 | 261 |
| 165 | | | | | 1.74 | 7.1 | 323 |
| 166 | | | | | 2.18 | 7.1 | 323 |
| 167 | | | | | 1.86 | 7.2 | 323 |
| 168 | | | | | 1.67 | 7.2 | 323 |
| 169 | | | | | 1.83 | 7.5 | 323 |
| 170 | | | | | 1.55 | 7.2 | 323 |
| 171 | | | | | 1.68 | 7 | 323 |
| 172 | | | | | 1.89 | 7.1 | 323 |
| 173 | | | | | 1.97 | 7.8 | 425 |
| 174 | | | | | 1.81 | 7 | 521 |
| 175 | | | | | 1.88 | 7.3 | 645 |
| 176 | | | | | 2.21 | 7.3 | 645 |
| 177 | | | | | 1.99 | 7.4 | 645 |
| 178 | | | | | 1.89 | 7.3 | 645 |
| 179 | | | | | 1.94 | 7.4 | 645 |
| 180 | | | | | 1.72 | 7.4 | 645 |
| 181 | | | | | 1.79 | 7.2 | 645 |
| 182 | | | | | 1.87 | 7.2 | 645 |
| 183 | | | | | 2.23 | 7.5 | 850 |
| 184 | | | | | 2.22 | 6.4 | 1042 |
| 185 | | | | | 2.28 | 6.5 | 1290 |
| 186 | | | | | 2.61 | 6.5 | 1649 |
| 187 | | | | | 2.74 | 6.5 | 1894 |
| 188 | | | | | 2.94 | 5.9 | 2167 |
| 189 | | | | | 3.92 | 5.9 | 2167 |
| 190 | | | | | 3.77 | 5.8 | 2167 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 153 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 154 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 155 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 156 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 157 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 158 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 159 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 160 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 161 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 162 | CENT POLY, FECL3 | 0 | 0 | NA | | ELLIOT | SiL |
| 163 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | ELLIOT | SiL |
| 164 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | ELLIOT | SiL |
| 165 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | ELLIOT | SiL |
| 166 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | ELLIOT | SiL |
| 167 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | ELLIOT | SiL |
| 168 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | ELLIOT | SiL |
| 169 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | ELLIOT | SiL |
| 170 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | ELLIOT | SiL |
| 171 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | ELLIOT | SiL |
| 172 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | ELLIOT | SiL |
| 173 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | ELLIOT | SiL |
| 174 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | ELLIOT | SiL |
| 175 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | ELLIOT | SiL |
| 176 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | ELLIOT | SiL |
| 177 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | ELLIOT | SiL |
| 178 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | ELLIOT | SiL |
| 179 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | ELLIOT | SiL |
| 180 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | ELLIOT | SiL |
| 181 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | ELLIOT | SiL |
| 182 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | ELLIOT | SiL |
| 183 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | ELLIOT | SiL |
| 184 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | ELLIOT | SiL |
| 185 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | ELLIOT | SiL |
| 186 | CENT POLY, FECL3 | 69.8 | 302.3 | 0 | | ELLIOT | SiL |
| 187 | CENT POLY, FECL3 | 54 | 356.3 | 0 | | ELLIOT | SiL |
| 188 | CENT POLY, FECL3 | 72 | 428.3 | 0 | | ELLIOT | SiL |
| 189 | CENT POLY, FECL3 | 0 | 428.3 | 1 | | ELLIOT | SiL |
| 190 | CENT POLY, FECL3 | 0 | 428.3 | 2 | | ELLIOT | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 153 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 154 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 155 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 156 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 157 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 158 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 159 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 160 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 161 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 162 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 163 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 164 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 165 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 166 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 167 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 168 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 169 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 170 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 171 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 172 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 173 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 174 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 175 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 176 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 177 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 178 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 179 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 180 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 181 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 182 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 183 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 184 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 185 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 186 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 187 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 188 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 189 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 190 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 153 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 154 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 155 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 156 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 157 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 158 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 159 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 160 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 161 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 162 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 163 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 164 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 165 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 166 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 167 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 168 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 169 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 170 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 171 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 172 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 173 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 174 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 175 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 176 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 177 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 178 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 179 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 180 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 181 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 182 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 183 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 184 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 185 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 186 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 187 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 188 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 189 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 190 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 115 | JOLIET, ILLINOIS |
| 116 | JOLIET, ILLINOIS |
| 117 | JOLIET, ILLINOIS |
| 118 | JOLIET, ILLINOIS |
| 119 | JOLIET, ILLINOIS |
| 120 | JOLIET, ILLINOIS |
| 121 | JOLIET, ILLINOIS |
| 122 | JOLIET, ILLINOIS |
| 123 | JOLIET, ILLINOIS |
| 124 | JOLIET, ILLINOIS |
| 125 | JOLIET, ILLINOIS |
| 126 | JOLIET, ILLINOIS |
| 127 | JOLIET, ILLINOIS |
| 128 | JOLIET, ILLINOIS |
| 129 | JOLIET, ILLINOIS |
| 130 | JOLIET, ILLINOIS |
| 131 | JOLIET, ILLINOIS |
| 132 | JOLIET, ILLINOIS |
| 133 | JOLIET, ILLINOIS |
| 134 | JOLIET, ILLINOIS |
| 135 | JOLIET, ILLINOIS |
| 136 | JOLIET, ILLINOIS |
| 137 | JOLIET, ILLINOIS |
| 138 | JOLIET, ILLINOIS |
| 139 | JOLIET, ILLINOIS |
| 140 | JOLIET, ILLINOIS |
| 141 | JOLIET, ILLINOIS |
| 142 | JOLIET, ILLINOIS |
| 143 | JOLIET, ILLINOIS |
| 144 | JOLIET, ILLINOIS |
| 145 | JOLIET, ILLINOIS |
| 146 | JOLIET, ILLINOIS |
| 147 | JOLIET, ILLINOIS |
| 148 | JOLIET, ILLINOIS |
| 149 | JOLIET, ILLINOIS |
| 150 | JOLIET, ILLINOIS |
| 151 | JOLIET, ILLINOIS |
| 152 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 115 | 0 | STOVER | NO | |
| 116 | 0 | STOVER | NO | |
| 117 | 0 | STOVER | NO | |
| 118 | 0 | STOVER | NO | |
| 119 | 0 | STOVER | NO | |
| 120 | 0 | STOVER | NO | |
| 121 | 0 | STOVER | NO | |
| 122 | 0 | STOVER | NO | |
| 123 | NA | STOVER | NO | |
| 124 | 0 | STOVER | NO | |
| 125 | 0 | STOVER | NO | |
| 126 | 0 | STOVER | NO | |
| 127 | 0 | STOVER | NO | |
| 128 | 0 | STOVER | NO | |
| 129 | 0 | STOVER | NO | |
| 130 | 0 | STOVER | NO | |
| 131 | 0 | STOVER | NO | |
| 132 | 0 | STOVER | NO | |
| 133 | NA | STOVER | NO | |
| 134 | 0 | STOVER | NO | |
| 135 | 0 | STOVER | NO | |
| 136 | 0 | STOVER | NO | |
| 137 | 0 | STOVER | NO | |
| 138 | 0 | STOVER | NO | |
| 139 | 0 | STOVER | NO | |
| 140 | 0 | STOVER | NO | |
| 141 | 0 | STOVER | NO | |
| 142 | 0 | STOVER | NO | |
| 143 | NA | STOVER | NO | |
| 144 | 0 | STOVER | NO | |
| 145 | 0 | STOVER | NO | |
| 146 | 0 | STOVER | NO | |
| 147 | 0 | STOVER | NO | |
| 148 | 0 | STOVER | NO | |
| 149 | 0 | STOVER | NO | |
| 150 | 0 | STOVER | NO | |
| 151 | 0 | STOVER | NO | |
| 152 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 115 | HCL-HF | 82 | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 116 | HCL-HF | 79 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 117 | HCL-HF | 84 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 118 | HCL-HF | 73 | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 119 | HCL-HF | 66 | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 120 | HCL-HF | 81 | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 121 | HCL-HF | 89 | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 122 | HCL-HF | 87 | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 123 | HCL-HF | 138 | 80 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 124 | HCL-HF | 124 | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 125 | HCL-HF | 130 | 47 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 126 | HCL-HF | 169 | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 127 | HCL-HF | 143 | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 128 | HCL-HF | 154 | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 129 | HCL-HF | 147 | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 130 | HCL-HF | 180 | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 131 | HCL-HF | 134 | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 132 | HCL-HF | 159 | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 133 | HCL-HF | 195 | 112 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 134 | HCL-HF | 167 | 85 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 135 | HCL-HF | 168 | 58 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 136 | HCL-HF | 270 | 55 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 137 | HCL-HF | 201 | 63 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 138 | HCL-HF | 200 | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 139 | HCL-HF | 215 | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 140 | HCL-HF | 267 | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 141 | HCL-HF | 178 | 50 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 142 | HCL-HF | 240 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 143 | HCL-HF | 319 | 145 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 144 | HCL-HF | 257 | 108 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 145 | HCL-HF | 327 | 112 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 146 | HCL-HF | 451 | 113 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 147 | HCL-HF | 314 | 84 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 148 | HCL-HF | 319 | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 149 | HCL-HF | 351 | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 150 | HCL-HF | 379 | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 151 | HCL-HF | 236 | 62 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 152 | HCL-HF | 313 | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 115 | | | | | 0.94 | 7.6 | 0 |
| 116 | | | | | 0.93 | 7.6 | 0 |
| 117 | | | | | 0.92 | 7.8 | 0 |
| 118 | | | | | 0.87 | 7.5 | 0 |
| 119 | | | | | 0.9 | 7.6 | 0 |
| 120 | | | | | 0.88 | 7.5 | 0 |
| 121 | | | | | 0.73 | 7.6 | 0 |
| 122 | | | | | 1 | 7.4 | 0 |
| 123 | | | | | 1.06 | 7.7 | 213 |
| 124 | | | | | 1.11 | 6.9 | 261 |
| 125 | | | | | 1.18 | 7.5 | 323 |
| 126 | | | | | 1.4 | 7.5 | 323 |
| 127 | | | | | 1.16 | 7.6 | 323 |
| 128 | | | | | 1.08 | 7.5 | 323 |
| 129 | | | | | 1.18 | 7.7 | 323 |
| 130 | | | | | 1.23 | 7.6 | 323 |
| 131 | | | | | 1.09 | 7.5 | 323 |
| 132 | | | | | 1.32 | 7.3 | 323 |
| 133 | | | | | 1.38 | 7.6 | 425 |
| 134 | | | | | 1.12 | 7 | 521 |
| 135 | | | | | 1.29 | 7.4 | 645 |
| 136 | | | | | 1.83 | 7.3 | 645 |
| 137 | | | | | 1.36 | 7.5 | 645 |
| 138 | | | | | 1.34 | 7.2 | 645 |
| 139 | | | | | 1.6 | 7.4 | 645 |
| 140 | | | | | 1.31 | 7.3 | 645 |
| 141 | | | | | 1.54 | 7.1 | 645 |
| 142 | | | | | 1.62 | 7.1 | 645 |
| 143 | | | | | 1.62 | 7.6 | 850 |
| 144 | | | | | 1.63 | 6.8 | 1042 |
| 145 | | | | | 1.94 | 7.3 | 1290 |
| 146 | | | | | 2.5 | 7.2 | 1290 |
| 147 | | | | | 1.83 | 7.3 | 1290 |
| 148 | | | | | 1.88 | 7.2 | 1290 |
| 149 | | | | | 2.03 | 7.3 | 1290 |
| 150 | | | | | 1.6 | 7.1 | 1290 |
| 151 | | | | | 1.54 | 7.1 | 1290 |
| 152 | | | | | 1.84 | 7 | 1290 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 115 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 116 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 117 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 118 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 119 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 120 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 121 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 122 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 123 | CENT POLY, FECL3 | 14.5 | 31.8 | 0 | | BLOUNT | SiL |
| 124 | CENT POLY, FECL3 | 11.1 | 42.9 | 0 | | BLOUNT | SiL |
| 125 | CENT POLY, FECL3 | 15.3 | 58.2 | 0 | | BLOUNT | SiL |
| 126 | CENT POLY, FECL3 | 0 | 58.2 | 1 | | BLOUNT | SiL |
| 127 | CENT POLY, FECL3 | 0 | 58.2 | 2 | | BLOUNT | SiL |
| 128 | CENT POLY, FECL3 | 0 | 58.2 | 3 | | BLOUNT | SiL |
| 129 | CENT POLY, FECL3 | 0 | 58.2 | 4 | | BLOUNT | SiL |
| 130 | CENT POLY, FECL3 | 0 | 58.2 | 5 | | BLOUNT | SiL |
| 131 | CENT POLY, FECL3 | 0 | 58.2 | 6 | | BLOUNT | SiL |
| 132 | CENT POLY, FECL3 | 0 | 58.2 | 7 | | BLOUNT | SiL |
| 133 | CENT POLY, FECL3 | 29 | 63.6 | 0 | | BLOUNT | SiL |
| 134 | CENT POLY, FECL3 | 22.2 | 85.8 | 0 | | BLOUNT | SiL |
| 135 | CENT POLY, FECL3 | 30.6 | 116.4 | 0 | | BLOUNT | SiL |
| 136 | CENT POLY, FECL3 | 0 | 116.4 | 1 | | BLOUNT | SiL |
| 137 | CENT POLY, FECL3 | 0 | 116.4 | 2 | | BLOUNT | SiL |
| 138 | CENT POLY, FECL3 | 0 | 116.4 | 3 | | BLOUNT | SiL |
| 139 | CENT POLY, FECL3 | 0 | 116.4 | 4 | | BLOUNT | SiL |
| 140 | CENT POLY, FECL3 | 0 | 116.4 | 5 | | BLOUNT | SiL |
| 141 | CENT POLY, FECL3 | 0 | 116.4 | 6 | | BLOUNT | SiL |
| 142 | CENT POLY, FECL3 | 0 | 116.4 | 7 | | BLOUNT | SiL |
| 143 | CENT POLY, FECL3 | 57.8 | 127 | 0 | | BLOUNT | SiL |
| 144 | CENT POLY, FECL3 | 44.4 | 171.4 | 0 | | BLOUNT | SiL |
| 145 | CENT POLY, FECL3 | 61.1 | 232.5 | 0 | | BLOUNT | SiL |
| 146 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 147 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 148 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 149 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 150 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 151 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |
| 152 | CENT POLY, FECL3 | 0 | 232.5 | 1 | | BLOUNT | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 116 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 117 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 118 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 119 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 120 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 121 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 122 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 123 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 124 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 125 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 126 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 127 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 128 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 129 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 130 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 131 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 132 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 133 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 134 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 135 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 136 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 137 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 138 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 139 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 140 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 141 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 142 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 143 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 144 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 145 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 146 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 147 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 148 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 149 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 150 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 151 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 152 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 115 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 116 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 117 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 118 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 119 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 120 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 121 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 122 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 123 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 124 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 125 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 126 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 127 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 128 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 129 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 130 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 131 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 132 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 133 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 134 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 135 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 136 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 137 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 138 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 139 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 140 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 141 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 142 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 143 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 144 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 145 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 146 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 147 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 148 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 149 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 150 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 151 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 152 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 77 | MUSCLE SCHOALES, AL |
| 78 | MUSCLE SCHOALES, AL |
| 79 | MUSCLE SCHOALES, AL |
| 80 | MUSCLE SCHOALES, AL |
| 81 | MUSCLE SCHOALES, AL |
| 82 | MUSCLE SCHOALES, AL |
| 83 | MUSCLE SCHOALES, AL |
| 84 | MUSCLE SCHOALES, AL |
| 85 | MUSCLE SCHOALES, AL |
| 86 | MUSCLE SCHOALES, AL |
| 87 | MUSCLE SCHOALES, AL |
| 88 | MUSCLE SCHOALES, AL |
| 89 | MUSCLE SCHOALES, AL |
| 90 | MUSCLE SCHOALES, AL |
| 91 | MUSCLE SCHOALES, AL |
| 92 | MUSCLE SCHOALES, AL |
| 93 | MUSCLE SCHOALES, AL |
| 94 | MUSCLE SCHOALES, AL |
| 95 | MUSCLE SCHOALES, AL |
| 96 | MUSCLE SCHOALES, AL |
| 97 | MUSCLE SCHOALES, AL |
| 98 | MUSCLE SCHOALES, AL |
| 99 | MUSCLE SCHOALES, AL |
| 100 | MUSCLE SCHOALES, AL |
| 101 | MUSCLE SCHOALES, AL |
| 102 | MUSCLE SCHOALES, AL |
| 103 | MUSCLE SCHOALES, AL |
| 104 | MUSCLE SCHOALES, AL |
| 105 | MUSCLE SCHOALES, AL |
| 106 | MUSCLE SCHOALES, AL |
| 107 | MUSCLE SCHOALES, AL |
| 108 | MUSCLE SCHOALES, AL |
| 109 | MUSCLE SCHOALES, AL |
| 110 | MUSCLE SCHOALES, AL |
| 111 | MUSCLE SCHOALES, AL |
| 112 | MUSCLE SCHOALES, AL |
| 113 | JOLIET, ILLINOIS |
| 114 | JOLIET, ILLINOIS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 77 | | | NO | |
| 78 | | | NO | |
| 79 | | | NO | |
| 80 | | | NO | |
| 81 | | | NO | |
| 82 | | | NO | |
| 83 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 84 | | | NO | |
| 85 | | | NO | |
| 86 | | | NO | |
| 87 | | | NO | |
| 88 | | | NO | |
| 89 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 90 | | | NO | |
| 91 | | | NO | |
| 92 | | | NO | |
| 93 | | | NO | |
| 94 | | | NO | |
| 95 | | | *NO | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS |
| 96 | | | NO | |
| 97 | | | NO | |
| 98 | | | NO | |
| 99 | | | *NO | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS |
| 100 | | | NO | |
| 101 | | | NO | |
| 102 | | | NO | |
| 103 | | | *NO | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS |
| 104 | | | NO | |
| 105 | | | NO | |
| 106 | | | NO | |
| 107 | | | NO | |
| 108 | | | NO | |
| 109 | | | NO | |
| 110 | | | NO | |
| 111 | | | NO | |
| 112 | | | NO | |
| 113 | 0 | STOVER | NO | |
| 114 | 0 | STOVER | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 77 | 0.5 M HCL | 89 | 113 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 78 | 0.5 M HCL | 5 | 56 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 79 | 0.5 M HCL | 97 | 53 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 80 | 0.5 M HCL | 89 | 76 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 81 | 0.5 M HCL | 5 | 61 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 82 | 0.5 M HCL | 97 | 153 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 83 | 0.5 M HCL | 89 | 130 | LEAF | FIELD, SLUDGE, MATURITY | 25* | EDIBLE PART |
| 84 | 0.5 M HCL | 5 | 36 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 85 | 0.5 M HCL | 97 | 79 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 86 | 0.5 M HCL | 89 | 61 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 87 | 0.5 M HCL | 5 | 112 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 88 | 0.5 M HCL | 97 | 233 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 89 | 0.5 M HCL | 89 | 287 | LEAF | FIELD, SLUDGE, MATURITY | 21.1* | EDIBLE PART |
| 90 | 0.5 M HCL | 5 | 109 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 91 | 0.5 M HCL | 97 | 166 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 92 | 0.5 M HCL | 89 | 316 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 93 | .5 M HCL | 2 | 54 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 94 | .5 M HCL | 2.9 | 44 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 95 | .5 M HCL | 112.8 | 142 | LEAF | FIELD, SLUDGE, MATURITY | 15.4* | TOTAL PLANT |
| 96 | .5 M HCL | 74.2 | 131 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 97 | .5 M HCL | 2 | 71 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 98 | .5 M HCL | 2.9 | 64 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 99 | .5 M HCL | 112.8 | 96 | LEAF | FIELD, SLUDGE, MATURITY | 10* | TOTAL PLANT |
| 100 | .5 M HCL | 74.2 | 109 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 101 | .5 M HCL | 2 | 37 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 102 | .5 M HCL | 2.9 | 46 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 103 | .5 M HCL | 112.8 | 62 | LEAF | FIELD, SLUDGE, MATURITY | 12.5* | TOTAL PLANT |
| 104 | .5 M HCL | 74.2 | 71 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 105 | .5 M HCL | 2 | 52 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 106 | .5 M HCL | 2.9 | 54 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 107 | .5 M HCL | 112.8 | 178 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 108 | .5 M HCL | 74.2 | 142 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 109 | .5 M HCL | 2 | 48 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 110 | .5 M HCL | 2.9 | 88 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 111 | .5 M HCL | 112.8 | 121 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 112 | .5 M HCL | 74.2 | 120 | LEAF | FIELD, SLUDGE, MATURITY | 0 | TOTAL PLANT |
| 113 | HCL-HF | 72 | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 114 | HCL-HF | 83 | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 77 | | | | | | 6.4 | 202 |
| 78 | | | | | | 5.8 | 0 |
| 79 | | | | | | 5.8 | 202 |
| 80 | | | | | | 5.8 | 202 |
| 81 | | | | | | 5.8 | 0 |
| 82 | | | | | | 5.8 | 202 |
| 83 | | | | | | 5.8 | 202 |
| 84 | | | | | | 5.8 | 0 |
| 85 | | | | | | 5.8 | 202 |
| 86 | | | | | | 5.8 | 202 |
| 87 | | | | | | 5.8 | 0 |
| 88 | | | | | | 5.8 | 202 |
| 89 | | | | | | 5.8 | 202 |
| 90 | | | | | | 5.8 | 0 |
| 91 | | | | | | 5.8 | 202 |
| 92 | | | | | | 5.8 | 202 |
| 93 | | | | | | 5.1 | 0 |
| 94 | | | | | | 5.1 | 0 |
| 95 | | | | | | 5.1 | 403 |
| 96 | | | | | | 5.1 | 403 |
| 97 | | | | | | 5.1 | 0 |
| 98 | | | | | | 5.1 | 0 |
| 99 | | | | | | 5.1 | 403 |
| 100 | | | | | | 5.1 | 403 |
| 101 | | | | | | 5.1 | 0 |
| 102 | | | | | | 5.1 | 0 |
| 103 | | | | | | 5.1 | 403 |
| 104 | | | | | | 5.1 | 403 |
| 105 | | | | | | 5.1 | 0 |
| 106 | | | | | | 5.1 | 0 |
| 107 | | | | | | 5.1 | 403 |
| 108 | | | | | | 5.1 | 403 |
| 109 | | | | | | 5.1 | 0 |
| 110 | | | | | | 5.1 | 0 |
| 111 | | | | | | 5.1 | 403 |
| 112 | | | | | | 5.1 | 403 |
| 113 | | | | | 0.85 | 7.8 | 0 |
| 114 | | | | | 0.9 | 6.9 | 0 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 77 | | 112 | 112 | 0 | | SANGO | SiL |
| 78 | | 0 | 0 | | | SANGO | SiL |
| 79 | | 112 | 112 | 1 | | SANGO | SiL |
| 80 | | 112 | 112 | 1 | | SANGO | SiL |
| 81 | | 0 | 0 | | | SANGO | SiL |
| 82 | | 112 | 112 | 1 | | SANGO | SiL |
| 83 | | 112 | 112 | 1 | | SANGO | SiL |
| 84 | | 0 | 0 | | | SANGO | SiL |
| 85 | | 112 | 112 | 1 | | SANGO | SiL |
| 86 | | 112 | 112 | 1 | | SANGO | SiL |
| 87 | | 0 | 0 | | | SANGO | SiL |
| 88 | | 112 | 112 | 1 | | SANGO | SiL |
| 89 | | 112 | 112 | 1 | | SANGO | SiL |
| 90 | | 0 | 0 | | | SANGO | SiL |
| 91 | | 112 | 112 | 1 | | SANGO | SiL |
| 92 | | 112 | 112 | 1 | | SANGO | SiL |
| 93 | | 0 | 0 | | | SANGO | SiL |
| 94 | | 0 | 0 | | | SANGO | SiL |
| 95 | | 224 | 224 | 0 | | SANGO | SiL |
| 96 | | 224 | 224 | 0 | | SANGO | SiL |
| 97 | | 0 | 0 | | | SANGO | SiL |
| 98 | | 0 | 0 | | | SANGO | SiL |
| 99 | | 224 | 224 | 0 | | SANGO | SiL |
| 100 | | 224 | 224 | 0 | | SANGO | SiL |
| 101 | | 0 | 0 | | | SANGO | SiL |
| 102 | | 0 | 0 | | | SANGO | SiL |
| 103 | | 224 | 224 | 0 | | SANGO | SiL |
| 104 | | 224 | 224 | 0 | | SANGO | SiL |
| 105 | | 0 | 0 | | | SANGO | SiL |
| 106 | | 0 | 0 | | | SANGO | SiL |
| 107 | | 224 | 224 | 0 | | SANGO | SiL |
| 108 | | 224 | 224 | 0 | | SANGO | SiL |
| 109 | | 0 | 0 | | | SANGO | SiL |
| 110 | | 0 | 0 | | | SANGO | SiL |
| 111 | | 224 | 224 | 0 | | SANGO | SiL |
| 112 | | 224 | 224 | 0 | | SANGO | SiL |
| 113 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |
| 114 | CENT POLY, FECL3 | 0 | 0 | NA | | BLOUNT | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 77 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 78 | | | | | | | | | | |
| 79 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 80 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 81 | | | | | | | | | | |
| 82 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 83 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 84 | | | | | | | | | | |
| 85 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 86 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 87 | | | | | | | | | | |
| 88 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 89 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 90 | | | | | | | | | | |
| 91 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 92 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 93 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 94 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 95 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 96 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 97 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 98 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 99 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 100 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 101 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 102 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 103 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 104 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 105 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 106 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 107 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 108 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 109 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 110 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 111 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 112 | 350 | 730 | 1.7 | 2.3 | 20 | 16000 | 530 | 1800 | | |
| 113 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |
| 114 | 2963 | 1422 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 77 | GIORDANO & MAYS 1977 | KALE | | 6.1 | | | 1.7 | 40 |
| 78 | GIORDANO & MAYS 1977 | OKRA | | | | | | |
| 79 | GIORDANO & MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 |
| 80 | GIORDANO & MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 |
| 81 | GIORDANO & MAYS 1977 | PEPPER | | | | | | |
| 82 | GIORDANO & MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 |
| 83 | GIORDANO & MAYS 1977 | PEPPER | | 6.1 | | | 1.7 | 40 |
| 84 | GIORDANO & MAYS 1977 | TOMATO | | | | | | |
| 85 | GIORDANO & MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 |
| 86 | GIORDANO & MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 |
| 87 | GIORDANO & MAYS 1977 | SQUASH | | | | | | |
| 88 | GIORDANO & MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 89 | GIORDANO & MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 |
| 90 | GIORDANO & MAYS 1977 | LETTUCE | | | | | | |
| 91 | GIORDANO & MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 |
| 92 | GIORDANO & MAYS 1977 | LETTUCE | | 6.1 | | | 1.7 | 40 |
| 93 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 |
| 94 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 |
| 95 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 |
| 96 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 |
| 97 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 |
| 98 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 |
| 99 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 |
| 100 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 |
| 101 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 |
| 102 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 |
| 103 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 |
| 104 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 |
| 105 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 |
| 106 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 |
| 107 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 |
| 108 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 |
| 109 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 110 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 111 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 112 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 113 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |
| 114 | HINESLY 1985 | CORN | | | | | 3.4 | 263 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 39 | MUSCLE SCHOALES, AL |
| 40 | MUSCLE SCHOALES, AL |
| 41 | MUSCLE SCHOALES, AL |
| 42 | MUSCLE SCHOALES, AL |
| 43 | MUSCLE SCHOALES, AL |
| 44 | MUSCLE SCHOALES, AL |
| 45 | MUSCLE SCHOALES, AL |
| 46 | MUSCLE SCHOALES, AL |
| 47 | MUSCLE SCHOALES, AL |
| 48 | MUSCLE SCHOALES, AL |
| 49 | MUSCLE SCHOALES, AL |
| 50 | MUSCLE SCHOALES, AL |
| 51 | MUSCLE SCHOALES, AL |
| 52 | MUSCLE SCHOALES, AL |
| 53 | MUSCLE SCHOALES, AL |
| 54 | MUSCLE SCHOALES, AL |
| 55 | MUSCLE SCHOALES, AL |
| 56 | MUSCLE SCHOALES, AL |
| 57 | MUSCLE SCHOALES, AL |
| 58 | MUSCLE SCHOALES, AL |
| 59 | MUSCLE SCHOALES, AL |
| 60 | MUSCLE SCHOALES, AL |
| 61 | MUSCLE SCHOALES, AL |
| 62 | MUSCLE SCHOALES, AL |
| 63 | MUSCLE SCHOALES, AL |
| 64 | MUSCLE SCHOALES, AL |
| 65 | MUSCLE SCHOALES, AL |
| 66 | MUSCLE SCHOALES, AL |
| 67 | MUSCLE SCHOALES, AL |
| 68 | MUSCLE SCHOALES, AL |
| 69 | MUSCLE SCHOALES, AL |
| 70 | MUSCLE SCHOALES, AL |
| 71 | MUSCLE SCHOALES, AL |
| 72 | MUSCLE SCHOALES, AL |
| 73 | MUSCLE SCHOALES, AL |
| 74 | MUSCLE SCHOALES, AL |
| 75 | MUSCLE SCHOALES, AL |
| 76 | MUSCLE SCHOALES, AL |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 39 | 0 | PODS | NO | |
| 40 | 60.4* | PODS | *NO | *DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT |
| 41 | 0 | PODS | NO | |
| 42 | 0 | PODS | NO | |
| 43 | 37.5* | PODS | *NO | *DOSE RESPONSE NOT CONSISTANT, PH<5.5 |
| 44 | 0 | PODS | NO | |
| 45 | 0 | PODS | NO | |
| 46 | 0 | PODS | NO | |
| 47 | 0 | PODS | NO | |
| 48 | 0 | PODS | NO | |
| 49 | 0 | PODS | NO | |
| 50 | 0 | PODS | NO | |
| 51 | 0 | PODS | *NO | *DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTANT |
| 52 | 0 | PODS | *NO | *DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTANT |
| 53 | 0 | PODS | NO | |
| 54 | 0 | PODS | POSSIBLE | SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES |
| 55 | 36.8 | PODS | POSSIBLE | SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES |
| 56 | 42.8 | PODS | POSSIBLE | SLUDGE LOADING EXCEEDS AGRONOMIC RATES |
| 57 | | | NO | |
| 58 | | | NO | |
| 59 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 60 | | | NO | |
| 61 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 62 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 63 | | | NO | |
| 64 | | | NO | |
| 65 | | | *NO | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS |
| 66 | | | NO | |
| 67 | | | NO | |
| 68 | | | NO | |
| 69 | | | NO | |
| 70 | | | NO | |
| 71 | | | NO | |
| 72 | | | NO | |
| 73 | | | NO | |
| 74 | | | NO | |
| 75 | | | NO | |
| 76 | | | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 39 | 0.5 M HCl | 75 | 230 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 40 | 0.5 M HCl | 206 | 211 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 41 | 0.5 M HCl | 7 | 53 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 42 | 0.5 M HCl | 7 | 63 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 43 | 0.5 M HCl | 20 | 282 | VINES | FIELD, SLUDGE, MATURITY | 30.8* | VINES |
| 44 | 0.5 M HCl | 40 | 254 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 45 | 0.5 M HCl | 62 | 296 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 46 | 0.5 M HCl | 143 | 404 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 47 | 0.5 M HCl | 261 | 410 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 48 | 0.5 M HCl | 774 | 338 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 49 | DTPA | 2 | 42 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 50 | DTPA | 2 | 36 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 51 | DTPA | 9 | 128 | VINES | FIELD, SLUDGE, MATURITY | 26.2* | VINES |
| 52 | DTPA | 19 | 141 | VINES | FIELD, SLUDGE, MATURITY | 14.5* | VINES |
| 53 | DTPA | 25 | 128 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 54 | DTPA | 69 | 304 | VINES | FIELD, SLUDGE, MATURITY | 27 | VINES |
| 55 | DTPA | 77 | 325 | VINES | FIELD, SLUDGE, MATURITY | 36 | VINES |
| 56 | DTPA | 157 | 308 | VINES | FIELD, SLUDGE, MATURITY | 32.8 | VINES |
| 57 | 0.5 M HCL | 5 | 40 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 58 | 0.5 M HCL | 97 | 179 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 59 | 0.5 M HCL | 89 | 95 | LEAF | FIELD, SLUDGE, MATURITY | 14.3* | EDIBLE PART |
| 60 | 0.5 M HCL | 5 | 41 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 61 | 0.5 M HCL | 97 | 94 | LEAF | FIELD, SLUDGE, MATURITY | 8.3* | EDIBLE PART |
| 62 | 0.5 M HCL | 89 | 55 | LEAF | FIELD, SLUDGE, MATURITY | 8.3* | EDIBLE PART |
| 63 | 0.5 M HCL | 5 | 68 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 64 | 0.5 M HCL | 97 | 143 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 65 | 0.5 M HCL | 89 | 92 | LEAF | FIELD, SLUDGE, MATURITY | 13* | EDIBLE PART |
| 66 | 0.5 M HCL | 5 | 49 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 67 | 0.5 M HCL | 97 | 77 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 68 | 0.5 M HCL | 89 | 55 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 69 | 0.5 M HCL | 5 | 93 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 70 | 0.5 M HCL | 97 | 233 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 71 | 0.5 M HCL | 89 | 226 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 72 | 0.5 M HCL | 5 | 52 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 73 | 0.5 M HCL | 97 | 194 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 74 | 0.5 M HCL | 89 | 96 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 75 | 0.5 M HCL | 5 | 33 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |
| 76 | 0.5 M HCL | 97 | 161 | LEAF | FIELD, SLUDGE, MATURITY | 0 | EDIBLE PART |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 39 | | | | | | 5.6 | 360 |
| 40 | | | | | | 5.6 | 720 |
| 41 | | | | | | 6.5 | 0 |
| 42 | | | | | | 6.5 | 0 |
| 43 | | | | | | 5.2 | 90 |
| 44 | | | | | | 5.6 | 180 |
| 45 | | | | | | 5.9 | 360 |
| 46 | | | | | | 6 | 270 |
| 47 | | | | | | 5.9 | 540 |
| 48 | | | | | | 6.3 | 1080 |
| 49 | | | | | | 6.3 | 0 |
| 50 | | | | | | 5.8 | 0 |
| 51 | | | | | | 5.5 | 90 |
| 52 | | | | | | 5.7 | 180 |
| 53 | | | | | | 6.1 | 360 |
| 54 | | | | | | 5 | 360 |
| 55 | | | | | | 5.3 | 720 |
| 56 | | | | | | 5.7 | 1440 |
| 57 | | | | | | 6.4 | 0 |
| 58 | | | | | | 6.4 | 202 |
| 59 | | | | | | 6.4 | 202 |
| 60 | | | | | | 6.4 | 0 |
| 61 | | | | | | 6.4 | 202 |
| 62 | | | | | | 6.4 | 202 |
| 63 | | | | | | 6.4 | 0 |
| 64 | | | | | | 6.4 | 202 |
| 65 | | | | | | 6.4 | 202 |
| 66 | | | | | | 6.4 | 0 |
| 67 | | | | | | 6.4 | 202 |
| 68 | | | | | | 6.4 | 202 |
| 69 | | | | | | 6.4 | 0 |
| 70 | | | | | | 6.4 | 202 |
| 71 | | | | | | 6.4 | 202 |
| 72 | | | | | | 6.4 | 0 |
| 73 | | | | | | 6.4 | 202 |
| 74 | | | | | | 6.4 | 202 |
| 75 | | | | | | 6.4 | 0 |
| 76 | | | | | | 6.4 | 202 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 39 | | 100 | 200 | 0 | | SANGO | SiL |
| 40 | | 200 | 400 | 0 | | SANGO | SiL |
| 41 | | 0 | 0 | | | SANGO | SiL |
| 42 | | 0 | 0 | | | SANGO | SiL |
| 43 | | 50 | 50 | 2 | | SANGO | SiL |
| 44 | | 100 | 100 | 2 | | SANGO | SiL |
| 45 | | 200 | 200 | 2 | | SANGO | SiL |
| 46 | | 50 | 150 | 0 | | SANGO | SiL |
| 47 | | 100 | 300 | 0 | | SANGO | SiL |
| 48 | | 200 | 600 | 0 | | SANGO | SiL |
| 49 | | 0 | 0 | | | SANGO | SiL |
| 50 | | 0 | 0 | | | SANGO | SiL |
| 51 | | 50 | 50 | 3 | | SANGO | SiL |
| 52 | | 100 | 100 | 3 | | SANGO | SiL |
| 53 | | 200 | 200 | 3 | | SANGO | SiL |
| 54 | | 50 | 200 | 0 | | SANGO | SiL |
| 55 | | 100 | 400 | 0 | | SANGO | SiL |
| 56 | | 200 | 800 | 0 | | SANGO | SiL |
| 57 | | 0 | 0 | | | SANGO | SiL |
| 58 | | 112 | 112 | 0 | | SANGO | SiL |
| 59 | | 112 | 112 | 0 | | SANGO | SiL |
| 60 | | 0 | 0 | | | SANGO | SiL |
| 61 | | 112 | 112 | 0 | | SANGO | SiL |
| 62 | | 112 | 112 | 0 | | SANGO | SiL |
| 63 | | 0 | 0 | | | SANGO | SiL |
| 64 | | 112 | 112 | 0 | | SANGO | SiL |
| 65 | | 112 | 112 | 0 | | SANGO | SiL |
| 66 | | 0 | 0 | | | SANGO | SiL |
| 67 | | 112 | 112 | 0 | | SANGO | SiL |
| 68 | | 112 | 112 | 0 | | SANGO | SiL |
| 69 | | 0 | 0 | | | SANGO | SiL |
| 70 | | 112 | 112 | 0 | | SANGO | SiL |
| 71 | | 112 | 112 | 0 | | SANGO | SiL |
| 72 | | 0 | 0 | | | SANGO | SiL |
| 73 | | 112 | 112 | 0 | | SANGO | SiL |
| 74 | | 112 | 112 | 0 | | SANGO | SiL |
| 75 | | 0 | 0 | | | SANGO | SiL |
| 76 | | 112 | 112 | 0 | | SANGO | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 39 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 40 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 41 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 42 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 43 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 44 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 45 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 46 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 47 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 48 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 49 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 50 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 51 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 52 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 53 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 54 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 55 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 56 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 57 | | | | | | | | | | |
| 58 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 59 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 60 | | | | | | | | | | |
| 61 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 62 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 63 | | | | | | | | | | |
| 64 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 65 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 66 | | | | | | | | | | |
| 67 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 68 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 69 | | | | | | | | | | |
| 70 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 71 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 72 | | | | | | | | | | |
| 73 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |
| 74 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 75 | | | | | | | | | | |
| 76 | 350 | 730 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 39 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 40 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 41 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 42 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 43 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 44 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 45 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 46 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 47 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 48 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 49 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 50 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 51 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 52 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 53 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 54 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 55 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 56 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 57 | GIORDANO & MAYS 1977 | BEANS | | | | | | |
| 58 | GIORDANO & MAYS 1977 | BEANS | | 6.6 | | | 2.5 | 50 |
| 59 | GIORDANO & MAYS 1977 | BEANS | | 6.1 | | | 1.7 | 40 |
| 60 | GIORDANO & MAYS 1977 | OKRA | | | | | | |
| 61 | GIORDANO & MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 |
| 62 | GIORDANO & MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 |
| 63 | GIORDANO & MAYS 1977 | PEPPERS | | | | | | |
| 64 | GIORDANO & MAYS 1977 | PEPPERS | | 6.6 | | | 2.5 | 50 |
| 65 | GIORDANO & MAYS 1977 | PEPPERS | | 6.1 | | | 1.7 | 40 |
| 66 | GIORDANO & MAYS 1977 | TOMATO | | | | | | |
| 67 | GIORDANO & MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 |
| 68 | GIORDANO & MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 |
| 69 | GIORDANO & MAYS 1977 | SQUASH | | | | | | |
| 70 | GIORDANO & MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 |
| 71 | GIORDANO & MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 |
| 72 | GIORDANO & MAYS 1977 | TURNIP | | | | | | |
| 73 | GIORDANO & MAYS 1977 | TURNIP | | 6.6 | | | 2.5 | 50 |
| 74 | GIORDANO & MAYS 1977 | TURNIP | | 6.1 | | | 1.7 | 40 |
| 75 | GIORDANO & MAYS 1977 | KALE | | | | | | |
| 76 | GIORDANO & MAYS 1977 | KALE | | 6.6 | | | 2.5 | 50 |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 1 | MUSCLE SCHOALES, AL |
| 2 | MUSCLE SCHOALES, AL |
| 3 | MUSCLE SCHOALES, AL |
| 4 | MUSCLE SCHOALES, AL |
| 5 | MUSCLE SCHOALES, AL |
| 6 | MUSCLE SCHOALES, AL |
| 7 | MUSCLE SCHOALES, AL |
| 8 | MUSCLE SCHOALES, AL |
| 9 | MUSCLE SCHOALES, AL |
| 10 | MUSCLE SCHOALES, AL |
| 11 | MUSCLE SCHOALES, AL |
| 12 | MUSCLE SCHOALES, AL |
| 13 | MUSCLE SCHOALES, AL |
| 14 | MUSCLE SCHOALES, AL |
| 15 | MUSCLE SCHOALES, AL |
| 16 | MUSCLE SCHOALES, AL |
| 17 | MUSCLE SCHOALES, AL |
| 18 | MUSCLE SCHOALES, AL |
| 19 | MUSCLE SCHOALES, AL |
| 20 | MUSCLE SCHOALES, AL |
| 21 | MUSCLE SCHOALES, AL |
| 22 | MUSCLE SCHOALES, AL |
| 23 | MUSCLE SCHOALES, AL |
| 24 | MUSCLE SCHOALES, AL |
| 25 | MUSCLE SCHOALES, AL |
| 26 | MUSCLE SCHOALES, AL |
| 27 | MUSCLE SCHOALES, AL |
| 28 | MUSCLE SCHOALES, AL |
| 29 | MUSCLE SCHOALES, AL |
| 30 | MUSCLE SCHOALES, AL |
| 31 | MUSCLE SCHOALES, AL |
| 32 | MUSCLE SCHOALES, AL |
| 33 | MUSCLE SCHOALES, AL |
| 34 | MUSCLE SCHOALES, AL |
| 35 | MUSCLE SCHOALES, AL |
| 36 | MUSCLE SCHOALES, AL |
| 37 | MUSCLE SCHOALES, AL |
| 38 | MUSCLE SCHOALES, AL |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 1 | | | NO | |
| 2 | | | NO | |
| 3 | | | NO | |
| 4 | | | NO | |
| 5 | | | NO | |
| 6 | | | NO | |
| 7 | | | NO | |
| 8 | | | NO | |
| 9 | | | NO | |
| 10 | | | NO | |
| 11 | | | NO | |
| 12 | | | NO | |
| 13 | | | NO | |
| 14 | | | NO | |
| 15 | | | NO | |
| 16 | | | NO | |
| 17 | | | NO | |
| 18 | | | NO | |
| 19 | | | NO | |
| 20 | | | NO | |
| 21 | | | NO | |
| 22 | | | NO | |
| 23 | | | *NO | *YIELD REDUCTION NOT CONSISTANT WITH DOSE RESPONCE RELATIONSHIP |
| 24 | | | NO | |
| 25 | | | NO | |
| 26 | | | POSSIBLE | ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5 |
| 27 | | | POSSIBLE | ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5 |
| 28 | | | NO | |
| 29 | 0 | PODS | NO | |
| 30 | 17.7* | PODS | *NO | *TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA |
| 31 | 35.3* | PODS | *NO | *TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA |
| 32 | 55* | PODS | *NO | *TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA |
| 33 | 0 | PODS | NO | |
| 34 | 0 | PODS | NO | |
| 35 | 25.4* | PODS | *NO | *DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT |
| 36 | 0 | PODS | NO | |
| 37 | 28.5* | PODS | *NO | *DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT |
| 38 | 0 | PODS | NO | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 1 | 0.5 M HCl | 4 | 41 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 2 | 0.5 M HCl | 29 | 94 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 3 | 0.5 M HCl | 53 | 95 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 4 | 0.5 M HCl | 93 | 97 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 5 | 0.5 M HCl | 6 | 47 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 6 | 0.5 M HCl | 6 | 53 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 7 | 0.5 M HCl | 18 | 153 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 8 | 0.5 M HCl | 54 | 184 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 9 | 0.5 M HCl | 73 | 207 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 10 | 0.5 M HCl | 68 | 225 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 11 | 0.5 M HCl | 75 | 202 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 12 | 0.5 M HCl | 206 | 241 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 13 | 0.5 M HCl | 7 | 28 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 14 | 0.5 M HCl | 7 | 28 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 15 | 0.5 M HCl | 20 | 98 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 16 | 0.5 M HCl | 40 | 94 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 17 | 0.5 M HCl | 62 | 130 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 18 | 0.5 M HCl | 143 | 172 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 19 | 0.5 M HCl | 261 | 221 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 20 | 0.5 M HCl | 774 | 250 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 21 | DTPA | 2 | 30 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 22 | DTPA | 2 | 46 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 23 | DTPA | 9 | 130 | FORAGE | FIELD, SLUDGE, MATURITY | 11.3* | STOVER |
| 24 | DTPA | 19 | 158 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 25 | DTPA | 25 | 172 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 26 | DTPA | 69 | 313 | FORAGE | FIELD, SLUDGE, MATURITY | 14.2 | STOVER |
| 27 | DTPA | 77 | 450 | FORAGE | FIELD, SLUDGE, MATURITY | 17.6 | STOVER |
| 28 | DTPA | 157 | 400 | FORAGE | FIELD, SLUDGE, MATURITY | 0 | STOVER |
| 29 | 0.5 M HCl | 4 | 60 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 30 | 0.5 M HCl | 29 | 158 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 31 | 0.5 M HCl | 53 | 189 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 32 | 0.5 M HCl | 93 | 164 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 33 | 0.5 M HCl | 6 | 44 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 34 | 0.5 M HCl | 6 | 48 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 35 | 0.5 M HCl | 18 | 171 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 36 | 0.5 M HCl | 54 | 184 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 37 | 0.5 M HCl | 73 | 187 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |
| 38 | 0.5 M HCl | 68 | 225 | VINES | FIELD, SLUDGE, MATURITY | 0 | VINES |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | 4.9 | 0 |
| 2 | | | | | | 5.3 | 90 |
| 3 | | | | | | 5.3 | 180 |
| 4 | | | | | | 5.6 | 360 |
| 5 | | | | | | 4.9 | 0 |
| 6 | | | | | | 4.9 | 0 |
| 7 | | | | | | 5.3 | 90 |
| 8 | | | | | | 5.3 | 180 |
| 9 | | | | | | 5.6 | 360 |
| 10 | | | | | | 5.6 | 180 |
| 11 | | | | | | 5.6 | 360 |
| 12 | | | | | | 5.6 | 720 |
| 13 | | | | | | 6.5 | 0 |
| 14 | | | | | | 6.5 | 0 |
| 15 | | | | | | 5.2 | 90 |
| 16 | | | | | | 5.6 | 180 |
| 17 | | | | | | 5.9 | 360 |
| 18 | | | | | | 6 | 270 |
| 19 | | | | | | 5.9 | 540 |
| 20 | | | | | | 6.3 | 1080 |
| 21 | | | | | | 6.3 | 0 |
| 22 | | | | | | 5.8 | 0 |
| 23 | | | | | | 5.5 | 90 |
| 24 | | | | | | 5.7 | 180 |
| 25 | | | | | | 6.1 | 360 |
| 26 | | | | | | 5 | 360 |
| 27 | | | | | | 5.3 | 720 |
| 28 | | | | | | 5.7 | 1440 |
| 29 | | | | | | 4.9 | 0 |
| 30 | | | | | | 5.3 | 90 |
| 31 | | | | | | 5.3 | 180 |
| 32 | | | | | | 5.6 | 360 |
| 33 | | | | | | 4.9 | 0 |
| 34 | | | | | | 4.9 | 0 |
| 35 | | | | | | 5.3 | 90 |
| 36 | | | | | | 5.3 | 180 |
| 37 | | | | | | 5.6 | 360 |
| 38 | | | | | | 5.6 | 180 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 1 | | 0 | 0 | | | SANGO | SiL |
| 2 | | 50 | 50 | 0 | | SANGO | SiL |
| 3 | | 100 | 100 | 0 | | SANGO | SiL |
| 4 | | 200 | 200 | 0 | | SANGO | SiL |
| 5 | | 0 | 0 | | | SANGO | SiL |
| 6 | | 0 | 0 | | | SANGO | SiL |
| 7 | | 50 | 50 | 1 | | SANGO | SiL |
| 8 | | 100 | 100 | 1 | | SANGO | SiL |
| 9 | | 200 | 200 | 1 | | SANGO | SiL |
| 10 | | 50 | 100 | 0 | | SANGO | SiL |
| 11 | | 100 | 200 | 0 | | SANGO | SiL |
| 12 | | 200 | 400 | 0 | | SANGO | SiL |
| 13 | | 0 | 0 | | | SANGO | SiL |
| 14 | | 0 | 0 | | | SANGO | SiL |
| 15 | | 50 | 50 | 2 | | SANGO | SiL |
| 16 | | 100 | 100 | 2 | | SANGO | SiL |
| 17 | | 200 | 200 | 2 | | SANGO | SiL |
| 18 | | 50 | 150 | 0 | | SANGO | SiL |
| 19 | | 100 | 300 | 0 | | SANGO | SiL |
| 20 | | 200 | 600 | 0 | | SANGO | SiL |
| 21 | | 0 | 0 | | | SANGO | SiL |
| 22 | | 0 | 0 | | | SANGO | SiL |
| 23 | | 50 | 50 | 3 | | SANGO | SiL |
| 24 | | 100 | 100 | 3 | | SANGO | SiL |
| 25 | | 200 | 200 | 3 | | SANGO | SiL |
| 26 | | 50 | 200 | 0 | | SANGO | SiL |
| 27 | | 100 | 400 | 0 | | SANGO | SiL |
| 28 | | 200 | 800 | 0 | | SANGO | SiL |
| 29 | | 0 | 0 | | | SANGO | SiL |
| 30 | | 50 | 50 | 0 | | SANGO | SiL |
| 31 | | 100 | 100 | 0 | | SANGO | SiL |
| 32 | | 200 | 200 | 0 | | SANGO | SiL |
| 33 | | 0 | 0 | | | SANGO | SiL |
| 34 | | 0 | 0 | | | SANGO | SiL |
| 35 | | 50 | 50 | 1 | | SANGO | SiL |
| 36 | | 100 | 100 | 1 | | SANGO | SiL |
| 37 | | 200 | 200 | 1 | | SANGO | SiL |
| 38 | | 50 | 100 | 0 | | SANGO | SiL |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 1 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 2 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 3 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 4 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 5 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 6 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 7 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 8 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 9 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 10 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 11 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 12 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 13 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 14 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 15 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 16 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 17 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 18 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 19 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 20 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 21 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 22 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 23 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 24 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 25 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 26 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 27 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 28 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 29 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 30 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 31 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 32 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 33 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 34 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 35 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 36 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 37 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |
| 38 | 400 | 520 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | |

TABLE F-4. ZINC DATA

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 1 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 2 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 3 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 4 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 5 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 6 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 7 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 8 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 9 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 10 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 11 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 12 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 13 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 14 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 15 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 16 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 17 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 18 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 19 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 20 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 21 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 22 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 23 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 24 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 25 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 26 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 27 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 28 | GIORDANO&MAYS 1977 | CORN | SILVER QUEEN | 6.1 | | | 1.7 | 40 |
| 29 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 30 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 31 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 32 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 33 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 34 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 35 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 36 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 37 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |
| 38 | GIORDANO&MAYS 1977 | BEANS | WHITE HALF RUNNER | 6.1 | | | 1.7 | 40 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 533 | | FULTON COUNTY, ILLINOIS |
| 534 | | FULTON COUNTY, ILLINOIS |
| 535 | | FULTON COUNTY, ILLINOIS |
| 536 | | FULTON COUNTY, ILLINOIS |
| 537 | | FULTON COUNTY, ILLINOIS |
| 538 | | FULTON COUNTY, ILLINOIS |
| 539 | | FULTON COUNTY, ILLINOIS |
| 540 | | FULTON COUNTY, ILLINOIS |
| 541 | | FULTON COUNTY, ILLINOIS |
| 542 | | FULTON COUNTY, ILLINOIS |
| 543 | | FULTON COUNTY, ILLINOIS |
| 544 | | FULTON COUNTY, ILLINOIS |
| 545 | | FULTON COUNTY, ILLINOIS |
| 546 | | FULTON COUNTY, ILLINOIS |
| 547 | | FULTON COUNTY, ILLINOIS |
| 548 | | FULTON COUNTY, ILLINOIS |
| 549 | | FULTON COUNTY, ILLINOIS |
| 550 | | FULTON COUNTY, ILLINOIS |
| 551 | | FULTON COUNTY, ILLINOIS |
| 552 | | FULTON COUNTY, ILLINOIS |
| 553 | | FULTON COUNTY, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 533 | NA | GRAIN | NA | STOVER | |
| 534 | 0 | GRAIN | 0 | STOVER | |
| 535 | 0 | GRAIN | 0 | STOVER | |
| 536 | 0 | GRAIN | 0 | STOVER | |
| 537 | 0 | GRAIN | 0 | STOVER | |
| 538 | 0 | GRAIN | 0 | STOVER | |
| 539 | 0 | GRAIN | 0 | STOVER | |
| 540 | 0 | GRAIN | 0 | STOVER | |
| 541 | 0 | GRAIN | 0 | STOVER | |
| 542 | 43.7 | GRAIN | 0 | STOVER | |
| 543 | 23 | GRAIN | 0 | STOVER | |
| 544 | NA | GRAIN | NA | STOVER | |
| 545 | 0 | GRAIN | 0 | STOVER | |
| 546 | 0 | GRAIN | 0 | STOVER | |
| 547 | 0 | GRAIN | 0 | STOVER | |
| 548 | 0 | GRAIN | 0 | STOVER | |
| 549 | 0 | GRAIN | 0 | STOVER | |
| 550 | 0 | GRAIN | 0 | STOVER | |
| 551 | 0 | GRAIN | 0 | STOVER | |
| 552 | 0 | GRAIN | 0 | STOVER | |
| 553 | 59.2 | GRAIN | 0 | STOVER | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 533 | | 0.94 | 7.5 | 84 | 0.1 M HCl | 12.9 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 534 | | 1.56 | 7.5 | 100 | 0.1 M HCl | 21.5 | 0.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 535 | | 1.56 | 7.5 | 110 | 0.1 M HCl | 23.9 | 3 | LEAF | FIELD, SLUDGE, MATURITY |
| 536 | | 1.04 | 7.5 | 126 | 0.1 M HCl | 21.2 | 1.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 537 | | 1.04 | 7.5 | 140 | 0.1 M HCl | 24.9 | 2.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 538 | | 1.48 | 7.5 | 154 | 0.1 M HCl | 23.6 | 3.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 539 | | 1.48 | 7.5 | 162 | 0.1 M HCl | 22.5 | 1.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 540 | | 2.15 | 7.5 | 170 | 0.1 M HCl | 33.1 | 1.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 541 | | 2.15 | 7.5 | 180 | 0.1 M HCl | 25.8 | 0.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 542 | | 1.9 | 7.5 | 186 | 0.1 M HCl | 31 | 1 | LEAF | FIELD, SLUDGE, MATURITY |
| 543 | | 1.22 | 7.5 | 148 | 0.1 M HCl | 18.8 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 544 | | 3.02 | 7.5 | 168 | 0.1 M HCl | 18.8 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 545 | | 3.02 | 7.5 | 200 | 0.1 M HCl | 42.4 | 1.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 546 | | 1.58 | 7.5 | 220 | 0.1 M HCl | 39.9 | 3 | LEAF | FIELD, SLUDGE, MATURITY |
| 547 | | 1.58 | 7.5 | 252 | 0.1 M HCl | 31.4 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 548 | | 2.38 | 7.5 | 280 | 0.1 M HCl | 44.8 | 2.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 549 | | 2.38 | 7.5 | 308 | 0.1 M HCl | 39.1 | 12 | LEAF | FIELD, SLUDGE, MATURITY |
| 550 | | 3.47 | 7.5 | 324 | 0.1 M HCl | 47.4 | 1.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 551 | | 3.47 | 7.5 | 340 | 0.1 M HCl | 49.3 | 1.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 552 | | 2.77 | 7.5 | 360 | 0.1 M HCl | 46.4 | 1.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 553 | | 2.77 | 7.5 | 372 | 0.1 M HCl | 43.8 | 1 | LEAF | FIELD, SLUDGE, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 533 | 39.8 | 200.9 | 0 | STRIP MINE SPOIL | | | | | |
| 534 | 34.8 | 235.7 | 0 | STRIP MINE SPOIL | | | | | |
| 535 | 22.8 | 258.5 | 0 | STRIP MINE SPOIL | | | | | |
| 536 | 34.9 | 293.4 | 0 | STRIP MINE SPOIL | | | | | |
| 537 | 35.8 | 329.2 | 0 | STRIP MINE SPOIL | | | | | |
| 538 | 33.6 | 362.8 | 0 | STRIP MINE SPOIL | | | | | |
| 539 | 33.6 | 396.4 | 0 | STRIP MINE SPOIL | | | | | |
| 540 | 33.6 | 430 | 0 | STRIP MINE SPOIL | | | | | |
| 541 | 33.6 | 463.6 | 0 | STRIP MINE SPOIL | | | | | |
| 542 | 33.6 | 497.2 | 0 | STRIP MINE SPOIL | | | | | |
| 543 | 64.3 | 321.9 | 0 | STRIP MINE SPOIL | | | | | |
| 544 | 79.7 | 401.6 | 0 | STRIP MINE SPOIL | | | | | |
| 545 | 69.8 | 471.4 | 0 | STRIP MINE SPOIL | | | | | |
| 546 | 45.5 | 516.9 | 0 | STRIP MINE SPOIL | | | | | |
| 547 | 68.8 | 585.7 | 0 | STRIP MINE SPOIL | | | | | |
| 548 | 71.7 | 657.4 | 0 | STRIP MINE SPOIL | | | | | |
| 549 | 67.2 | 724.6 | 0 | STRIP MINE SPOIL | | | | | |
| 550 | 67.2 | 791.8 | 0 | STRIP MINE SPOIL | | | | | |
| 551 | 67.2 | 859 | 0 | STRIP MINE SPOIL | | | | | |
| 552 | 67.2 | 926.2 | 0 | STRIP MINE SPOIL | | | | | |
| 553 | 67.2 | 993.4 | 0 | STRIP MINE SPOIL | | | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 533 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 534 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 535 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 536 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 537 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 538 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 539 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 540 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 541 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 542 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 543 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 544 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 545 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 546 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 547 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 548 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 549 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 550 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 551 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 552 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 553 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 533 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 534 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 535 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 536 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 537 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 538 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 539 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 540 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 541 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 542 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 543 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 544 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 545 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 546 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 547 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 548 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 549 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 550 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 551 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 552 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 553 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 495 | | FULTON COUNTY, ILLINOIS |
| 496 | | FULTON COUNTY, ILLINOIS |
| 497 | | FULTON COUNTY, ILLINOIS |
| 498 | | FULTON COUNTY, ILLINOIS |
| 499 | | FULTON COUNTY, ILLINOIS |
| 500 | | FULTON COUNTY, ILLINOIS |
| 501 | | FULTON COUNTY, ILLINOIS |
| 502 | | FULTON COUNTY, ILLINOIS |
| 503 | | FULTON COUNTY, ILLINOIS |
| 504 | | FULTON COUNTY, ILLINOIS |
| 505 | | FULTON COUNTY, ILLINOIS |
| 506 | | FULTON COUNTY, ILLINOIS |
| 507 | | FULTON COUNTY, ILLINOIS |
| 508 | | FULTON COUNTY, ILLINOIS |
| 509 | | FULTON COUNTY, ILLINOIS |
| 510 | | FULTON COUNTY, ILLINOIS |
| 511 | | FULTON COUNTY, ILLINOIS |
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| 527 | | FULTON COUNTY, ILLINOIS |
| 528 | | FULTON COUNTY, ILLINOIS |
| 529 | | FULTON COUNTY, ILLINOIS |
| 530 | | FULTON COUNTY, ILLINOIS |
| 531 | | FULTON COUNTY, ILLINOIS |
| 532 | | FULTON COUNTY, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 495 | 0 | GRAIN | 0 | STOVER | |
| 496 | 0 | GRAIN | 0 | STOVER | |
| 497 | 0 | GRAIN | 0 | STOVER | |
| 498 | 0 | GRAIN | 0 | STOVER | |
| 499 | 0 | GRAIN | 0 | STOVER | |
| 500 | 0 | GRAIN | 0 | STOVER | |
| 501 | 0 | GRAIN | 0 | STOVER | |
| 502 | 0 | GRAIN | 0 | STOVER | |
| 503 | 0 | GRAIN | 0 | STOVER | |
| 504 | 0 | GRAIN | 0 | STOVER | |
| 505 | 0 | GRAIN | 0 | STOVER | |
| 506 | 0 | GRAIN | 0 | STOVER | |
| 507 | 0 | GRAIN | 0 | STOVER | |
| 508 | 0 | GRAIN | 0 | STOVER | |
| 509 | 0 | GRAIN | 0 | STOVER | |
| 510 | 0 | GRAIN | 0 | STOVER | |
| 511 | 0 | GRAIN | 0 | STOVER | |
| 512 | 0 | GRAIN | 0 | STOVER | |
| 513 | 0 | GRAIN | 0 | STOVER | |
| 514 | 0 | GRAIN | 0 | STOVER | |
| 515 | 0 | GRAIN | 0 | STOVER | |
| 516 | 0 | GRAIN | 0 | STOVER | |
| 517 | 0 | GRAIN | 0 | STOVER | |
| 518 | 0 | GRAIN | 0 | STOVER | |
| 519 | 0 | GRAIN | 0 | STOVER | |
| 520 | 0 | GRAIN | 0 | STOVER | |
| 521 | 29.5 | GRAIN | 0 | STOVER | |
| 522 | NA | GRAIN | NA | STOVER | |
| 523 | 0 | GRAIN | 0 | STOVER | |
| 524 | 0 | GRAIN | 0 | STOVER | |
| 525 | 0 | GRAIN | 0 | STOVER | |
| 526 | 0 | GRAIN | 0 | STOVER | |
| 527 | 0 | GRAIN | 0 | STOVER | |
| 528 | 0 | GRAIN | 0 | STOVER | |
| 529 | 0 | GRAIN | 0 | STOVER | |
| 530 | 0 | GRAIN | 0 | STOVER | |
| 531 | 0 | GRAIN | 0 | STOVER | |
| 532 | 21.5 | GRAIN | 0 | STOVER | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 495 | 12.6 | 0.33 | 7.8 | 0.8 | 0.1 M HCl | 3.9 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 496 | 12.6 | 0.27 | 7.8 | 5.1 | 0.1 M HCl | 5.4 | 0.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 497 | 12.6 | 0.41 | 7.8 | 11 | 0.1 M HCl | 5.7 | 0.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 498 | 12.6 | 0.41 | 7.8 | 18 | 0.1 M HCl | 7.5 | 0.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 499 | 12.6 | 0.59 | 7.8 | 28 | 0.1 M HCl | 5.3 | 0.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 500 | 12.6 | 0.35 | 7.8 | 1.6 | 0.1 M HCl | 5.4 | 2.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 501 | 12.6 | 0.3 | 7.8 | 10.2 | 0.1 M HCl | 5.7 | 0.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 502 | 12.6 | 0.3 | 7.8 | 22 | 0.1 M HCl | 8.3 | 0.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 503 | 12.6 | 0.5 | 7.8 | 36 | 0.1 M HCl | 8.9 | 0.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 504 | 12.6 | 0.5 | 7.8 | 56 | 0.1 M HCl | 7.1 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 505 | 12.6 | 0.33 | 7.8 | 3.2 | 0.1 M HCl | 4.8 | 1.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 506 | 12.6 | 0.33 | 7.8 | 20.4 | 0.1 M HCl | 6 | 0.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 507 | 12.6 | 0.76 | 7.8 | 44 | 0.1 M HCl | 11.3 | 0.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 508 | 12.6 | 0.76 | 7.8 | 72 | 0.1 M HCl | 10.8 | 1.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 509 | 12.6 | 1.22 | 7.8 | 112 | 0.1 M HCl | 13.2 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 510 | | 0.33 | 7.5 | 0 | 0.1 M HCl | 7.9 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 511 | | 0.44 | 7.5 | 0 | 0.1 M HCl | 6 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 512 | | 0.44 | 7.5 | 0 | 0.1 M HCl | 7 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 513 | | 0.36 | 7.5 | 0 | 0.1 M HCl | 7.7 | 2.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 514 | | 0.36 | 7.5 | 0 | 0.1 M HCl | 9.1 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 515 | | 0.46 | 7.5 | 0 | 0.1 M HCl | 7.6 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 516 | | 0.46 | 7.5 | 0 | 0.1 M HCl | 7.7 | 6 | LEAF | FIELD, SLUDGE, MATURITY |
| 517 | | 0.73 | 7.5 | 0 | 0.1 M HCl | 7.9 | 1.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 518 | | 0.73 | 7.5 | 0 | 0.1 M HCl | 9.4 | 1.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 519 | | 0.7 | 7.5 | 0 | 0.1 M HCl | 7.7 | 1.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 520 | | 0.7 | 7.5 | 0 | 0.1 M HCl | 9.8 | 1.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 521 | | 0.59 | 7.5 | 37 | 0.1 M HCl | 11.3 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 522 | | 0.94 | 7.5 | 42 | 0.1 M HCl | 11.2 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 523 | | 0.94 | 7.5 | 50 | 0.1 M HCl | 15.8 | 0.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 524 | | 0.67 | 7.5 | 55 | 0.1 M HCl | 13.3 | 3.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 525 | | 0.67 | 7.5 | 63 | 0.1 M HCl | 9.6 | 1.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 526 | | 0.87 | 7.5 | 70 | 0.1 M HCl | 15.2 | 2.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 527 | | 0.87 | 7.5 | 77 | 0.1 M HCl | 12.9 | 5.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 528 | | 1.41 | 7.5 | 81 | 0.1 M HCl | 12.7 | 1.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 529 | | 1.41 | 7.5 | 85 | 0.1 M HCl | 18.5 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 530 | | 1.25 | 7.5 | 90 | 0.1 M HCl | 18.4 | 0.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 531 | | 1.25 | 7.5 | 93 | 0.1 M HCl | 18.2 | 0.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 532 | | 0.94 | 7.5 | 74 | 0.1 M HCl | 14.4 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 495 | 3 | 3 | | STRIP MINE SPOIL | | | | | |
| 496 | 12.8 | 15.8 | 0 | STRIP MINE SPOIL | | | | | |
| 497 | 12.4 | 28.1 | 0 | STRIP MINE SPOIL | | | | | |
| 498 | 14.3 | 42.4 | 0 | STRIP MINE SPOIL | | | | | |
| 499 | 19.5 | 61.9 | 0 | STRIP MINE SPOIL | | | | | |
| 500 | 6 | 6 | 0 | STRIP MINE SPOIL | | | | | |
| 501 | 25.5 | 31.5 | 0 | STRIP MINE SPOIL | | | | | |
| 502 | 29.8 | 61.3 | 0 | STRIP MINE SPOIL | | | | | |
| 503 | 28.6 | 89.9 | 0 | STRIP MINE SPOIL | | | | | |
| 504 | 39 | 128.9 | 0 | STRIP MINE SPOIL | | | | | |
| 505 | 11.9 | 11.9 | 0 | STRIP MINE SPOIL | | | | | |
| 506 | 51 | 62.9 | 0 | STRIP MINE SPOIL | | | | | |
| 507 | 59.6 | 122.5 | 0 | STRIP MINE SPOIL | | | | | |
| 508 | 57.1 | 179.6 | 0 | STRIP MINE SPOIL | | | | | |
| 509 | 78 | 257.6 | 0 | STRIP MINE SPOIL | | | | | |
| 510 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 511 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 512 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 513 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 514 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 515 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 516 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 517 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 518 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 519 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 520 | 0 | 0 | 0 | STRIP MINE SPOIL | | | | | |
| 521 | 16.1 | 78 | 0 | STRIP MINE SPOIL | | | | | |
| 522 | 19.9 | 97.9 | 0 | STRIP MINE SPOIL | | | | | |
| 523 | 17.4 | 115.3 | 0 | STRIP MINE SPOIL | | | | | |
| 524 | 11.4 | 126.7 | 0 | STRIP MINE SPOIL | | | | | |
| 525 | 16.8 | 143.5 | 0 | STRIP MINE SPOIL | | | | | |
| 526 | 17.9 | 161.4 | 0 | STRIP MINE SPOIL | | | | | |
| 527 | 16.8 | 178.2 | 0 | STRIP MINE SPOIL | | | | | |
| 528 | 16.8 | 195 | 0 | STRIP MINE SPOIL | | | | | |
| 529 | 16.8 | 211.8 | 0 | STRIP MINE SPOIL | | | | | |
| 530 | 16.8 | 228.6 | 0 | STRIP MINE SPOIL | | | | | |
| 531 | 16.8 | 245.4 | 0 | STRIP MINE SPOIL | | | | | |
| 532 | 32.2 | 161.1 | 0 | STRIP MINE SPOIL | | | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 495 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 496 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 497 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 498 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 499 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 500 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 501 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 502 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 503 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 504 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 505 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 506 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 507 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 508 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 509 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 510 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 511 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 512 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 513 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 514 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 515 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 516 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 517 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 518 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 519 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 520 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 521 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 522 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 523 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 524 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 525 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 526 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 527 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 528 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 529 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 530 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 531 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 532 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 495 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 496 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 497 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 498 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 499 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 500 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 501 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 502 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 503 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 504 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 505 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 506 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 507 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 508 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 509 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |
| 510 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 511 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 512 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 513 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 514 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 515 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 516 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 517 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 518 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 519 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 520 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 521 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 522 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 523 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 524 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 525 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |
| 526 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 527 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 | 3505 | 1471 |
| 528 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 529 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 | 775 | 460 |
| 530 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 | 775 | 460 |
| 531 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 | 679 | 454 |
| 532 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 | 3505 | 1471 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 457 | | WOODTHORNE, U.K. |
| 458 | | WOODTHORNE, U.K. |
| 459 | | WOODTHORNE, U.K. |
| 460 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 461 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 462 | | WOODTHORNE, U.K. |
| 463 | | WOODTHORNE, U.K. |
| 464 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 465 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 466 | | MINNESOTA |
| 467 | | MINNESOTA |
| 468 | | MINNESOTA |
| 469 | | MINNESOTA |
| 470 | | MINNESOTA |
| 471 | | MINNESOTA |
| 472 | | MINNESOTA |
| 473 | | MINNESOTA |
| 474 | | MINNESOTA |
| 475 | | MINNESOTA |
| 476 | | LEEDS, U.K. |
| 477 | | LEEDS, U.K. |
| 478 | HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS USED | LEEDS, U.K. |
| 479 | HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS USED | LEEDS, U.K. |
| 480 | | LEEDS, U.K. |
| 481 | | LEEDS, U.K. |
| 482 | | LEEDS, U.K. |
| 483 | | LEEDS, U.K. |
| 484 | | LEEDS, U.K. |
| 485 | HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS U | LEEDS, U.K. |
| 486 | | LEEDS, U.K. |
| 487 | | LEEDS, U.K. |
| 488 | | |
| 489 | | |
| 490 | | FULTON COUNTY, ILLINOIS |
| 491 | | FULTON COUNTY, ILLINOIS |
| 492 | | FULTON COUNTY, ILLINOIS |
| 493 | | FULTON COUNTY, ILLINOIS |
| 494 | | FULTON COUNTY, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| | | | | | |
| 457 | 0 | BULB | | | NO |
| 458 | 0 | LEAF | | | NO |
| 459 | 0 | LEAF | | | NO |
| 460 | 30 | LEAF | | | POSSIBLE |
| 461 | 96.3 | LEAF | | | POSSIBLE |
| 462 | 0 | LEAF | | | NO |
| 463 | 0 | LEAF | | | NO |
| 464 | 23.7 | LEAF | | | POSSIBLE |
| 465 | 28.4 | LEAF | | | POSSIBLE |
| 466 | 0 | GRAIN | | | |
| 467 | 0 | GRAIN | | | |
| 468 | 0 | GRAIN | | | |
| 469 | 0 | GRAIN | | | |
| 470 | 0 | GRAIN | | | |
| 471 | 0 | GRAIN | | | |
| 472 | 0 | GRAIN | | | |
| 473 | 0 | GRAIN | | | |
| 474 | 0 | GRAIN | | | |
| 475 | 0 | GRAIN | | | |
| 476 | 0 | TOTAL BIOMASS | | | NO |
| 477 | 0 | TOTAL BIOMASS | | | NO |
| 478 | 48 | TOTAL BIOMASS | | | POSSIBLE |
| 479 | 100 | TOTAL BIOMASS | | | POSSIBLE |
| 480 | 0 | TOTAL BIOMASS | | | NO |
| 481 | 0 | TOTAL BIOMASS | | | NO |
| 482 | 0 | STALKS | | | NO |
| 483 | 0 | STALKS | | | NO |
| 484 | 0 | STALKS | | | NO |
| 485 | 70 | STALKS | | | POSSIBLE |
| 486 | 0 | STALKS | | | NO |
| 487 | 0 | STALKS | | | NO |
| 488 | | | | | |
| 489 | | | | | |
| 490 | 0 | GRAIN | 0 | STOVER | |
| 491 | 0 | GRAIN | 0 | STOVER | |
| 492 | 0 | GRAIN | 0 | STOVER | |
| 493 | 0 | GRAIN | 0 | STOVER | |
| 494 | 0 | GRAIN | 0 | STOVER | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 457 | | 1.2 | 7.2 | 1140 | .5 M HOAC | 68 | NL | | SLUDGE, FIELD, MATURITY |
| 458 | | 1.2 | 6.5 | 0 | .5 M HOAC | 4 | NL | | SLUDGE, FIELD, MATURITY |
| 459 | | 1.2 | 6.5 | 285 | .5 M HOAC | 36 | NL | | SLUDGE, FIELD, MATURITY |
| 460 | | 1.2 | 6.5 | 570 | .5 M HOAC | 55 | NL | | SLUDGE, FIELD, MATURITY |
| 461 | | 1.2 | 6.5 | 1140 | .5 M HOAC | 101 | NL | | SLUDGE, FIELD, MATURITY |
| 462 | | 1.2 | 7 | 0 | .5 M HOAC | 4 | NL | | SLUDGE, FIELD, MATURITY |
| 463 | | 1.2 | 7 | 285 | .5 M HOAC | 36 | NL | | SLUDGE, FIELD, MATURITY |
| 464 | | 1.2 | 7 | 570 | .5 M HOAC | 55 | NL | | SLUDGE, FIELD, MATURITY |
| 465 | | 1.2 | 7 | 1140 | .5 M HOAC | 101 | NL | | SLUDGE, FIELD, MATURITY |
| 466 | | | 6.5 | 0 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 467 | | | 6.5 | 11 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 468 | | | 6.5 | 22 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 469 | | | 6.5 | 44 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 470 | | | 6.5 | 88 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 471 | | | 6.5 | 0 | | N.L. | 10 | LEAF | SLUDGE, FIELD, MATURITY |
| 472 | | | 6.5 | 11 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 473 | | | 6.5 | 22 | | N.L. | 13 | LEAF | SLUDGE, FIELD, MATURITY |
| 474 | | | 6.5 | 44 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 475 | | | 6.5 | 88 | | N.L. | NR | LEAF | SLUDGE, FIELD, MATURITY |
| 476 | | | 6.1 | 0 | .5 M HOAC | 2.1 | | | SLUDGE, FIELD, MATURITY |
| 477 | | | NR | 26 | .5 M HOAC | 7 | | | SLUDGE, FIELD, MATURITY |
| 478 | | | NR | 251 | .5 M HOAC | 57 | | | SLUDGE, FIELD, MATURITY |
| 479 | | | NR | 502 | .5 M HOAC | 91 | | | SLUDGE, FIELD, MATURITY |
| 480 | | | NR | 20 | .5 M HOAC | 6.2 | | | SLUDGE, FIELD, MATURITY |
| 481 | | | NR | 31.4 | .5 M HOAC | 21 | | | SLUDGE, FIELD, MATURITY |
| 482 | | | 6.1 | 0 | .5 M HOAC | 2.1 | | | SLUDGE, FIELD, MATURITY |
| 483 | | | NR | 26 | .5 M HOAC | 7 | | | SLUDGE, FIELD, MATURITY |
| 484 | | | NR | 251 | .5 M HOAC | 57 | | | SLUDGE, FIELD, MATURITY |
| 485 | | | NR | 502 | .5 M HOAC | 91 | | | SLUDGE, FIELD, MATURITY |
| 486 | | | NR | 20 | .5 M HOAC | 6.2 | | | SLUDGE, FIELD, MATURITY |
| 487 | | | NR | 31.4 | .5 M HOAC | 21 | | | SLUDGE, FIELD, MATURITY |
| 488 | | | | | | | | | |
| 489 | | | | | | | | | |
| 490 | 12.6 | 0.25 | 7.8 | 0 | 0.1 M HCl | 4.4 | 2.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 491 | 12.6 | 0.25 | 7.8 | 0 | 0.1 M HCl | 5.4 | 0.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 492 | 12.6 | 0.33 | 7.8 | 0 | 0.1 M HCl | 4.4 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 493 | 12.6 | 0.33 | 7.8 | 0 | 0.1 M HCl | 5.7 | 0.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 494 | 12.6 | 0.33 | 7.8 | 0 | 0.1 M HCl | 2.5 | 0.5 | LEAF | FIELD, SLUDGE, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 457 | 224 | 224 | 11 | | | LS | | | |
| 458 | 0 | 0 | 12 | | | LS | | | |
| 459 | 56 | 56 | 12 | | | LS | | | |
| 460 | 112 | 112 | 12 | | | LS | | | |
| 461 | 224 | 224 | 12 | | | LS | | | |
| 462 | 0 | 0 | 12 | | | LS | | | |
| 463 | 56 | 56 | 12 | | | LS | | | |
| 464 | 112 | 112 | 12 | | | LS | | | |
| 465 | 224 | 224 | 12 | | | LS | | | |
| 466 | 0 | 0 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 467 | 25 | 25 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 468 | 50 | 50 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 469 | 100 | 100 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 470 | 200 | 200 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 471 | 0 | 0 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 472 | 25 | 25 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 473 | 50 | 50 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 474 | 100 | 100 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 475 | 200 | 200 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SiL | | | |
| 476 | 0 | 0 | 0 | | | | | | |
| 477 | 125.5 | 125.5 | 2 | | | | | | |
| 478 | 125.5 | 125.5 | 2 | | | | | | |
| 479 | 125.5 | 125.5 | 2 | | | | | | |
| 480 | 31.4 | 94.2 | 0 | | | | | | |
| 481 | 31.4 | 94.2 | 0 | | | | | | |
| 482 | 0 | 0 | 0 | | | | | | |
| 483 | 125.5 | 125.5 | 2 | | | | | | |
| 484 | 125.5 | 125.5 | 2 | | | | | | |
| 485 | 125.5 | 125.5 | 2 | | | | | | |
| 486 | 31.4 | 94.2 | 0 | | | | | | |
| 487 | 31.4 | 94.2 | 0 | | | | | | |
| 488 | | | | | | | | | |
| 489 | | | | | | | | | |
| 490 | 0 | 0 | | STRIP MINE SPOIL | | | | | |
| 491 | 0 | 0 | | STRIP MINE SPOIL | | | | | |
| 492 | 0 | 0 | | STRIP MINE SPOIL | | | | | |
| 493 | 0 | 0 | | STRIP MINE SPOIL | | | | | |
| 494 | 0 | 0 | | STRIP MINE SPOIL | | | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 457 | | | 5100 | | | 11400 | AIR DRIED | | |
| 458 | | | 5100 | | | 11400 | AIR DRIED | | |
| 459 | | | 5100 | | | 11400 | AIR DRIED | | |
| 460 | | | 5100 | | | 11400 | AIR DRIED | | |
| 461 | | | 5100 | | | 11400 | AIR DRIED | | |
| 462 | | | 5100 | | | 11400 | AIR DRIED | | |
| 463 | | | 5100 | | | 11400 | AIR DRIED | | |
| 464 | | | 5100 | | | 11400 | AIR DRIED | | |
| 465 | | | 5100 | | | 11400 | AIR DRIED | | |
| 466 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 467 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 468 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 469 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 470 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 471 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 472 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 473 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 474 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 475 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED | |
| 476 | | | | | | | | | |
| 477 | | | 210 | | | 3000 | | | |
| 478 | | | 3900 | | | 5100 | | | |
| 479 | | | 3900 | | | 5100 | | | |
| 480 | | | 210 | | | 3000 | | | |
| 481 | | | 3900 | | | 5100 | | | |
| 482 | | | | | | | | | |
| 483 | | | 210 | | | 3000 | | | |
| 484 | | | 3900 | | | 5100 | | | |
| 485 | | | 3900 | | | 5100 | | | |
| 486 | | | 210 | | | 3000 | | | |
| 487 | | | 3900 | | | 5100 | | | |
| 488 | | | | | | | | | |
| 489 | | | | | | | | | |
| 490 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 491 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 492 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 493 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |
| 494 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON | POLYMER,FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 457 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 458 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 459 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 460 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 461 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 462 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 463 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 464 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 465 | WILLIAMS 1977 | LETTUCE | | | | | | | | 100 |
| 466 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 467 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 468 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 469 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 470 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 471 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 472 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 473 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 474 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 475 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 | 1100 | 2020 |
| 476 | WEBBER 1972 | RED BEET | | | | | | | | |
| 477 | WEBBER 1972 | RED BEET | | | | | | | 240 | 1100 |
| 478 | WEBBER 1972 | RED BEET | | | | | | | 200 | 670 |
| 479 | WEBBER 1972 | RED BEET | | | | | | | 200 | 670 |
| 480 | WEBBER 1972 | RED BEET | | | | | | | 240 | 1100 |
| 481 | WEBBER 1972 | RED BEET | | | | | | | 200 | 670 |
| 482 | WEBBER 1972 | CELERY | | | | | | | | |
| 483 | WEBBER 1972 | CELERY | | | | | | | 240 | 1100 |
| 484 | WEBBER 1972 | CELERY | | | | | | | 200 | 670 |
| 485 | WEBBER 1972 | CELERY | | | | | | | 200 | 670 |
| 486 | WEBBER 1972 | CELERY | | | | | | | 240 | 1100 |
| 487 | WEBBER 1972 | CELERY | | | | | | | 200 | 670 |
| 488 | WEBBER 1972 | CELERY | | | | | | | | |
| 489 | WEBBER 1972 | CELERY | | | | | | | | |
| 490 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 491 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 | 3505 | 1471 |
| 492 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 | 3505 | 1471 |
| 493 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 | 3505 | 1471 |
| 494 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 | 3505 | 1471 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 419 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 420 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 421 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 422 | | WOODTHORNE, U.K. |
| 423 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 424 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 425 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 426 | | WOODTHORNE, U.K. |
| 427 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 428 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 429 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 430 | | WOODTHORNE, U.K. |
| 431 | | WOODTHORNE, U.K. |
| 432 | | WOODTHORNE, U.K. |
| 433 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 434 | | WOODTHORNE, U.K. |
| 435 | | WOODTHORNE, U.K. |
| 436 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 437 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 438 | | WOODTHORNE, U.K. |
| 439 | | WOODTHORNE, U.K. |
| 440 | | WOODTHORNE, U.K. |
| 441 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 442 | | WOODTHORNE, U.K. |
| 443 | | WOODTHORNE, U.K. |
| 444 | | WOODTHORNE, U.K. |
| 445 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 446 | | WOODTHORNE, U.K. |
| 447 | | WOODTHORNE, U.K. |
| 448 | | WOODTHORNE, U.K. |
| 449 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 450 | | WOODTHORNE, U.K. |
| 451 | | WOODTHORNE, U.K. |
| 452 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 453 | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) | WOODTHORNE, U.K. |
| 454 | | WOODTHORNE, U.K. |
| 455 | | WOODTHORNE, U.K. |
| 456 | | WOODTHORNE, U.K. |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 419 | 94.5 | ROOT | | | POSSIBLE |
| 420 | 99.3 | ROOT | | | POSSIBLE |
| 421 | 100 | ROOT | | | POSSIBLE |
| 422 | 0 | ROOT | | | NO |
| 423 | 36 | ROOT | | | POSSIBLE |
| 424 | 69.4 | ROOT | | | POSSIBLE |
| 425 | 93.2 | ROOT | | | POSSIBLE |
| 426 | 0 | ROOT TUBER | | | NO |
| 427 | 86.1 | ROOT TUBER | | | POSSIBLE |
| 428 | 92.9 | ROOT TUBER | | | POSSIBLE |
| 429 | 96.7 | ROOT TUBER | | | POSSIBLE |
| 430 | 0 | ROOT TUBER | | | NO |
| 431 | 0 | ROOT TUBER | | | NO |
| 432 | 0 | ROOT TUBER | | | NO |
| 433 | 52.8 | ROOT TUBER | | | POSSIBLE |
| 434 | 0 | BULB | | | NO |
| 435 | 0 | BULB | | | NO |
| 436 | 77.6 | BULB | | | POSSIBLE |
| 437 | 93.9 | BULB | | | POSSIBLE |
| 438 | 0 | BULB | | | NO |
| 439 | 0 | BULB | | | NO |
| 440 | 0 | BULB | | | NO |
| 441 | 38.1 | BULB | | | POSSIBLE |
| 442 | 0 | BULB | | | NO |
| 443 | 0 | BULB | | | NO |
| 444 | 0 | BULB | | | NO |
| 445 | 99 | BULB | | | POSSIBLE |
| 446 | 0 | BULB | | | NO |
| 447 | 0 | BULB | | | NO |
| 448 | 0 | BULB | | | NO |
| 449 | 36.4 | BULB | | | POSSIBLE |
| 450 | 0 | BULB | | | NO |
| 451 | 0 | BULB | | | NO |
| 452 | 70.3 | BULB | | | POSSIBLE |
| 453 | 100 | BULB | | | POSSIBLE |
| 454 | 0 | BULB | | | NO |
| 455 | 0 | BULB | | | NO |
| 456 | 0 | BULB | | | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 419 | | 1.2 | 5.8 | 285 | .5 M HOAC | 29 | N.L. | | SLUDGE, FIELD, MATURITY |
| 420 | | 1.2 | 5.8 | 570 | .5 M HOAC | 50 | N.L. | | SLUDGE, FIELD, MATURITY |
| 421 | | 1.2 | 5.8 | 1140 | .5 M HOAC | 85 | N.L. | | SLUDGE, FIELD, MATURITY |
| 422 | | 1.2 | 6.6 | 0 | .5 M HOAC | 2 | N.L. | | SLUDGE, FIELD, MATURITY |
| 423 | | 1.2 | 6.6 | 285 | .5 M HOAC | 29 | N.L. | | SLUDGE, FIELD, MATURITY |
| 424 | | 1.2 | 6.6 | 570 | .5 M HOAC | 50 | N.L. | | SLUDGE, FIELD, MATURITY |
| 425 | | 1.2 | 6.6 | 1140 | .5 M HOAC | 85 | N.L. | | SLUDGE, FIELD, MATURITY |
| 426 | | 1.2 | 6.2 | 0 | .5 M HOAC | NL | 2.5 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 427 | | 1.2 | 6.2 | 285 | .5 M HOAC | NL | 2.5 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 428 | | 1.2 | 6.2 | 570 | .5 M HOAC | NL | 3.8 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 429 | | 1.2 | 6.2 | 1140 | .5 M HOAC | NL | 6.3 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 430 | | 1.2 | 7 | 0 | .5 M HOAC | NL | 1.3 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 431 | | 1.2 | 7 | 285 | .5 M HOAC | NL | 2.5 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 432 | | 1.2 | 7 | 570 | .5 M HOAC | NL | 6.3 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 433 | | 1.2 | 7 | 1140 | .5 M HOAC | NL | 5 | ROOT TUBER | SLUDGE, FIELD, MATURITY |
| 434 | | 1.2 | 6.2 | 0 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 435 | | 1.2 | 6.2 | 285 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 436 | | 1.2 | 6.2 | 570 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 437 | | 1.2 | 6.2 | 1140 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 438 | | 1.2 | 7 | 0 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 439 | | 1.2 | 7 | 285 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 440 | | 1.2 | 7 | 570 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 441 | | 1.2 | 7 | 1140 | | NL | NL | | SLUDGE, FIELD, MATURITY |
| 442 | | 1.2 | 6.3 | 0 | | NL | 6.3 | BULB | SLUDGE, FIELD, MATURITY |
| 443 | | 1.2 | 6.3 | 285 | | NL | 16.3 | BULB | SLUDGE, FIELD, MATURITY |
| 444 | | 1.2 | 6.3 | 570 | | NL | 23.8 | BULB | SLUDGE, FIELD, MATURITY |
| 445 | | 1.2 | 6.3 | 1140 | | NL | NL | BULB | SLUDGE, FIELD, MATURITY |
| 446 | | 1.2 | 6.8 | 0 | | NL | 2.5 | BULB | SLUDGE, FIELD, MATURITY |
| 447 | | 1.2 | 6.8 | 285 | | NL | 6.3 | BULB | SLUDGE, FIELD, MATURITY |
| 448 | | 1.2 | 6.8 | 570 | | NL | 7.5 | BULB | SLUDGE, FIELD, MATURITY |
| 449 | | 1.2 | 6.8 | 1140 | | NL | 18.8 | BULB | SLUDGE, FIELD, MATURITY |
| 450 | | 1.2 | 6.7 | 0 | .5 M HOAC | 4 | NL | | SLUDGE, FIELD, MATURITY |
| 451 | | 1.2 | 6.7 | 285 | .5 M HOAC | 23 | NL | | SLUDGE, FIELD, MATURITY |
| 452 | | 1.2 | 6.7 | 570 | .5 M HOAC | 42 | NL | | SLUDGE, FIELD, MATURITY |
| 453 | | 1.2 | 6.7 | 1140 | .5 M HOAC | 68 | NL | | SLUDGE, FIELD, MATURITY |
| 454 | | 1.2 | 7.2 | 0 | .5 M HOAC | 4 | NL | | SLUDGE, FIELD, MATURITY |
| 455 | | 1.2 | 7.2 | 285 | .5 M HOAC | 23 | NL | | SLUDGE, FIELD, MATURITY |
| 456 | | 1.2 | 7.2 | 570 | .5 M HOAC | 42 | NL | | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 419 | 56 | 56 | 8 | | | LS | | | |
| 420 | 112 | 112 | 8 | | | LS | | | |
| 421 | 224 | 224 | 8 | | | LS | | | |
| 422 | 0 | 0 | 8 | | | LS | | | |
| 423 | 56 | 56 | 8 | | | LS | | | |
| 424 | 112 | 112 | 8 | | | LS | | | |
| 425 | 224 | 224 | 8 | | | LS | | | |
| 426 | 0 | 0 | 9 | | | LS | | | |
| 427 | 56 | 56 | 9 | | | LS | | | |
| 428 | 112 | 112 | 9 | | | LS | | | |
| 429 | 224 | 224 | 9 | | | LS | | | |
| 430 | 0 | 0 | 9 | | | LS | | | |
| 431 | 56 | 56 | 9 | | | LS | | | |
| 432 | 112 | 112 | 9 | | | LS | | | |
| 433 | 224 | 224 | 9 | | | LS | | | |
| 434 | 0 | 0 | 10 | | | LS | | | |
| 435 | 56 | 56 | 10 | | | LS | | | |
| 436 | 112 | 112 | 10 | | | LS | | | |
| 437 | 224 | 224 | 10 | | | LS | | | |
| 438 | 0 | 0 | 10 | | | LS | | | |
| 439 | 56 | 56 | 10 | | | LS | | | |
| 440 | 112 | 112 | 10 | | | LS | | | |
| 441 | 224 | 224 | 10 | | | LS | | | |
| 442 | 0 | 0 | 13 | | | LS | | | |
| 443 | 56 | 56 | 13 | | | LS | | | |
| 444 | 112 | 112 | 13 | | | LS | | | |
| 445 | 224 | 224 | 13 | | | LS | | | |
| 446 | 0 | 0 | 13 | | | LS | | | |
| 447 | 56 | 56 | 13 | | | LS | | | |
| 448 | 112 | 112 | 13 | | | LS | | | |
| 449 | 224 | 224 | 13 | | | LS | | | |
| 450 | 0 | 0 | 11 | | | LS | | | |
| 451 | 56 | 56 | 11 | | | LS | | | |
| 452 | 112 | 112 | 11 | | | LS | | | |
| 453 | 224 | 224 | 11 | | | LS | | | |
| 454 | 0 | 0 | 11 | | | LS | | | |
| 455 | 56 | 56 | 11 | | | LS | | | |
| 456 | 112 | 112 | 11 | | | LS | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 419 | | | 5100 | | | 11400 | AIR DRIED | | |
| 420 | | | 5100 | | | 11400 | AIR DRIED | | |
| 421 | | | 5100 | | | 11400 | AIR DRIED | | |
| 422 | | | 5100 | | | 11400 | AIR DRIED | | |
| 423 | | | 5100 | | | 11400 | AIR DRIED | | |
| 424 | | | 5100 | | | 11400 | AIR DRIED | | |
| 425 | | | 5100 | | | 11400 | AIR DRIED | | |
| 426 | | | 5100 | | | 11400 | AIR DRIED | | |
| 427 | | | 5100 | | | 11400 | AIR DRIED | | |
| 428 | | | 5100 | | | 11400 | AIR DRIED | | |
| 429 | | | 5100 | | | 11400 | AIR DRIED | | |
| 430 | | | 5100 | | | 11400 | AIR DRIED | | |
| 431 | | | 5100 | | | 11400 | AIR DRIED | | |
| 432 | | | 5100 | | | 11400 | AIR DRIED | | |
| 433 | | | 5100 | | | 11400 | AIR DRIED | | |
| 434 | | | 5100 | | | 11400 | AIR DRIED | | |
| 435 | | | 5100 | | | 11400 | AIR DRIED | | |
| 436 | | | 5100 | | | 11400 | AIR DRIED | | |
| 437 | | | 5100 | | | 11400 | AIR DRIED | | |
| 438 | | | 5100 | | | 11400 | AIR DRIED | | |
| 439 | | | 5100 | | | 11400 | AIR DRIED | | |
| 440 | | | 5100 | | | 11400 | AIR DRIED | | |
| 441 | | | 5100 | | | 11400 | AIR DRIED | | |
| 442 | | | 5100 | | | 11400 | AIR DRIED | | |
| 443 | | | 5100 | | | 11400 | AIR DRIED | | |
| 444 | | | 5100 | | | 11400 | AIR DRIED | | |
| 445 | | | 5100 | | | 11400 | AIR DRIED | | |
| 446 | | | 5100 | | | 11400 | AIR DRIED | | |
| 447 | | | 5100 | | | 11400 | AIR DRIED | | |
| 448 | | | 5100 | | | 11400 | AIR DRIED | | |
| 449 | | | 5100 | | | 11400 | AIR DRIED | | |
| 450 | | | 5100 | | | 11400 | AIR DRIED | | |
| 451 | | | 5100 | | | 11400 | AIR DRIED | | |
| 452 | | | 5100 | | | 11400 | AIR DRIED | | |
| 453 | | | 5100 | | | 11400 | AIR DRIED | | |
| 454 | | | 5100 | | | 11400 | AIR DRIED | | |
| 455 | | | 5100 | | | 11400 | AIR DRIED | | |
| 456 | | | 5100 | | | 11400 | AIR DRIED | | |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 419 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 420 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 421 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 422 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 423 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 424 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 425 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |
| 426 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 427 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 428 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 429 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 430 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 431 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 432 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 433 | WILLIAMS 1977 | BEET | | | | | | | | 100 |
| 434 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 435 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 436 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 437 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 438 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 439 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 440 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 441 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 442 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 443 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 444 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 445 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 446 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 447 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 448 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 449 | WILLIAMS 1977 | ONION | | | | | | | | 100 |
| 450 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 451 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 452 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 453 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 454 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 455 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |
| 456 | WILLIAMS 1977 | SWEDE | | | | | | | | 100 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 381 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 382 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 383 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 384 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 385 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 386 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 387 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 388 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 389 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 390 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 391 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 392 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 393 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 394 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 395 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 396 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 397 | | Virginia |
| 398 | | Virginia |
| 399 | | Virginia |
| 400 | | Virginia |
| 401 | | Virginia |
| 402 | | Virginia |
| 403 | | Virginia |
| 404 | | Virginia |
| 405 | | Virginia |
| 406 | | Virginia |
| 407 | | Virginia |
| 408 | | Virginia |
| 409 | | Virginia |
| 410 | | Virginia |
| 411 | | Virginia |
| 412 | | Virginia |
| 413 | | Virginia |
| 414 | | Virginia |
| 415 | | Atlantic Coastal Plain |
| 416 | | Atlantic Coastal Plain |
| 417 | | Atlantic Coastal Plain |
| 418 | | WOODTHORNE, U.K. |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| | | | | | |
| 381 | | | | | |
| 382 | | | | | |
| 383 | | | | | |
| 384 | | | | | |
| 385 | | | | | |
| 386 | | | | | |
| 387 | | | | | |
| 388 | | | | | |
| 389 | | | | | |
| 390 | | | | | |
| 391 | | | | | |
| 392 | | | | | |
| 393 | | | | | |
| 394 | | | | | |
| 395 | | | | | |
| 396 | | | | | |
| 397 | | | | | |
| 398 | | | | | |
| 399 | | | | | |
| 400 | | | | | |
| 401 | | | | | |
| 402 | | | | | |
| 403 | | | | | |
| 404 | | | | | |
| 405 | | | | | |
| 406 | | | | | |
| 407 | | | | | |
| 408 | | | | | |
| 409 | | | | | |
| 410 | | | | | |
| 411 | | | | | |
| 412 | | | | | |
| 413 | | | | | |
| 414 | | | | | |
| 415 | 0 | Stover | | | |
| 416 | 39 | Stover | | | |
| 417 | 29 | Stover | | | |
| 418 | 0 | ROOT | | | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 381 | | 2.8 | 5.6 | 33 | DTPA | 1.8 | 6.2 | Leaf | SLUDGE, FIELD, MATURITY |
| 382 | | 2.8 | 5.6 | 0 | DTPA | 0.9 | 5.6 | Leaf | SLUDGE, FIELD, MATURITY |
| 383 | | 2.8 | 5.6 | 11 | DTPA | 2.1 | 7.6 | Leaf | SLUDGE, FIELD, MATURITY |
| 384 | | 2.8 | 5.6 | 33 | DTPA | 3.2 | 9.6 | Leaf | SLUDGE, FIELD, MATURITY |
| 385 | | 2.8 | 5.6 | 0 | DTPA | 0.6 | 4 | Leaf | SLUDGE, FIELD, MATURITY |
| 386 | | 2.8 | 5.6 | 11 | DTPA | 1 | 9 | Leaf | SLUDGE, FIELD, MATURITY |
| 387 | | 2.8 | 5.6 | 33 | DTPA | 1.8 | 14 | Leaf | SLUDGE, FIELD, MATURITY |
| 388 | | 2.8 | 5.6 | 0 | DTPA | 0.9 | 20 | Leaf | SLUDGE, FIELD, MATURITY |
| 389 | | 2.8 | 5.6 | 11 | DTPA | 2.1 | 21 | Leaf | SLUDGE, FIELD, MATURITY |
| 390 | | 2.8 | 5.6 | 33 | DTPA | 3.2 | 22 | Leaf | SLUDGE, FIELD, MATURITY |
| 391 | | 2.8 | 5.6 | 0 | DTPA | 0.6 | 5 | Leaf | SLUDGE, FIELD, MATURITY |
| 392 | | 2.8 | 5.6 | 11 | DTPA | 1 | 5 | Leaf | SLUDGE, FIELD, MATURITY |
| 393 | | 2.8 | 5.6 | 33 | DTPA | 1.8 | 7 | Leaf | SLUDGE, FIELD, MATURITY |
| 394 | | 2.8 | 5.6 | 0 | DTPA | 0.9 | 8 | Leaf | SLUDGE, FIELD, MATURITY |
| 395 | | 2.8 | 5.6 | 11 | DTPA | 2.1 | 8 | Leaf | SLUDGE, FIELD, MATURITY |
| 396 | | 2.8 | 5.6 | 33 | DTPA | 3.2 | 11 | Leaf | SLUDGE, FIELD, MATURITY |
| 397 | 5.4 | 16 | 6.1 | 0 | | | 0.54 | Earleaf | |
| 398 | 5.4 | 16 | 6.2 | 8.6 | | | 1.02 | Earleaf | |
| 399 | 5.4 | 16 | 6.1 | 17.2 | | | 0.88 | Earleaf | |
| 400 | 5.4 | 16 | 5.8 | 25.8 | | | 0.94 | Earleaf | |
| 401 | 5.4 | 16 | 6 | 34.4 | | | 0.8 | Earleaf | |
| 402 | 5.4 | 16 | 6 | 43 | | | 0.84 | Earleaf | |
| 403 | 12.5 | 18 | 5.7 | 0 | | | 0.38 | Earleaf | |
| 404 | 12.5 | 18 | 6 | 8.6 | | | 0.41 | Earleaf | |
| 405 | 12.5 | 18 | 5.8 | 17.2 | | | 0.36 | Earleaf | |
| 406 | 12.5 | 18 | 5.9 | 25.8 | | | 0.31 | Earleaf | |
| 407 | 12.5 | 18 | 5.9 | 34.4 | | | 0.2 | Earleaf | |
| 408 | 12.5 | 18 | 5.9 | 43 | | | 0.23 | Earleaf | |
| 409 | 9.3 | 25 | 5.7 | 0 | | | 0.28 | Earleaf | |
| 410 | 9.3 | 25 | 6 | 8.6 | | | 0.39 | Earleaf | |
| 411 | 9.3 | 25 | 5.9 | 17.2 | | | 0.42 | Earleaf | |
| 412 | 9.3 | 25 | 5.9 | 25.8 | | | 0.35 | Earleaf | |
| 413 | 9.3 | 25 | 5.9 | 34.4 | | | 0.36 | Earleaf | |
| 414 | 9.3 | 25 | 5.9 | 43 | | | 0.46 | Earleaf | |
| 415 | 6.9 | 23 | 6.6 | 0 | | | 0.54 | Earleaf | |
| 416 | 6.9 | 23 | 6.6 | 8.6 | | | 0.66 | Earleaf | |
| 417 | 6.9 | 23 | 6.6 | 17.2 | | | 0.66 | Earleaf | |
| 418 | | 1.2 | 5.8 | 0 | .5 M HOAC | 2 | N.L. | | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 381 | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 382 | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 383 | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 384 | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 385 | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 386 | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 387 | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 388 | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 389 | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 390 | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 391 | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 392 | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 393 | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 394 | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 395 | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 396 | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 397 | 0 | 0 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 398 | 42 | 42 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 399 | 84 | 84 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 400 | 126 | 126 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 401 | 168 | 168 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 402 | 210 | 210 | | Typic Hapludult | Bojac | loamy sand | 64 | 27.8 | 8.2 |
| 403 | 0 | 0 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 404 | 42 | 42 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 405 | 84 | 84 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 406 | 126 | 126 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 407 | 168 | 168 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 408 | 210 | 210 | | Rhodic Paleudult | Davidson | clay loam | 15.3 | 47.1 | 37.6 |
| 409 | 0 | 0 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 410 | 42 | 42 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 411 | 84 | 84 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 412 | 126 | 126 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 413 | 168 | 168 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 414 | 210 | 210 | | Typic Hapludult | Groseclose | silt loam | 20.7 | 59.3 | 20 |
| 415 | 0 | 0 | | Typic Ochraqualfs | Acredale | silt loam | 37.8 | 52.3 | 9.9 |
| 416 | 42 | 42 | | Typic Ochraqualfs | Acredale | silt loam | 37.8 | 52.3 | 9.9 |
| 417 | 84 | 84 | | Typic Ochraqualfs | Acredale | silt loam | 37.8 | 52.3 | 9.9 |
| 418 | 0 | 0 | 8 | | | LS | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 381 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 382 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 383 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 384 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 385 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 386 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 387 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 388 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 389 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 390 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 391 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 392 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 393 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 394 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 395 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 396 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 397 | | | 0 | | | 0 | | All sludge data in kg/ha | |
| 398 | | | 8.6 | | | 125 | | as metals applied to soils | |
| 399 | | | 17.2 | | | 248 | | from sludge application. | |
| 400 | | | 25.8 | | | 372 | | | |
| 401 | | | 34.4 | | | 496 | | | |
| 402 | | | 43 | | | 620 | | | |
| 403 | | | 0 | | | 0 | | | |
| 404 | | | 8.6 | | | 125 | | | |
| 405 | | | 17.2 | | | 248 | | | |
| 406 | | | 25.8 | | | 372 | | | |
| 407 | | | 34.4 | | | 496 | | | |
| 408 | | | 43 | | | 620 | | | |
| 409 | | | 0 | | | 0 | | | |
| 410 | | | 8.6 | | | 125 | | | |
| 411 | | | 17.2 | | | 248 | | | |
| 412 | | | 25.8 | | | 372 | | | |
| 413 | | | 34.4 | | | 496 | | | |
| 414 | | | 43 | | | 620 | | | |
| 415 | | | | | | | | No sludge data given | |
| 416 | | | | | | | | | |
| 417 | | | | | | | | | |
| 418 | | | 5100 | | | 11400 | AIR DRIED | | |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 381 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |
| 382 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |
| 383 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |
| 384 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |
| 385 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 386 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 387 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 388 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 389 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 390 | Schauer, et al. 1980 | Radishes | Cherrybelle | 4.7 | 67.5 | | | 21 | | 2520 |
| 391 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 392 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 393 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 394 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 395 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 396 | Schauer, et al. 1980 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 | | 2520 |
| 397 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0 | | 0 |
| 398 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0.9 | | 153 |
| 399 | RAPPAPORT ET AL 1988 | Corn | | | | | | 1.8 | | 304 |
| 400 | RAPPAPORT ET AL 1988 | Corn | | | | | | 2.7 | | 456 |
| 401 | RAPPAPORT ET AL 1988 | Corn | | | | | | 3.6 | | 608 |
| 402 | RAPPAPORT ET AL 1988 | Corn | | | | | | 4.5 | | 760 |
| 403 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0 | | 0 |
| 404 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0.9 | | 153 |
| 405 | RAPPAPORT ET AL 1988 | Corn | | | | | | 1.8 | | 304 |
| 406 | RAPPAPORT ET AL 1988 | Corn | | | | | | 2.7 | | 456 |
| 407 | RAPPAPORT ET AL 1988 | Corn | | | | | | 3.6 | | 608 |
| 408 | RAPPAPORT ET AL 1988 | Corn | | | | | | 4.5 | | 760 |
| 409 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0 | | 0 |
| 410 | RAPPAPORT ET AL 1988 | Corn | | | | | | 0.9 | | 153 |
| 411 | RAPPAPORT ET AL 1988 | Corn | | | | | | 1.8 | | 304 |
| 412 | RAPPAPORT ET AL 1988 | Corn | | | | | | 2.7 | | 456 |
| 413 | RAPPAPORT ET AL 1988 | Corn | | | | | | 3.6 | | 608 |
| 414 | RAPPAPORT ET AL 1988 | Corn | | | | | | 4.5 | | 760 |
| 415 | RAPPAPORT ET AL 1987 | Corn | | | | | | | | |
| 416 | RAPPAPORT ET AL 1987 | Corn | | | | | | | | |
| 417 | RAPPAPORT ET AL 1987 | Corn | | | | | | | | |
| 418 | WILLIAMS 1977 | CARROT | | | | | | | | 100 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 343 | | Saskatoon, Can |
| 344 | | Beltsville, MD |
| 345 | | Beltsville, MD |
| 346 | | Beltsville, MD |
| 347 | | Beltsville, MD |
| 348 | | Beltsville, MD |
| 349 | | Beltsville, MD |
| 350 | | Beltsville, MD |
| 351 | | Beltsville, MD |
| 352 | | Beltsville, MD |
| 353 | | Beltsville, MD |
| 354 | | Beltsville, MD |
| 355 | | Beltsville, MD |
| 356 | | Beltsville, MD |
| 357 | | Beltsville, MD |
| 358 | | Beltsville, MD |
| 359 | | Beltsville, MD |
| 360 | | Beltsville, MD |
| 361 | | Beltsville, MD |
| 362 | | Beltsville, MD |
| 363 | | Beltsville, MD |
| 364 | | Beltsville, MD |
| 365 | | Beltsville, MD |
| 366 | | Beltsville, MD |
| 367 | | Beltsville, MD |
| 368 | | Beltsville, MD |
| 369 | | Manhattan, Kansas |
| 370 | | Manhattan, Kansas |
| 371 | | Dayton, Ohio |
| 372 | | Dayton, Ohio |
| 373 | | Oakland, CA |
| 374 | | Oakland, CA |
| 375 | | Oakland, CA |
| 376 | | Oakland, CA |
| 377 | | Oakland, CA |
| 378 | | Oakland, CA |
| 379 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |
| 380 | YIELD NOT DETERMINED | KINGSTON, RHODE ISLAND |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| | | | | | |
| 343 | 0 | Whole plant | | | |
| 344 | 0 | Shoots | | | |
| 345 | 0 | Shoots | | | |
| 346 | 0 | Shoots | | | |
| 347 | 0 | Shoots | | | |
| 348 | 0 | Shoots | | | |
| 349 | 0 | Shoots | | | |
| 350 | 0 | Shoots | | | |
| 351 | 0 | Shoots | | | |
| 352 | 0 | Shoots | | | |
| 353 | 0 | Shoots | | | |
| 354 | 0 | Shoots | | | |
| 355 | 0 | Shoots | | | |
| 356 | 0 | Shoots | | | |
| 357 | 0 | Shoots | | | |
| 358 | 0 | Shoots | | | |
| 359 | 0 | Shoots | | | |
| 360 | 0 | Shoots | | | |
| 361 | 0 | Shoots | | | |
| 362 | 0 | Shoots | | | |
| 363 | 0 | Shoots | | | |
| 364 | 0 | Shoots | | | |
| 365 | 0 | Shoots | | | |
| 366 | 0 | Shoots | | | |
| 367 | 0 | Shoots | | | |
| 368 | 0 | Shoots | | | |
| 369 | | | | | |
| 370 | | | | | |
| 371 | | Leaves | | | |
| 372 | | Leaves | | | |
| 373 | 0 | Grain | | | |
| 374 | 0 | Grain | | | |
| 375 | 0 | Grain | | | |
| 376 | 0 | Grain | | | |
| 377 | 0 | Grain | | | |
| 378 | 0 | Grain | | | |
| 379 | | | | | |
| 380 | | | | | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 343 | 35.7 | | | | | 8.6 | 17 | Root | |
| 344 | | | 5.9 | | | | 5.8 | Shoots | |
| 345 | | | 7.4 | | | | 8.2 | Shoots | |
| 346 | | | 7 | | | | 6.9 | Shoots | |
| 347 | | | 7.4 | | | | 5.8 | Shoots | |
| 348 | | | 7.6 | | | | 3.7 | Shoots | |
| 349 | | | 7.7 | | | | 4.7 | Shoots | |
| 350 | | | 7.6 | | | | 3.3 | Shoots | |
| 351 | | | 6.9 | | | | 4.4 | Shoots | |
| 352 | | | 7.4 | | | | 3.2 | Shoots | |
| 353 | | | 7.6 | | | | 3.2 | Shoots | |
| 354 | | | 5.8 | | | | 7.8 | Shoots | |
| 355 | | | 6.1 | | | | 4.6 | Shoots | |
| 356 | | | 6.8 | | | | 4.8 | Shoots | |
| 357 | | | 7 | | | | 2.5 | Shoots | |
| 358 | | | 7.1 | | | | 3.3 | Shoots | |
| 359 | | | 5.8 | | | | 7.7 | Shoots | |
| 360 | | | 5.7 | | | | 4.4 | Shoots | |
| 361 | | | 6 | | | | 4.4 | Shoots | |
| 362 | | | 5.2 | | | | 12.6 | Shoots | |
| 363 | | | 5.3 | | | | 7.9 | Shoots | |
| 364 | | | 5.1 | | | | 9.8 | Shoots | |
| 365 | | | 6.4 | | | | 7.7 | Shoots | |
| 366 | | | 6.6 | | | | 7.6 | Shoots | |
| 367 | | | 5.9 | | | | 9.6 | Shoots | |
| 368 | | | 5.7 | | | | 11.3 | Shoots | |
| 369 | | 0.9 | 5.9 | | | 11.9 | 0.059 | Leaves | |
| 370 | | 0.9 | 5.9 | | | 11.9 | 4.53 | Roots | |
| 371 | | | 6.2 | | | 71.5 | 2 | Leaves | |
| 372 | | | 6.2 | | | 147 | 2 | Leaves | |
| 373 | | | | 0 | | 93 | <5.0 | Straw | |
| 374 | | | | 0 | | 94 | <5.0 | Straw | |
| 375 | | | | 5 | | 106 | <5.0 | Straw | |
| 376 | | | | 9.9 | | 99 | <5.0 | Straw | |
| 377 | | | | 15.5 | | 104 | <5.0 | Straw | |
| 378 | | | | 20.6 | | 105 | <5.0 | Straw | |
| 379 | | 2.8 | 5.6 | 0 | DTPA | 0.6 | 5.2 | Leaf | SLUDGE, FIELD, MATURITY |
| 380 | | 2.8 | 5.6 | 11 | DTPA | 1 | 6 | Leaf | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 343 | 150 | | | | | | | | |
| 344 | 0 | 0 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 345 | 0 | 0 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 346 | 56 | 56 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 347 | 112 | 112 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 348 | 224 | 224 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 349 | 336 | 336 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 350 | 448 | 448 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 351 | 56 | 56 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 352 | 112 | 112 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 353 | 224 | 224 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 354 | 56 | 56 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 355 | 112 | 112 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 356 | 224 | 224 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 357 | 448 | 448 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 358 | 672 | 672 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 359 | 56 | 56 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 360 | 112 | 112 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 361 | 224 | 224 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 362 | 56 | 56 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 363 | 112 | 112 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 364 | 224 | 224 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 365 | 50 | 50 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 366 | 100 | 100 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 367 | 50 | 50 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 368 | 100 | 100 | | Typic Paleudults | Christiana | fine sandy loam | | | |
| 369 | 32 | 128 | | Typic Udifluvent | Haynie | fine sandy loam | | | |
| 370 | 32 | 128 | | Typic Udifluvent | Haynie | fine sandy loam | | | |
| 371 | 28 | 980 | | | Warsaw | silt loam | | | |
| 372 | 0 | 0 | | | Warsaw | silt loam | | | |
| 373 | 0 | 0 | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 374 | 0+NPK | 0+NPK | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 375 | 33 | 33 | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 376 | 66 | 66 | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 377 | 107 | 107 | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 378 | 147 | 147 | 4 | Fluvaquentic Haplaquolls | Omni | silty clay | | | |
| 379 | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |
| 380 | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam | 34 | 58 | 8 |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 343 | | | 26.3 | 6620 | 164 | 420 | | | |
| 344 | | | | | | | | Control, low pH | |
| 345 | | | | | | | | Control, high pH | |
| 346 | | | 15 | | 217 | 639 | | Limed-digested | |
| 347 | | | 15 | | 217 | 639 | | Limed-digested | |
| 348 | | | 15 | | 217 | 639 | | Limed-digested | |
| 349 | | | 15 | | 217 | 639 | | Limed-digested | |
| 350 | | | 15 | | 217 | 639 | | Limed-digested | |
| 351 | | | 17 | | 215 | 599 | | Limed-raw | |
| 352 | | | 17 | | 215 | 599 | | Limed-raw | |
| 353 | | | 17 | | 215 | 599 | | Limed-raw | |
| 354 | | | 201 | | 272 | 731 | | Limed-compost | |
| 355 | | | 201 | | 272 | 731 | | Limed-compost | |
| 356 | | | 201 | | 272 | 731 | | Limed-compost | |
| 357 | | | 201 | | 272 | 731 | | Limed-compost | |
| 358 | | | 201 | | 272 | 731 | | Limed-compost | |
| 359 | | | 37 | | 360 | 1330 | | Heat-treated, high pH | |
| 360 | | | 37 | | 360 | 1330 | | Heat-treated, high pH | |
| 361 | | | 37 | | 360 | 1330 | | Heat-treated, high pH | |
| 362 | | | 37 | | 360 | 1330 | | Heat-treated, low pH | |
| 363 | | | 37 | | 360 | 1330 | | Heat-treated, low pH | |
| 364 | | | 37 | | 360 | 1330 | | Heat-treated, low pH | |
| 365 | | | 590 | | 865 | 4140 | | Nu-Earth, high pH | |
| 366 | | | 590 | | 865 | 4140 | | Nu-Earth, high pH | |
| 367 | | | 590 | | 865 | 4140 | | Nu-Earth, low pH | |
| 368 | | | 590 | | 865 | 4140 | | Nu-Earth, low pH | |
| 369 | | | 35.6 | 21300 | 124 | 1890 | | aerobically digested | |
| 370 | | | 35.6 | 21300 | 124 | 1890 | | aerobically digested | |
| 371 | | | 20370 | 24000 | 6940 | 8390 | | 28t/ha/yr at 35 years | |
| 372 | | | 20370 | 24000 | 6940 | 8390 | | Control | |
| 373 | | | | | | | | No sludge data given | |
| 374 | | | | | | | | No sludge data given | |
| 375 | | | | | | | | No sludge data given | |
| 376 | | | | | | | | No sludge data given | |
| 377 | | | | | | | | No sludge data given | |
| 378 | | | | | | | | No sludge data given | |
| 379 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |
| 380 | | 3 | 560 | | | 1630 | | ANAEROBICALLY DIGESTED | |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 343 | GILLIES ET AL 1989 | Oat | Harmon | | | | | 4.6 | 191 | 143 |
| 344 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | | | |
| 345 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | | | |
| 346 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 5.9 | | 259 |
| 347 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 5.9 | | 259 |
| 348 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 5.9 | | 259 |
| 349 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 5.9 | | 259 |
| 350 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 5.9 | | 259 |
| 351 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 4.9 | | 277 |
| 352 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 4.9 | | 277 |
| 353 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 4.9 | | 277 |
| 354 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 7.2 | | 274 |
| 355 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 7.2 | | 274 |
| 356 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 7.2 | | 274 |
| 357 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 7.2 | | 274 |
| 358 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 7.2 | | 274 |
| 359 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 360 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 361 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 362 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 363 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 364 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 13.4 | | 404 |
| 365 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 210 | | 1160 |
| 366 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 210 | | 1160 |
| 367 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 210 | | 1160 |
| 368 | HECKMAN ET AL 1987 | Soybean | Clark | | | | | 210 | | 1160 |
| 369 | KIRKHAM 1983 | Sorghum | Dekalb C-46 Plus | 6.7 | 7770 mg/l | | | 29.2 | 851 | 375 |
| 370 | KIRKHAM 1983 | Winter Wheat | Newton | 6.7 | 7770 mg/l | | | 29.2 | 851 | 375 |
| 371 | KIRKHAM 1975 | Corn | | | | | | 830 | 5900 | 6020 |
| 372 | KIRKHAM 1975 | Corn | | | | | | 830 | 5900 | 6020 |
| 373 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 374 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 375 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 376 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 377 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 378 | CHANG ET AL 1982 | Winter Weat | Anza | | | | | | | |
| 379 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |
| 380 | Schauer, et al. 1980 | Carrots | Danvers | 4.7 | 67.5 | | | 21 | | 2520 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 305 | | JOLIET, ILLINOIS |
| 306 | | JOLIET, ILLINOIS |
| 307 | | JOLIET, ILLINOIS |
| 308 | | JOLIET, ILLINOIS |
| 309 | | JOLIET, ILLINOIS |
| 310 | | JOLIET, ILLINOIS |
| 311 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 312 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 313 | | JOLIET, ILLINOIS |
| 314 | | JOLIET, ILLINOIS |
| 315 | | JOLIET, ILLINOIS |
| 316 | | JOLIET, ILLINOIS |
| 317 | | JOLIET, ILLINOIS |
| 318 | | JOLIET, ILLINOIS |
| 319 | | JOLIET, ILLINOIS |
| 320 | | JOLIET, ILLINOIS |
| 321 | | JOLIET, ILLINOIS |
| 322 | | JOLIET, ILLINOIS |
| 323 | | JOLIET, ILLINOIS |
| 324 | | JOLIET, ILLINOIS |
| 325 | | JOLIET, ILLINOIS |
| 326 | | JOLIET, ILLINOIS |
| 327 | | JOLIET, ILLINOIS |
| 328 | | JOLIET, ILLINOIS |
| 329 | | JOLIET, ILLINOIS |
| 330 | | JOLIET, ILLINOIS |
| 331 | | JOLIET, ILLINOIS |
| 332 | | JOLIET, ILLINOIS |
| 333 | | JOLIET, ILLINOIS |
| 334 | | JOLIET, ILLINOIS |
| 335 | | JOLIET, ILLINOIS |
| 336 | | JOLIET, ILLINOIS |
| 337 | | JOLIET, ILLINOIS |
| 338 | | JOLIET, ILLINOIS |
| 339 | | JOLIET, ILLINOIS |
| 340 | | JOLIET, ILLINOIS |
| 341 | | Saskatoon, Can |
| 342 | | Saskatoon, Can |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 305 | 0 | GRAIN | 0 | STOVER | NO |
| 306 | 0 | GRAIN | 0 | STOVER | NO |
| 307 | 0 | GRAIN | 0 | STOVER | NO |
| 308 | 0 | GRAIN | NA | STOVER | NO |
| 309 | 0 | GRAIN | 0 | STOVER | NO |
| 310 | 0 | GRAIN | 0 | STOVER | NO |
| 311 | 60* | GRAIN | 0 | STOVER | *NO |
| 312 | 60* | GRAIN | 0 | STOVER | *NO |
| 313 | 0 | GRAIN | 0 | STOVER | NO |
| 314 | 0 | GRAIN | 0 | STOVER | NO |
| 315 | 0 | GRAIN | 0 | STOVER | NO |
| 316 | 0 | GRAIN | 0 | STOVER | NO |
| 317 | 0 | GRAIN | 0 | STOVER | NO |
| 318 | 0 | GRAIN | 0 | STOVER | NO |
| 319 | NA | GRAIN | NA | STOVER | NO |
| 320 | 0 | GRAIN | 0 | STOVER | NO |
| 321 | 0 | GRAIN | 0 | STOVER | NO |
| 322 | 0 | GRAIN | 0 | STOVER | NO |
| 323 | 0 | GRAIN | 0 | STOVER | NO |
| 324 | 0 | GRAIN | 0 | STOVER | NO |
| 325 | 0 | GRAIN | 0 | STOVER | NO |
| 326 | 0 | GRAIN | 0 | STOVER | NO |
| 327 | 0 | GRAIN | 0 | STOVER | NO |
| 328 | 0 | GRAIN | 0 | STOVER | NO |
| 329 | 0 | GRAIN | 0 | STOVER | NO |
| 330 | 0 | GRAIN | NA | STOVER | NO |
| 331 | 0 | GRAIN | 0 | STOVER | NO |
| 332 | 0 | GRAIN | 0 | STOVER | NO |
| 333 | 0 | GRAIN | 0 | STOVER | NO |
| 334 | 0 | GRAIN | 0 | STOVER | NO |
| 335 | 0 | GRAIN | 0 | STOVER | NO |
| 336 | 0 | GRAIN | 0 | STOVER | NO |
| 337 | 0 | GRAIN | 0 | STOVER | NO |
| 338 | 0 | GRAIN | 0 | STOVER | NO |
| 339 | 0 | GRAIN | 0 | STOVER | NO |
| 340 | 0 | GRAIN | 0 | STOVER | NO |
| 341 | 0 | Whole plant | | | |
| 342 | 0 | Whole plant | | | |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 305 | | 0.76 | 7 | 0 | HCL-HF | 19 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 306 | | 1.21 | 6.9 | 0 | HCL-HF | 20 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 307 | | 0.84 | 7.1 | 0 | HCL-HF | 24 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 308 | | 0.31 | NA | 12.6 | HCL-HF | 15 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 309 | | 0.44 | 7.2 | 13.4 | HCL-HF | 31 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 310 | | 0.63 | 7.3 | 15.3 | HCL-HF | 12 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 311 | | 0.67 | 7.5 | 21 | HCL-HF | 12 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 312 | | 0.78 | 7 | 26.3 | HCL-HF | 20 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 313 | | 0.8 | 7 | 34 | HCL-HF | 19 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 314 | | 0.99 | 6.6 | 34 | HCL-HF | 25 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 315 | | 1.42 | 7.1 | 34 | HCL-HF | 35 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 316 | | 1.71 | 7.2 | 34 | HCL-HF | 30 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 317 | | 1.82 | 7.2 | 34 | HCL-HF | 34 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 318 | | 1.96 | 7.1 | 34 | HCL-HF | 31 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 319 | | 0.43 | NA | 25.2 | HCL-HF | 13 | 1.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 320 | | 0.51 | 7.1 | 26.8 | HCL-HF | 20 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 321 | | 0.94 | 7 | 30.6 | HCL-HF | 16 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 322 | | 1.16 | 7.2 | 41.9 | HCL-HF | 22 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 323 | | 1.4 | 7 | 52.5 | HCL-HF | 24 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 324 | | 1.75 | 6.4 | 68 | HCL-HF | 35 | 1.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 325 | | 2 | 6.3 | 68 | HCL-HF | 32 | 2 | LEAF | SLUDGE, FIELD, MATURITY |
| 326 | | 2.16 | 6.8 | 68 | HCL-HF | 38 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 327 | | 2.02 | 6.8 | 68 | HCL-HF | 51 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 328 | | 2.33 | 7.1 | 68 | HCL-HF | 53 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 329 | | 1.66 | 7 | 68 | HCL-HF | 45 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 330 | | 0.73 | NA | 50.4 | HCL-HF | 21 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 331 | | 0.57 | 6.8 | 53.5 | HCL-HF | 37 | 1.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 332 | | 1.3 | 6.7 | 61.1 | HCL-HF | 16 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 333 | | 1.42 | 6.6 | 83.7 | HCL-HF | 34 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 334 | | 2.4 | 6.4 | 105 | HCL-HF | 40 | 2.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 335 | | 2.76 | 6.1 | 135.9 | HCL-HF | 45 | 3.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 336 | | 3.44 | 5.8 | 135.9 | HCL-HF | 49 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 337 | | 3.16 | 5.9 | 135.9 | HCL-HF | 62 | 1.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 338 | | 3.28 | 6.2 | 135.9 | HCL-HF | 52 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 339 | | 3.1 | 6.4 | 135.9 | HCL-HF | 64 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 340 | | 3.15 | 6.5 | 135.9 | HCL-HF | 70 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 341 | 34.8 | | | | | 10.4 | 14 | Root | |
| 342 | 36.7 | | | | | 7.5 | 21 | Root | |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 305 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 306 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 307 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 308 | 26.2 | 40.1 | 0 | | PLAINFIELD | SL | | | |
| 309 | 8.1 | 48.2 | 0 | | PLAINFIELD | SL | | | |
| 310 | 14.7 | 62.9 | 0 | | PLAINFIELD | SL | | | |
| 311 | 17.7 | 80.6 | 0 | | PLAINFIELD | SL | | | |
| 312 | 13.1 | 93.7 | 0 | | PLAINFIELD | SL | | | |
| 313 | 17.8 | 111.5 | 0 | | PLAINFIELD | SL | | | |
| 314 | 0 | 111.5 | 1 | | PLAINFIELD | SL | | | |
| 315 | 0 | 111.5 | 2 | | PLAINFIELD | SL | | | |
| 316 | 0 | 111.5 | 3 | | PLAINFIELD | SL | | | |
| 317 | 0 | 111.5 | 4 | | PLAINFIELD | SL | | | |
| 318 | 0 | 111.5 | 5 | | PLAINFIELD | SL | | | |
| 319 | 52.4 | 80.2 | 0 | | PLAINFIELD | SL | | | |
| 320 | 16.2 | 96.4 | 0 | | PLAINFIELD | SL | | | |
| 321 | 29.4 | 125.8 | 0 | | PLAINFIELD | SL | | | |
| 322 | 35.4 | 161.2 | 0 | | PLAINFIELD | SL | | | |
| 323 | 26.2 | 187.4 | 0 | | PLAINFIELD | SL | | | |
| 324 | 35.6 | 223 | 0 | | PLAINFIELD | SL | | | |
| 325 | 0 | 223 | 1 | | PLAINFIELD | SL | | | |
| 326 | 0 | 223 | 2 | | PLAINFIELD | SL | | | |
| 327 | 0 | 223 | 3 | | PLAINFIELD | SL | | | |
| 328 | 0 | 223 | 4 | | PLAINFIELD | SL | | | |
| 329 | 0 | 223 | 5 | | PLAINFIELD | SL | | | |
| 330 | 104.8 | 160.4 | 0 | | PLAINFIELD | SL | | | |
| 331 | 32.4 | 192.8 | 0 | | PLAINFIELD | SL | | | |
| 332 | 58.8 | 251.6 | 0 | | PLAINFIELD | SL | | | |
| 333 | 70.8 | 322.4 | 0 | | PLAINFIELD | SL | | | |
| 334 | 52.4 | 374.8 | 0 | | PLAINFIELD | SL | | | |
| 335 | 71.2 | 446 | 0 | | PLAINFIELD | SL | | | |
| 336 | 0 | 446 | 1 | | PLAINFIELD | SL | | | |
| 337 | 0 | 446 | 2 | | PLAINFIELD | SL | | | |
| 338 | 0 | 446 | 3 | | PLAINFIELD | SL | | | |
| 339 | 0 | 446 | 4 | | PLAINFIELD | SL | | | |
| 340 | 0 | 446 | 5 | | PLAINFIELD | SL | | | |
| 341 | 0 | | | | | | | | |
| 342 | 75 | | | | | | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 305 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 306 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 307 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 308 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 309 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 310 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 311 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 312 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 313 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 314 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 315 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 316 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 317 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 318 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 319 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 320 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 321 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 322 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 323 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 324 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 325 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 326 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 327 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 328 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 329 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 330 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 331 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 332 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 333 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 334 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 335 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 336 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 337 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 338 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 339 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 340 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 341 | | | 26.3 | 6620 | 164 | 420 | | | |
| 342 | | | 26.3 | 6620 | 164 | 420 | | | |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 305 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 306 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 307 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 308 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 309 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 310 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 311 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 312 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 313 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 314 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 315 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 316 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 317 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 318 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 319 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 320 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 321 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 322 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 323 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 324 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 325 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 326 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 327 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 328 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 329 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 330 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 331 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 332 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 333 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 334 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 335 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 336 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 337 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 338 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 339 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 340 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 341 | GILLIES ET AL 1989 | Oat | Harmon | | | | | 4.6 | 191 | 143 |
| 342 | GILLIES ET AL 1989 | Oat | Harmon | | | | | 4.6 | 191 | 143 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 267 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 268 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 269 | | JOLIET, ILLINOIS |
| 270 | | JOLIET, ILLINOIS |
| 271 | | JOLIET, ILLINOIS |
| 272 | | JOLIET, ILLINOIS |
| 273 | | JOLIET, ILLINOIS |
| 274 | | JOLIET, ILLINOIS |
| 275 | | JOLIET, ILLINOIS |
| 276 | | JOLIET, ILLINOIS |
| 277 | | JOLIET, ILLINOIS |
| 278 | | JOLIET, ILLINOIS |
| 279 | | JOLIET, ILLINOIS |
| 280 | | JOLIET, ILLINOIS |
| 281 | | JOLIET, ILLINOIS |
| 282 | | JOLIET, ILLINOIS |
| 283 | | JOLIET, ILLINOIS |
| 284 | | JOLIET, ILLINOIS |
| 285 | | JOLIET, ILLINOIS |
| 286 | | JOLIET, ILLINOIS |
| 287 | | JOLIET, ILLINOIS |
| 288 | | JOLIET, ILLINOIS |
| 289 | | JOLIET, ILLINOIS |
| 290 | | JOLIET, ILLINOIS |
| 291 | | JOLIET, ILLINOIS |
| 292 | | JOLIET, ILLINOIS |
| 293 | | JOLIET, ILLINOIS |
| 294 | | JOLIET, ILLINOIS |
| 295 | | JOLIET, ILLINOIS |
| 296 | | JOLIET, ILLINOIS |
| 297 | | JOLIET, ILLINOIS |
| 298 | | JOLIET, ILLINOIS |
| 299 | | JOLIET, ILLINOIS |
| 300 | | JOLIET, ILLINOIS |
| 301 | | JOLIET, ILLINOIS |
| 302 | | JOLIET, ILLINOIS |
| 303 | | JOLIET, ILLINOIS |
| 304 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 267 | 60* | GRAIN | 0 | STOVER | *NO |
| 268 | 28* | GRAIN | 0 | STOVER | *NO |
| 269 | 0 | GRAIN | 0 | STOVER | NO |
| 270 | 0 | GRAIN | 0 | STOVER | NO |
| 271 | 0 | GRAIN | 0 | STOVER | NO |
| 272 | 0 | GRAIN | 0 | STOVER | NO |
| 273 | 0 | GRAIN | 0 | STOVER | NO |
| 274 | 0 | GRAIN | 0 | STOVER | NO |
| 275 | 0 | GRAIN | NA | STOVER | NO |
| 276 | 0 | GRAIN | 0 | STOVER | NO |
| 277 | 0 | GRAIN | 0 | STOVER | NO |
| 278 | 0 | GRAIN | 0 | STOVER | NO |
| 279 | 0 | GRAIN | 0 | STOVER | NO |
| 280 | 0 | GRAIN | 0 | STOVER | NO |
| 281 | 0 | GRAIN | 0 | STOVER | NO |
| 282 | 0 | GRAIN | 0 | STOVER | NO |
| 283 | 0 | GRAIN | 0 | STOVER | NO |
| 284 | 0 | GRAIN | 0 | STOVER | NO |
| 285 | 0 | GRAIN | 0 | STOVER | NO |
| 286 | 0 | GRAIN | NA | STOVER | NO |
| 287 | 0 | GRAIN | 0 | STOVER | NO |
| 288 | 0 | GRAIN | 0 | STOVER | NO |
| 289 | 0 | GRAIN | 0 | STOVER | NO |
| 290 | 0 | GRAIN | 0 | STOVER | NO |
| 291 | 0 | GRAIN | 0 | STOVER | NO |
| 292 | 0 | GRAIN | 0 | STOVER | NO |
| 293 | 0 | GRAIN | 0 | STOVER | NO |
| 294 | 0 | GRAIN | 0 | STOVER | NO |
| 295 | 0 | GRAIN | 0 | STOVER | NO |
| 296 | 0 | GRAIN | 0 | STOVER | NO |
| 297 | 0 | GRAIN | NA | STOVER | NO |
| 298 | 0 | GRAIN | 0 | STOVER | NO |
| 299 | 0 | GRAIN | 0 | STOVER | NO |
| 300 | 0 | GRAIN | 0 | STOVER | NO |
| 301 | 0 | GRAIN | 0 | STOVER | NO |
| 302 | 0 | GRAIN | 0 | STOVER | NO |
| 303 | 0 | GRAIN | 0 | STOVER | NO |
| 304 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 267 | | 1.58 | 7.4 | 21 | HCL-HF | 39 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 268 | | 1.54 | 7.1 | 26.3 | HCL-HF | 32 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 269 | | 1.64 | 6.9 | 34 | HCL-HF | 31 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 270 | | 1.69 | 6.9 | 34 | HCL-HF | 32 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 271 | | 1.91 | 7 | 34 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 272 | | 1.66 | 7.3 | 34 | HCL-HF | 33 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 273 | | 2.05 | 7.1 | 34 | HCL-HF | 32 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 274 | | 1.95 | 7.2 | 34 | HCL-HF | 34 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 275 | | 1.71 | NA | 25.2 | HCL-HF | 22 | 1.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 276 | | 1.57 | 6.9 | 26.8 | HCL-HF | 29 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 277 | | 1.57 | 7.3 | 30.6 | HCL-HF | 24 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 278 | | 1.79 | 7.1 | 41.9 | HCL-HF | 41 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 279 | | 1.93 | 6.9 | 52.5 | HCL-HF | 35 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 280 | | 2.09 | 6.6 | 68 | HCL-HF | 37 | 1 | LEAF | SLUDGE, FIELD, MATURITY |
| 281 | | 2.37 | 6.4 | 68 | HCL-HF | 39 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 282 | | 2.4 | 6.4 | 68 | HCL-HF | 49 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 283 | | 2.4 | 6.8 | 68 | HCL-HF | 41 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 284 | | 2.38 | 6.8 | 68 | HCL-HF | 35 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 285 | | 2.48 | 7.2 | 68 | HCL-HF | 44 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 286 | | 2.06 | NA | 50.4 | HCL-HF | 27 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 287 | | 2 | 6.4 | 53.5 | HCL-HF | 27 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 288 | | 1.76 | 6.4 | 61.1 | HCL-HF | 30 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 289 | | 2.67 | 6.2 | 83.7 | HCL-HF | 41 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 290 | | 2.72 | 6.1 | 105 | HCL-HF | 44 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 291 | | 3.53 | 5.4 | 135.9 | HCL-HF | 52 | 1.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 292 | | 3.35 | 5.5 | 135.9 | HCL-HF | 55 | 1.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 293 | | 3.29 | 5.8 | 135.9 | HCL-HF | 51 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 294 | | 2.68 | 6 | 135.9 | HCL-HF | 46 | 1 | LEAF | SLUDGE, FIELD, MATURITY |
| 295 | | 3.02 | 6 | 135.9 | HCL-HF | 47 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 296 | | 2.2 | 6.3 | 135.9 | HCL-HF | 46 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 297 | | 0.36 | NA | 0 | HCL-HF | 11 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 298 | | 0.17 | 7 | 0 | HCL-HF | 12 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 299 | | 0.21 | 7.2 | 0 | HCL-HF | 8 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 300 | | 0.42 | 7.1 | 0 | HCL-HF | 13 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 301 | | 0.44 | 7 | 0 | HCL-HF | 16 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 302 | | 0.56 | 6.9 | 0 | HCL-HF | 33 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 303 | | 0.48 | 7 | 0 | HCL-HF | 15 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 304 | | 0.75 | 7 | 0 | HCL-HF | 19 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 267 | 17.7 | 80.6 | 0 | | ELLIOT | SiL | | | |
| 268 | 13.1 | 93.7 | 0 | | ELLIOT | SiL | | | |
| 269 | 17.8 | 111.5 | 0 | | ELLIOT | SiL | | | |
| 270 | 0 | 111.5 | 1 | | ELLIOT | SiL | | | |
| 271 | 0 | 111.5 | 2 | | ELLIOT | SiL | | | |
| 272 | 0 | 111.5 | 3 | | ELLIOT | SiL | | | |
| 273 | 0 | 111.5 | 4 | | ELLIOT | SiL | | | |
| 274 | 0 | 111.5 | 5 | | ELLIOT | SiL | | | |
| 275 | 52.4 | 80.2 | 0 | | ELLIOT | SiL | | | |
| 276 | 16.2 | 96.4 | 0 | | ELLIOT | SiL | | | |
| 277 | 29.4 | 125.8 | 0 | | ELLIOT | SiL | | | |
| 278 | 35.4 | 161.2 | 0 | | ELLIOT | SiL | | | |
| 279 | 26.2 | 187.4 | 0 | | ELLIOT | SiL | | | |
| 280 | 35.6 | 223 | 0 | | ELLIOT | SiL | | | |
| 281 | 0 | 223 | 1 | | ELLIOT | SiL | | | |
| 282 | 0 | 223 | 2 | | ELLIOT | SiL | | | |
| 283 | 0 | 223 | 3 | | ELLIOT | SiL | | | |
| 284 | 0 | 223 | 4 | | ELLIOT | SiL | | | |
| 285 | 0 | 223 | 5 | | ELLIOT | SiL | | | |
| 286 | 104.8 | 160.4 | 0 | | ELLIOT | SiL | | | |
| 287 | 32.4 | 192.8 | 0 | | ELLIOT | SiL | | | |
| 288 | 58.8 | 251.6 | 0 | | ELLIOT | SiL | | | |
| 289 | 70.8 | 322.4 | 0 | | ELLIOT | SiL | | | |
| 290 | 52.4 | 374.8 | 0 | | ELLIOT | SiL | | | |
| 291 | 71.2 | 446 | 0 | | ELLIOT | SiL | | | |
| 292 | 0 | 446 | 1 | | ELLIOT | SiL | | | |
| 293 | 0 | 446 | 2 | | ELLIOT | SiL | | | |
| 294 | 0 | 446 | 3 | | ELLIOT | SiL | | | |
| 295 | 0 | 446 | 4 | | ELLIOT | SiL | | | |
| 296 | 0 | 446 | 5 | | ELLIOT | SiL | | | |
| 297 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 298 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 299 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 300 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 301 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 302 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 303 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 304 | 0 | 0 | NA | | PLAINFIELD | SL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 267 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 268 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 269 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 270 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 271 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 272 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 273 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 274 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 275 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 276 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 277 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 278 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 279 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 280 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 281 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 282 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 283 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 284 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 285 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 286 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 287 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 288 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 289 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 290 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 291 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 292 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 293 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 294 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 295 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 296 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 297 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 298 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 299 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 300 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 301 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 302 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 303 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 304 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 267 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 268 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 269 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 270 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 271 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 272 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 273 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 274 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 275 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 276 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 277 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 278 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 279 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 280 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 281 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 282 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 283 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 284 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 285 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 286 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 287 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 288 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 289 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 290 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 291 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 292 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 293 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 294 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 295 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 296 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 297 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 298 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 299 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 300 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 301 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 302 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 303 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 304 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 229 | | JOLIET, ILLINOIS |
| 230 | | JOLIET, ILLINOIS |
| 231 | | JOLIET, ILLINOIS |
| 232 | | JOLIET, ILLINOIS |
| 233 | | JOLIET, ILLINOIS |
| 234 | | JOLIET, ILLINOIS |
| 235 | | JOLIET, ILLINOIS |
| 236 | | JOLIET, ILLINOIS |
| 237 | | JOLIET, ILLINOIS |
| 238 | | JOLIET, ILLINOIS |
| 239 | | JOLIET, ILLINOIS |
| 240 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 241 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 242 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 243 | | JOLIET, ILLINOIS |
| 244 | | JOLIET, ILLINOIS |
| 245 | *DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT | JOLIET, ILLINOIS |
| 246 | | JOLIET, ILLINOIS |
| 247 | | JOLIET, ILLINOIS |
| 248 | | JOLIET, ILLINOIS |
| 249 | | JOLIET, ILLINOIS |
| 250 | | JOLIET, ILLINOIS |
| 251 | | JOLIET, ILLINOIS |
| 252 | | JOLIET, ILLINOIS |
| 253 | | JOLIET, ILLINOIS |
| 254 | | JOLIET, ILLINOIS |
| 255 | | JOLIET, ILLINOIS |
| 256 | | JOLIET, ILLINOIS |
| 257 | | JOLIET, ILLINOIS |
| 258 | | JOLIET, ILLINOIS |
| 259 | | JOLIET, ILLINOIS |
| 260 | | JOLIET, ILLINOIS |
| 261 | | JOLIET, ILLINOIS |
| 262 | | JOLIET, ILLINOIS |
| 263 | | JOLIET, ILLINOIS |
| 264 | | JOLIET, ILLINOIS |
| 265 | | JOLIET, ILLINOIS |
| 266 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 229 | 0 | GRAIN | 0 | STOVER | NO |
| 230 | 0 | GRAIN | 0 | STOVER | NO |
| 231 | 0 | GRAIN | 0 | STOVER | NO |
| 232 | 0 | GRAIN | 0 | STOVER | NO |
| 233 | 0 | GRAIN | NA | STOVER | NO |
| 234 | 0 | GRAIN | 0 | STOVER | NO |
| 235 | 0 | GRAIN | 0 | STOVER | NO |
| 236 | 0 | GRAIN | 0 | STOVER | NO |
| 237 | 0 | GRAIN | 0 | STOVER | NO |
| 238 | 0 | GRAIN | NA | STOVER | NO |
| 239 | 0 | GRAIN | 0 | STOVER | NO |
| 240 | 0 | GRAIN | 37* | STOVER | *NO |
| 241 | 60* | GRAIN | 0 | STOVER | *NO |
| 242 | 28* | GRAIN | 0 | STOVER | *NO |
| 243 | 0 | GRAIN | NA | STOVER | NO |
| 244 | 0 | GRAIN | 0 | STOVER | NO |
| 245 | 0 | GRAIN | 22* | STOVER | *NO |
| 246 | 0 | GRAIN | 0 | STOVER | NO |
| 247 | 0 | GRAIN | 0 | STOVER | NO |
| 248 | 0 | GRAIN | NA | STOVER | NO |
| 249 | 0 | GRAIN | 0 | STOVER | NO |
| 250 | 0 | GRAIN | 0 | STOVER | NO |
| 251 | 0 | GRAIN | 0 | STOVER | NO |
| 252 | 0 | GRAIN | 0 | STOVER | NO |
| 253 | 0 | GRAIN | NA | STOVER | NO |
| 254 | 0 | GRAIN | 0 | STOVER | NO |
| 255 | 0 | GRAIN | 0 | STOVER | NO |
| 256 | 0 | GRAIN | 0 | STOVER | NO |
| 257 | 0 | GRAIN | 0 | STOVER | NO |
| 258 | 0 | GRAIN | 0 | STOVER | NO |
| 259 | 0 | GRAIN | 0 | STOVER | NO |
| 260 | 0 | GRAIN | 0 | STOVER | NO |
| 261 | 0 | GRAIN | 0 | STOVER | NO |
| 262 | 0 | GRAIN | 0 | STOVER | NO |
| 263 | 0 | GRAIN | 0 | STOVER | NO |
| 264 | 0 | GRAIN | NA | STOVER | NO |
| 265 | 0 | GRAIN | 0 | STOVER | NO |
| 266 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 229 | | 2.84 | 6 | 135.5 | HCL-HF | 38 | 2.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 230 | | 3.35 | 5.9 | 135.5 | HCL-HF | 73 | 1.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 231 | | 2.1 | 6.2 | 135.5 | HCL-HF | 39 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 232 | | 3.03 | 6.1 | 135.5 | HCL-HF | 63 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 233 | | 1.19 | NA | 0 | HCL-HF | 22 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 234 | | 1.01 | 7.1 | 0 | HCL-HF | 25 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 235 | | 0.93 | 7.5 | 0 | HCL-HF | 25 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 236 | | 1.05 | 7.7 | 0 | HCL-HF | 33 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 237 | | 1.07 | 7.3 | 0 | HCL-HF | 21 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 238 | | 1.29 | NA | 12.6 | HCL-HF | 26 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 239 | | 1.06 | 7.2 | 13.4 | HCL-HF | 33 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 240 | | 1.1 | 7.6 | 15.3 | HCL-HF | 29 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 241 | | 1.29 | 7.6 | 21 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 242 | | 1.17 | 7.6 | 26.3 | HCL-HF | 29 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 243 | | 1.38 | NA | 25.2 | HCL-HF | 29 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 244 | | 1.15 | 7.1 | 26.8 | HCL-HF | 32 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 245 | | 1.29 | 7.6 | 30.6 | HCL-HF | 28 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 246 | | 1.58 | 7.6 | 41.9 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 247 | | 1.75 | 7.5 | 52.5 | HCL-HF | 36 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 248 | | 1.63 | NA | 50.4 | HCL-HF | 31 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 249 | | 1.28 | 6.9 | 53.5 | HCL-HF | 41 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 250 | | 1.59 | 7.5 | 61.1 | HCL-HF | 38 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 251 | | 1.9 | 7.5 | 83.7 | HCL-HF | 45 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 252 | | 2.56 | 7.3 | 105 | HCL-HF | 48 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 253 | | 1.51 | NA | 0 | HCL-HF | 20 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 254 | | 1.34 | 7 | 0 | HCL-HF | 24 | 1.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 255 | | 1.29 | 7.2 | 0 | HCL-HF | 25 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 256 | | 1.45 | 7.1 | 0 | HCL-HF | 31 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 257 | | 1.3 | 7.6 | 0 | HCL-HF | 20 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 258 | | 1.3 | 7 | 0 | HCL-HF | 38 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 259 | | 1.41 | 7.2 | 0 | HCL-HF | 23 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 260 | | 1.32 | 6.7 | 0 | HCL-HF | 24 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 261 | | 1.38 | 7 | 0 | HCL-HF | 21 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 262 | | 1.69 | 7 | 0 | HCL-HF | 23 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 263 | | 1.48 | 7.4 | 0 | HCL-HF | 29 | NA | LEAF | SLUDGE, FIELD, MATURITY |
| 264 | | 1.52 | NA | 12.6 | HCL-HF | 22 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 265 | | 1.4 | 6.9 | 13.4 | HCL-HF | 32 | 1 | LEAF | SLUDGE, FIELD, MATURITY |
| 266 | | 1.35 | 7.2 | 15.3 | HCL-HF | 22 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 229 | 0 | 428.3 | 1 | | PLAINFIELD | SL | | | |
| 230 | 0 | 428.3 | 2 | | PLAINFIELD | SL | | | |
| 231 | 0 | 428.3 | 3 | | PLAINFIELD | SL | | | |
| 232 | 0 | 428.3 | 4 | | PLAINFIELD | SL | | | |
| 233 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 234 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 235 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 236 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 237 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 238 | 26.2 | 40.1 | 0 | | BLOUNT | SiL | | | |
| 239 | 8.1 | 48.2 | 0 | | BLOUNT | SiL | | | |
| 240 | 14.7 | 62.9 | 0 | | BLOUNT | SiL | | | |
| 241 | 17.7 | 80.6 | 0 | | BLOUNT | SiL | | | |
| 242 | 13.1 | 93.7 | 0 | | BLOUNT | SiL | | | |
| 243 | 52.4 | 80.2 | 0 | | BLOUNT | SiL | | | |
| 244 | 16.2 | 96.4 | 0 | | BLOUNT | SiL | | | |
| 245 | 29.4 | 125.8 | 0 | | BLOUNT | SiL | | | |
| 246 | 35.4 | 161.2 | 0 | | BLOUNT | SiL | | | |
| 247 | 26.2 | 187.4 | 0 | | BLOUNT | SiL | | | |
| 248 | 104.8 | 160.4 | 0 | | BLOUNT | SiL | | | |
| 249 | 32.4 | 192.8 | 0 | | BLOUNT | SiL | | | |
| 250 | 58.8 | 251.6 | 0 | | BLOUNT | SiL | | | |
| 251 | 70.8 | 322.4 | 0 | | BLOUNT | SiL | | | |
| 252 | 52.4 | 374.8 | 0 | | BLOUNT | SiL | | | |
| 253 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 254 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 255 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 256 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 257 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 258 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 259 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 260 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 261 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 262 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 263 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 264 | 26.2 | 40.1 | 0 | | ELLIOT | SiL | | | |
| 265 | 8.1 | 48.2 | 0 | | ELLIOT | SiL | | | |
| 266 | 14.7 | 62.9 | 0 | | ELLIOT | SiL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 229 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 230 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 231 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 232 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 233 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 234 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 235 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 236 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 237 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 238 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 239 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 240 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 241 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 242 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 243 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 244 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 245 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 246 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 247 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 248 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 249 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 250 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 251 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 252 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 253 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 254 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 255 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 256 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 257 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 258 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 259 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 260 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 261 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 262 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 263 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 264 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 265 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 266 | 4.2 | 5.5 | 305 | 3.3 | 1169 | 4769 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 229 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 230 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 231 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 232 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 233 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 234 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 235 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 236 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 237 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 238 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 239 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 240 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 241 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 242 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 243 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 244 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 245 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 246 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 247 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 248 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 249 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 250 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 251 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 252 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 253 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 254 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 255 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 256 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 257 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 258 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 259 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 260 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 261 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 262 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 263 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 264 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 265 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 266 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 191 | | JOLIET, ILLINOIS |
| 192 | | JOLIET, ILLINOIS |
| 193 | | JOLIET, ILLINOIS |
| 194 | | JOLIET, ILLINOIS |
| 195 | | JOLIET, ILLINOIS |
| 196 | | JOLIET, ILLINOIS |
| 197 | | JOLIET, ILLINOIS |
| 198 | | JOLIET, ILLINOIS |
| 199 | | JOLIET, ILLINOIS |
| 200 | | JOLIET, ILLINOIS |
| 201 | | JOLIET, ILLINOIS |
| 202 | | JOLIET, ILLINOIS |
| 203 | | JOLIET, ILLINOIS |
| 204 | | JOLIET, ILLINOIS |
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| 206 | | JOLIET, ILLINOIS |
| 207 | | JOLIET, ILLINOIS |
| 208 | | JOLIET, ILLINOIS |
| 209 | | JOLIET, ILLINOIS |
| 210 | | JOLIET, ILLINOIS |
| 211 | | JOLIET, ILLINOIS |
| 212 | | JOLIET, ILLINOIS |
| 213 | | JOLIET, ILLINOIS |
| 214 | | JOLIET, ILLINOIS |
| 215 | | JOLIET, ILLINOIS |
| 216 | | JOLIET, ILLINOIS |
| 217 | | JOLIET, ILLINOIS |
| 218 | | JOLIET, ILLINOIS |
| 219 | | JOLIET, ILLINOIS |
| 220 | | JOLIET, ILLINOIS |
| 221 | | JOLIET, ILLINOIS |
| 222 | | JOLIET, ILLINOIS |
| 223 | | JOLIET, ILLINOIS |
| 224 | | JOLIET, ILLINOIS |
| 225 | | JOLIET, ILLINOIS |
| 226 | | JOLIET, ILLINOIS |
| 227 | | JOLIET, ILLINOIS |
| 228 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 229 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 230 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 231 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 232 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 233 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 234 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 235 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 236 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 237 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 238 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 239 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 240 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 241 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 242 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 243 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 244 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 245 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 246 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 247 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 248 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 249 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 250 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 251 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 252 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 253 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 254 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 255 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 256 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 257 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 258 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 259 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 260 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 261 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 262 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 263 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 264 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 265 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |
| 266 | HINESLY 1985 | CORN | | | | | 3.2 | 265 | 2846 | 1311 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 191 | | JOLIET, ILLINOIS |
| 192 | | JOLIET, ILLINOIS |
| 193 | | JOLIET, ILLINOIS |
| 194 | | JOLIET, ILLINOIS |
| 195 | | JOLIET, ILLINOIS |
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| 200 | | JOLIET, ILLINOIS |
| 201 | | JOLIET, ILLINOIS |
| 202 | | JOLIET, ILLINOIS |
| 203 | | JOLIET, ILLINOIS |
| 204 | | JOLIET, ILLINOIS |
| 205 | | JOLIET, ILLINOIS |
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| 208 | | JOLIET, ILLINOIS |
| 209 | | JOLIET, ILLINOIS |
| 210 | | JOLIET, ILLINOIS |
| 211 | | JOLIET, ILLINOIS |
| 212 | | JOLIET, ILLINOIS |
| 213 | | JOLIET, ILLINOIS |
| 214 | | JOLIET, ILLINOIS |
| 215 | | JOLIET, ILLINOIS |
| 216 | | JOLIET, ILLINOIS |
| 217 | | JOLIET, ILLINOIS |
| 218 | | JOLIET, ILLINOIS |
| 219 | | JOLIET, ILLINOIS |
| 220 | | JOLIET, ILLINOIS |
| 221 | | JOLIET, ILLINOIS |
| 222 | | JOLIET, ILLINOIS |
| 223 | | JOLIET, ILLINOIS |
| 224 | | JOLIET, ILLINOIS |
| 225 | | JOLIET, ILLINOIS |
| 226 | | JOLIET, ILLINOIS |
| 227 | | JOLIET, ILLINOIS |
| 228 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 191 | 0 | GRAIN | 0 | STOVER | NO |
| 192 | 0 | GRAIN | 0 | STOVER | NO |
| 193 | NA | GRAIN | 0 | STOVER | NO |
| 194 | 0 | GRAIN | 0 | STOVER | NO |
| 195 | 0 | GRAIN | 0 | STOVER | NO |
| 196 | 0 | GRAIN | 0 | STOVER | NO |
| 197 | 0 | GRAIN | 0 | STOVER | NO |
| 198 | 0 | GRAIN | 0 | STOVER | NO |
| 199 | 0 | GRAIN | 0 | STOVER | NO |
| 200 | 0 | GRAIN | 0 | STOVER | NO |
| 201 | 0 | GRAIN | 0 | STOVER | NO |
| 202 | 0 | GRAIN | 0 | STOVER | NO |
| 203 | 0 | GRAIN | NA | STOVER | NO |
| 204 | 0 | GRAIN | 0 | STOVER | NO |
| 205 | 0 | GRAIN | 0 | STOVER | NO |
| 206 | 0 | GRAIN | 0 | STOVER | NO |
| 207 | 0 | GRAIN | 0 | STOVER | NO |
| 208 | 0 | GRAIN | 0 | STOVER | NO |
| 209 | 0 | GRAIN | 0 | STOVER | NO |
| 210 | 0 | GRAIN | 0 | STOVER | NO |
| 211 | 0 | GRAIN | 0 | STOVER | NO |
| 212 | 0 | GRAIN | 0 | STOVER | NO |
| 213 | NA | GRAIN | NA | STOVER | NO |
| 214 | 0 | GRAIN | 0 | STOVER | NO |
| 215 | 0 | GRAIN | 0 | STOVER | NO |
| 216 | 0 | GRAIN | 0 | STOVER | NO |
| 217 | 0 | GRAIN | 0 | STOVER | NO |
| 218 | 0 | GRAIN | 0 | STOVER | NO |
| 219 | 0 | GRAIN | 0 | STOVER | NO |
| 220 | 0 | GRAIN | 0 | STOVER | NO |
| 221 | 0 | GRAIN | 0 | STOVER | NO |
| 222 | 0 | GRAIN | 0 | STOVER | NO |
| 223 | NA | GRAIN | NA | STOVER | NO |
| 224 | 0 | GRAIN | 0 | STOVER | NO |
| 225 | 0 | GRAIN | 0 | STOVER | NO |
| 226 | 0 | GRAIN | 0 | STOVER | NO |
| 227 | 0 | GRAIN | 0 | STOVER | NO |
| 228 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 191 | | 2.6 | 6.1 | 135.5 | HCL-HF | 51 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 192 | | 3.2 | 6.1 | 135.5 | HCL-HF | 68 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 193 | | 0.39 | 7.8 | 0 | HCL-HF | 17 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 194 | | 0.17 | 7.1 | 0 | HCL-HF | 14 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 195 | | 0.26 | 7.3 | 0 | HCL-HF | 14 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 196 | | 0.27 | 6.8 | 0 | HCL-HF | 10 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 197 | | 0.33 | 7.6 | 0 | HCL-HF | 15 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 198 | | 0.27 | 7.5 | 0 | HCL-HF | 14 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 199 | | 0.29 | 7.5 | 0 | HCL-HF | 8 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 200 | | 0.42 | 7.4 | 0 | HCL-HF | 14 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 201 | | 0.49 | 7.4 | 0 | HCL-HF | 16 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 202 | | 0.64 | 7.3 | 0 | HCL-HF | 20 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 203 | | 0.36 | 7.6 | 12.1 | HCL-HF | 16 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 204 | | 0.28 | 7.1 | 13.2 | HCL-HF | 22 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 205 | | 0.61 | 7.4 | 14.5 | HCL-HF | 15 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 206 | | 0.91 | 7.3 | 14.5 | HCL-HF | 16 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 207 | | 0.56 | 7.4 | 14.5 | HCL-HF | 17 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 208 | | 0.58 | 7.1 | 14.5 | HCL-HF | 16 | 2 | LEAF | SLUDGE, FIELD, MATURITY |
| 209 | | 0.45 | 7.5 | 14.5 | HCL-HF | 9 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 210 | | 0.34 | 7.7 | 14.5 | HCL-HF | 18 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 211 | | 0.47 | 7.4 | 14.5 | HCL-HF | 19 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 212 | | 0.83 | 7.4 | 14.5 | HCL-HF | 24 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 213 | | 0.58 | 7.5 | 24.2 | HCL-HF | 16 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 214 | | 0.44 | 6.9 | 26.4 | HCL-HF | 24 | 5.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 215 | | 0.81 | 7.1 | 29 | HCL-HF | 18 | 3.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 216 | | 0.95 | 6.8 | 29 | HCL-HF | 15 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 217 | | 0.75 | 7.1 | 29 | HCL-HF | 22 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 218 | | 0.96 | 7.1 | 29 | HCL-HF | 15 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 219 | | 0.59 | 6.9 | 29 | HCL-HF | 15 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 220 | | 0.89 | 7 | 29 | HCL-HF | 17 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 221 | | 0.81 | 7.1 | 29 | HCL-HF | 17 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 222 | | 0.52 | 7.1 | 29 | HCL-HF | 17 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 223 | | 0.9 | 7.6 | 48.4 | HCL-HF | 43 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 224 | | 0.6 | 6.6 | 52.7 | HCL-HF | 34 | 2 | LEAF | SLUDGE, FIELD, MATURITY |
| 225 | | 2.4 | 6.8 | 57.9 | HCL-HF | 32 | 2.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 226 | | 1.85 | 6.5 | 82.1 | HCL-HF | 14 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 227 | | 1.78 | 6.1 | 103.4 | HCL-HF | 32 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 228 | | 1.96 | 6.2 | 135.5 | HCL-HF | 32 | 6.2 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 191 | 0 | 428.3 | 3 | | ELLIOT | SiL | | | |
| 192 | 0 | 428.3 | 4 | | ELLIOT | SiL | | | |
| 193 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 194 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 195 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 196 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 197 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 198 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 199 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 200 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 201 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 202 | 0 | 0 | NA | | PLAINFIELD | SL | | | |
| 203 | 14.5 | 31.8 | 0 | | PLAINFIELD | SL | | | |
| 204 | 11.1 | 42.9 | 0 | | PLAINFIELD | SL | | | |
| 205 | 15.3 | 58.2 | 0 | | PLAINFIELD | SL | | | |
| 206 | 0 | 58.2 | 1 | | PLAINFIELD | SL | | | |
| 207 | 0 | 58.2 | 2 | | PLAINFIELD | SL | | | |
| 208 | 0 | 58.2 | 3 | | PLAINFIELD | SL | | | |
| 209 | 0 | 58.2 | 4 | | PLAINFIELD | SL | | | |
| 210 | 0 | 58.2 | 5 | | PLAINFIELD | SL | | | |
| 211 | 0 | 58.2 | 6 | | PLAINFIELD | SL | | | |
| 212 | 0 | 58.2 | 7 | | PLAINFIELD | SL | | | |
| 213 | 29 | 63.6 | 0 | | PLAINFIELD | SL | | | |
| 214 | 22.2 | 85.8 | 0 | | PLAINFIELD | SL | | | |
| 215 | 30.6 | 116.4 | 0 | | PLAINFIELD | SL | | | |
| 216 | 0 | 116.4 | 1 | | PLAINFIELD | SL | | | |
| 217 | 0 | 116.4 | 2 | | PLAINFIELD | SL | | | |
| 218 | 0 | 116.4 | 3 | | PLAINFIELD | SL | | | |
| 219 | 0 | 116.4 | 4 | | PLAINFIELD | SL | | | |
| 220 | 0 | 116.4 | 5 | | PLAINFIELD | SL | | | |
| 221 | 0 | 116.4 | 6 | | PLAINFIELD | SL | | | |
| 222 | 0 | 116.4 | 7 | | PLAINFIELD | SL | | | |
| 223 | 57.8 | 127 | 0 | | PLAINFIELD | SL | | | |
| 224 | 44.4 | 171.4 | 0 | | PLAINFIELD | SL | | | |
| 225 | 61.1 | 232.5 | 0 | | PLAINFIELD | SL | | | |
| 226 | 69.8 | 302.3 | 0 | | PLAINFIELD | SL | | | |
| 227 | 54 | 356.3 | 0 | | PLAINFIELD | SL | | | |
| 228 | 72 | 428.3 | 0 | | PLAINFIELD | SL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 191 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 192 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 193 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 194 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 195 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 196 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 197 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 198 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 199 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 200 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 201 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 202 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 203 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 204 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 205 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 206 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 207 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 208 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 209 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 210 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 211 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 212 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 213 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 214 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 215 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 216 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 217 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 218 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 219 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 220 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 221 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 222 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 223 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 224 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 225 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 226 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 227 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 228 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 191 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 192 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 193 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 194 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 195 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 196 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 197 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 198 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 199 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 200 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 201 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 202 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 203 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 204 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 205 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 206 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 207 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 208 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 209 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 210 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 211 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 212 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 213 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 214 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 215 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 216 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 217 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 218 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 219 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 220 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 221 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 222 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 223 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 224 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 225 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 226 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 227 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 228 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 153 | | JOLIET, ILLINOIS |
| 154 | | JOLIET, ILLINOIS |
| 155 | | JOLIET, ILLINOIS |
| 156 | | JOLIET, ILLINOIS |
| 157 | | JOLIET, ILLINOIS |
| 158 | | JOLIET, ILLINOIS |
| 159 | | JOLIET, ILLINOIS |
| 160 | | JOLIET, ILLINOIS |
| 161 | | JOLIET, ILLINOIS |
| 162 | | JOLIET, ILLINOIS |
| 163 | | JOLIET, ILLINOIS |
| 164 | | JOLIET, ILLINOIS |
| 165 | | JOLIET, ILLINOIS |
| 166 | | JOLIET, ILLINOIS |
| 167 | | JOLIET, ILLINOIS |
| 168 | | JOLIET, ILLINOIS |
| 169 | | JOLIET, ILLINOIS |
| 170 | | JOLIET, ILLINOIS |
| 171 | | JOLIET, ILLINOIS |
| 172 | | JOLIET, ILLINOIS |
| 173 | | JOLIET, ILLINOIS |
| 174 | | JOLIET, ILLINOIS |
| 175 | | JOLIET, ILLINOIS |
| 176 | | JOLIET, ILLINOIS |
| 177 | | JOLIET, ILLINOIS |
| 178 | | JOLIET, ILLINOIS |
| 179 | | JOLIET, ILLINOIS |
| 180 | | JOLIET, ILLINOIS |
| 181 | | JOLIET, ILLINOIS |
| 182 | | JOLIET, ILLINOIS |
| 183 | | JOLIET, ILLINOIS |
| 184 | | JOLIET, ILLINOIS |
| 185 | | JOLIET, ILLINOIS |
| 186 | | JOLIET, ILLINOIS |
| 187 | | JOLIET, ILLINOIS |
| 188 | | JOLIET, ILLINOIS |
| 189 | | JOLIET, ILLINOIS |
| 190 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 153 | 0 | GRAIN | 0 | STOVER | NO |
| 154 | 0 | GRAIN | 0 | STOVER | NO |
| 155 | 0 | GRAIN | 0 | STOVER | NO |
| 156 | 0 | GRAIN | 0 | STOVER | NO |
| 157 | 0 | GRAIN | 0 | STOVER | NO |
| 158 | 0 | GRAIN | 0 | STOVER | NO |
| 159 | 0 | GRAIN | 0 | STOVER | NO |
| 160 | 0 | GRAIN | 0 | STOVER | NO |
| 161 | 0 | GRAIN | 0 | STOVER | NO |
| 162 | 0 | GRAIN | 0 | STOVER | NO |
| 163 | 0 | GRAIN | NA | STOVER | NO |
| 164 | 0 | GRAIN | 0 | STOVER | NO |
| 165 | 0 | GRAIN | 0 | STOVER | NO |
| 166 | 0 | GRAIN | 0 | STOVER | NO |
| 167 | 0 | GRAIN | 0 | STOVER | NO |
| 168 | 0 | GRAIN | 0 | STOVER | NO |
| 169 | 0 | GRAIN | 0 | STOVER | NO |
| 170 | 0 | GRAIN | 0 | STOVER | NO |
| 171 | 0 | GRAIN | 0 | STOVER | NO |
| 172 | 0 | GRAIN | 0 | STOVER | NO |
| 173 | 0 | GRAIN | NA | STOVER | NO |
| 174 | 0 | GRAIN | 0 | STOVER | NO |
| 175 | 0 | GRAIN | 0 | STOVER | NO |
| 176 | 0 | GRAIN | 0 | STOVER | NO |
| 177 | 0 | GRAIN | 0 | STOVER | NO |
| 178 | 0 | GRAIN | 0 | STOVER | NO |
| 179 | 0 | GRAIN | 0 | STOVER | NO |
| 180 | 0 | GRAIN | 0 | STOVER | NO |
| 181 | 0 | GRAIN | 0 | STOVER | NO |
| 182 | 0 | GRAIN | 0 | STOVER | NO |
| 183 | 0 | GRAIN | NA | STOVER | NO |
| 184 | 0 | GRAIN | 0 | STOVER | NO |
| 185 | 0 | GRAIN | 0 | STOVER | NO |
| 186 | 0 | GRAIN | 0 | STOVER | NO |
| 187 | 0 | GRAIN | 0 | STOVER | NO |
| 188 | 0 | GRAIN | 0 | STOVER | NO |
| 189 | 0 | GRAIN | 0 | STOVER | NO |
| 190 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT NI CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 153 | | 1.64 | 7.6 | 0 | HCL-HF | 18 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 154 | | 1.61 | 6.8 | 0 | HCL-HF | 23 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 155 | | 1.54 | 7.2 | 0 | HCL-HF | 30 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 156 | | 1.53 | 7.2 | 0 | HCL-HF | 28 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 157 | | 1.54 | 7 | 0 | HCL-HF | 23 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 158 | | 1.51 | 7 | 0 | HCL-HF | 25 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 159 | | 1.58 | 7.4 | 0 | HCL-HF | 18 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 160 | | 1.54 | 7.2 | 0 | HCL-HF | 29 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 161 | | 1.51 | 7 | 0 | HCL-HF | 28 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 162 | | 1.62 | 7 | 0 | HCL-HF | 31 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 163 | | 1.64 | 7.3 | 12.1 | HCL-HF | 24 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 164 | | 1.84 | 6.8 | 13.2 | HCL-HF | 24 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 165 | | 1.74 | 7.1 | 14.5 | HCL-HF | 36 | 1.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 166 | | 2.18 | 7.1 | 14.5 | HCL-HF | 28 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 167 | | 1.86 | 7.2 | 14.5 | HCL-HF | 26 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 168 | | 1.67 | 7.2 | 14.5 | HCL-HF | 30 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 169 | | 1.83 | 7.5 | 14.5 | HCL-HF | 22 | 0.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 170 | | 1.55 | 7.2 | 14.5 | HCL-HF | 30 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 171 | | 1.68 | 7 | 14.5 | HCL-HF | 23 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 172 | | 1.89 | 7.1 | 14.5 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 173 | | 1.97 | 7.8 | 24.2 | HCL-HF | 29 | 1.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 174 | | 1.81 | 7 | 26.4 | HCL-HF | 40 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 175 | | 1.88 | 7.3 | 29 | HCL-HF | 27 | 1.5 | LEAF | SLUDGE, FIELD, MATURITY |
| 176 | | 2.21 | 7.3 | 29 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 177 | | 1.99 | 7.4 | 29 | HCL-HF | 26 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 178 | | 1.89 | 7.3 | 29 | HCL-HF | 34 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 179 | | 1.94 | 7.4 | 29 | HCL-HF | 26 | 2.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 180 | | 1.72 | 7.4 | 29 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 181 | | 1.79 | 7.2 | 29 | HCL-HF | 27 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 182 | | 1.87 | 7.2 | 29 | HCL-HF | 41 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 183 | | 2.23 | 7.5 | 48.4 | HCL-HF | 37 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 184 | | 2.22 | 6.4 | 52.7 | HCL-HF | 40 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 185 | | 2.28 | 6.5 | 57.9 | HCL-HF | 36 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 186 | | 2.61 | 6.5 | 82.1 | HCL-HF | 44 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 187 | | 2.74 | 6.5 | 103.4 | HCL-HF | 41 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 188 | | 2.94 | 5.9 | 135.5 | HCL-HF | 49 | 2.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 189 | | 3.92 | 5.9 | 135.5 | HCL-HF | 60 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 190 | | 3.77 | 5.8 | 135.5 | HCL-HF | 75 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 153 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 154 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 155 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 156 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 157 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 158 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 159 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 160 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 161 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 162 | 0 | 0 | NA | | ELLIOT | SiL | | | |
| 163 | 14.5 | 31.8 | 0 | | ELLIOT | SiL | | | |
| 164 | 11.1 | 42.9 | 0 | | ELLIOT | SiL | | | |
| 165 | 15.3 | 58.2 | 0 | | ELLIOT | SiL | | | |
| 166 | 0 | 58.2 | 1 | | ELLIOT | SiL | | | |
| 167 | 0 | 58.2 | 2 | | ELLIOT | SiL | | | |
| 168 | 0 | 58.2 | 3 | | ELLIOT | SiL | | | |
| 169 | 0 | 58.2 | 4 | | ELLIOT | SiL | | | |
| 170 | 0 | 58.2 | 5 | | ELLIOT | SiL | | | |
| 171 | 0 | 58.2 | 6 | | ELLIOT | SiL | | | |
| 172 | 0 | 58.2 | 7 | | ELLIOT | SiL | | | |
| 173 | 29 | 63.6 | 0 | | ELLIOT | SiL | | | |
| 174 | 22.2 | 85.8 | 0 | | ELLIOT | SiL | | | |
| 175 | 30.6 | 116.4 | 0 | | ELLIOT | SiL | | | |
| 176 | 0 | 116.4 | 1 | | ELLIOT | SiL | | | |
| 177 | 0 | 116.4 | 2 | | ELLIOT | SiL | | | |
| 178 | 0 | 116.4 | 3 | | ELLIOT | SiL | | | |
| 179 | 0 | 116.4 | 4 | | ELLIOT | SiL | | | |
| 180 | 0 | 116.4 | 5 | | ELLIOT | SiL | | | |
| 181 | 0 | 116.4 | 6 | | ELLIOT | SiL | | | |
| 182 | 0 | 116.4 | 7 | | ELLIOT | SiL | | | |
| 183 | 57.8 | 127 | 0 | | ELLIOT | SiL | | | |
| 184 | 44.4 | 171.4 | 0 | | ELLIOT | SiL | | | |
| 185 | 61.1 | 232.5 | 0 | | ELLIOT | SiL | | | |
| 186 | 69.8 | 302.3 | 0 | | ELLIOT | SiL | | | |
| 187 | 54 | 356.3 | 0 | | ELLIOT | SiL | | | |
| 188 | 72 | 428.3 | 0 | | ELLIOT | SiL | | | |
| 189 | 0 | 428.3 | 1 | | ELLIOT | SiL | | | |
| 190 | 0 | 428.3 | 2 | | ELLIOT | SiL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 153 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 154 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 155 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 156 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 157 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 158 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 159 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 160 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 161 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 162 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 163 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 164 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 165 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 166 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 167 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 168 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 169 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 170 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 171 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 172 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 173 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 174 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 175 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 176 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 177 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 178 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 179 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 180 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 181 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 182 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 183 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 184 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 185 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 186 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 187 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 188 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 189 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 190 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 153 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 154 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 155 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 156 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 157 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 158 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 159 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 160 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 161 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 162 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 163 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 164 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 165 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 166 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 167 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 168 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 169 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 170 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 171 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 172 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 173 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 174 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 175 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 176 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 177 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 178 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 179 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 180 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 181 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 182 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 183 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 184 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 185 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 186 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 187 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 188 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 189 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 190 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| 115 | | JOLIET, ILLINOIS |
| 116 | | JOLIET, ILLINOIS |
| 117 | | JOLIET, ILLINOIS |
| 118 | | JOLIET, ILLINOIS |
| 119 | | JOLIET, ILLINOIS |
| 120 | | JOLIET, ILLINOIS |
| 121 | | JOLIET, ILLINOIS |
| 122 | | JOLIET, ILLINOIS |
| 123 | | JOLIET, ILLINOIS |
| 124 | | JOLIET, ILLINOIS |
| 125 | | JOLIET, ILLINOIS |
| 126 | | JOLIET, ILLINOIS |
| 127 | | JOLIET, ILLINOIS |
| 128 | | JOLIET, ILLINOIS |
| 129 | | JOLIET, ILLINOIS |
| 130 | | JOLIET, ILLINOIS |
| 131 | | JOLIET, ILLINOIS |
| 132 | | JOLIET, ILLINOIS |
| 133 | | JOLIET, ILLINOIS |
| 134 | | JOLIET, ILLINOIS |
| 135 | | JOLIET, ILLINOIS |
| 136 | | JOLIET, ILLINOIS |
| 137 | | JOLIET, ILLINOIS |
| 138 | | JOLIET, ILLINOIS |
| 139 | | JOLIET, ILLINOIS |
| 140 | | JOLIET, ILLINOIS |
| 141 | | JOLIET, ILLINOIS |
| 142 | | JOLIET, ILLINOIS |
| 143 | | JOLIET, ILLINOIS |
| 144 | | JOLIET, ILLINOIS |
| 145 | | JOLIET, ILLINOIS |
| 146 | | JOLIET, ILLINOIS |
| 147 | | JOLIET, ILLINOIS |
| 148 | | JOLIET, ILLINOIS |
| 149 | | JOLIET, ILLINOIS |
| 150 | | JOLIET, ILLINOIS |
| 151 | | JOLIET, ILLINOIS |
| 152 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 115 | 0 | GRAIN | 0 | STOVER | NO |
| 116 | 0 | GRAIN | 0 | STOVER | NO |
| 117 | 0 | GRAIN | 0 | STOVER | NO |
| 118 | 0 | GRAIN | 0 | STOVER | NO |
| 119 | 0 | GRAIN | 0 | STOVER | NO |
| 120 | 0 | GRAIN | 0 | STOVER | NO |
| 121 | 0 | GRAIN | 0 | STOVER | NO |
| 122 | 0 | GRAIN | 0 | STOVER | NO |
| 123 | 0 | GRAIN | NA | STOVER | NO |
| 124 | 0 | GRAIN | 0 | STOVER | NO |
| 125 | 0 | GRAIN | 0 | STOVER | NO |
| 126 | 0 | GRAIN | 0 | STOVER | NO |
| 127 | 0 | GRAIN | 0 | STOVER | NO |
| 128 | 0 | GRAIN | 0 | STOVER | NO |
| 129 | 0 | GRAIN | 0 | STOVER | NO |
| 130 | 0 | GRAIN | 0 | STOVER | NO |
| 131 | 0 | GRAIN | 0 | STOVER | NO |
| 132 | 0 | GRAIN | 0 | STOVER | NO |
| 133 | 0 | GRAIN | NA | STOVER | NO |
| 134 | 0 | GRAIN | 0 | STOVER | NO |
| 135 | 0 | GRAIN | 0 | STOVER | NO |
| 136 | 0 | GRAIN | 0 | STOVER | NO |
| 137 | 0 | GRAIN | 0 | STOVER | NO |
| 138 | 0 | GRAIN | 0 | STOVER | NO |
| 139 | 0 | GRAIN | 0 | STOVER | NO |
| 140 | 0 | GRAIN | 0 | STOVER | NO |
| 141 | 0 | GRAIN | 0 | STOVER | NO |
| 142 | 0 | GRAIN | 0 | STOVER | NO |
| 143 | 0 | GRAIN | NA | STOVER | NO |
| 144 | 0 | GRAIN | 0 | STOVER | NO |
| 145 | 0 | GRAIN | 0 | STOVER | NO |
| 146 | 0 | GRAIN | 0 | STOVER | NO |
| 147 | 0 | GRAIN | 0 | STOVER | NO |
| 148 | 0 | GRAIN | 0 | STOVER | NO |
| 149 | 0 | GRAIN | 0 | STOVER | NO |
| 150 | 0 | GRAIN | 0 | STOVER | NO |
| 151 | 0 | GRAIN | 0 | STOVER | NO |
| 152 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 115 | | 0.94 | 7.6 | 0 | HCL-HF | 30 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 116 | | 0.93 | 7.6 | 0 | HCL-HF | 31 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 117 | | 0.92 | 7.8 | 0 | HCL-HF | 25 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 118 | | 0.87 | 7.5 | 0 | HCL-HF | 27 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 119 | | 0.9 | 7.6 | 0 | HCL-HF | 22 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 120 | | 0.88 | 7.5 | 0 | HCL-HF | 30 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 121 | | 0.73 | 7.6 | 0 | HCL-HF | 26 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 122 | | 1 | 7.4 | 0 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 123 | | 1.06 | 7.7 | 12.1 | HCL-HF | 28 | 1.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 124 | | 1.11 | 6.9 | 13.2 | HCL-HF | 20 | 1 | LEAF | SLUDGE, FIELD, MATURITY |
| 125 | | 1.18 | 7.5 | 14.5 | HCL-HF | 35 | 2.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 126 | | 1.4 | 7.5 | 14.5 | HCL-HF | 42 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 127 | | 1.16 | 7.6 | 14.5 | HCL-HF | 25 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 128 | | 1.08 | 7.5 | 14.5 | HCL-HF | 33 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 129 | | 1.18 | 7.7 | 14.5 | HCL-HF | 26 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 130 | | 1.23 | 7.6 | 14.5 | HCL-HF | 32 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 131 | | 1.09 | 7.5 | 14.5 | HCL-HF | 27 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 132 | | 1.32 | 7.3 | 14.5 | HCL-HF | 38 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 133 | | 1.38 | 7.6 | 24.2 | HCL-HF | 28 | 1.4 | LEAF | SLUDGE, FIELD, MATURITY |
| 134 | | 1.12 | 7 | 26.4 | HCL-HF | 19 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |
| 135 | | 1.29 | 7.4 | 29 | HCL-HF | 44 | 2 | LEAF | SLUDGE, FIELD, MATURITY |
| 136 | | 1.83 | 7.3 | 29 | HCL-HF | 35 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 137 | | 1.36 | 7.5 | 29 | HCL-HF | 21 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 138 | | 1.34 | 7.2 | 29 | HCL-HF | 28 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 139 | | 1.6 | 7.4 | 29 | HCL-HF | 26 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 140 | | 1.31 | 7.3 | 29 | HCL-HF | 35 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 141 | | 1.54 | 7.1 | 29 | HCL-HF | 27 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 142 | | 1.62 | 7.1 | 29 | HCL-HF | 39 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 143 | | 1.62 | 7.6 | 48.4 | HCL-HF | 37 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 144 | | 1.63 | 6.8 | 52.7 | HCL-HF | 30 | 1.1 | LEAF | SLUDGE, FIELD, MATURITY |
| 145 | | 1.94 | 7.3 | 57.9 | HCL-HF | 42 | 2.3 | LEAF | SLUDGE, FIELD, MATURITY |
| 146 | | 2.5 | 7.2 | 57.9 | HCL-HF | 44 | 0.7 | LEAF | SLUDGE, FIELD, MATURITY |
| 147 | | 1.83 | 7.3 | 57.9 | HCL-HF | 36 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 148 | | 1.88 | 7.2 | 57.9 | HCL-HF | 37 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 149 | | 2.03 | 7.3 | 57.9 | HCL-HF | 33 | 0.8 | LEAF | SLUDGE, FIELD, MATURITY |
| 150 | | 1.6 | 7.1 | 57.9 | HCL-HF | 40 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 151 | | 1.54 | 7.1 | 57.9 | HCL-HF | 28 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |
| 152 | | 1.84 | 7 | 57.9 | HCL-HF | 43 | <.6 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 115 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 116 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 117 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 118 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 119 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 120 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 121 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 122 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 123 | 14.5 | 31.8 | 0 | | BLOUNT | SiL | | | |
| 124 | 11.1 | 42.9 | 0 | | BLOUNT | SiL | | | |
| 125 | 15.3 | 58.2 | 0 | | BLOUNT | SiL | | | |
| 126 | 0 | 58.2 | 1 | | BLOUNT | SiL | | | |
| 127 | 0 | 58.2 | 2 | | BLOUNT | SiL | | | |
| 128 | 0 | 58.2 | 3 | | BLOUNT | SiL | | | |
| 129 | 0 | 58.2 | 4 | | BLOUNT | SiL | | | |
| 130 | 0 | 58.2 | 5 | | BLOUNT | SiL | | | |
| 131 | 0 | 58.2 | 6 | | BLOUNT | SiL | | | |
| 132 | 0 | 58.2 | 7 | | BLOUNT | SiL | | | |
| 133 | 29 | 63.6 | 0 | | BLOUNT | SiL | | | |
| 134 | 22.2 | 85.8 | 0 | | BLOUNT | SiL | | | |
| 135 | 30.3 | 116.4 | 0 | | BLOUNT | SiL | | | |
| 136 | 0 | 116.4 | 1 | | BLOUNT | SiL | | | |
| 137 | 0 | 116.4 | 2 | | BLOUNT | SiL | | | |
| 138 | 0 | 116.4 | 3 | | BLOUNT | SiL | | | |
| 139 | 0 | 116.4 | 4 | | BLOUNT | SiL | | | |
| 140 | 0 | 116.4 | 5 | | BLOUNT | SiL | | | |
| 141 | 0 | 116.4 | 6 | | BLOUNT | SiL | | | |
| 142 | 0 | 116.4 | 7 | | BLOUNT | SiL | | | |
| 143 | 57.8 | 127 | 0 | | BLOUNT | SiL | | | |
| 144 | 44.4 | 171.4 | 0 | | BLOUNT | SiL | | | |
| 145 | 61.1 | 232.5 | 0 | | BLOUNT | SiL | | | |
| 146 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 147 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 148 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 149 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 150 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 151 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |
| 152 | 0 | 232.5 | 1 | | BLOUNT | SiL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| 115 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 116 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 117 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 118 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 119 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 120 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 121 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 122 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 123 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 124 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 125 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 126 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 127 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 128 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 129 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 130 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 131 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 132 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 133 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 134 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 135 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 136 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 137 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 138 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 139 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 140 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 141 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 142 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 143 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 144 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 145 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 146 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 147 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 148 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 149 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 150 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 151 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 152 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 116 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 117 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 118 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 119 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 120 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 121 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 122 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 123 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 124 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 125 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 126 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 127 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 128 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 129 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 130 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 131 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 132 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 133 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 134 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 135 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 136 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 137 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 138 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 139 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 140 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 141 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 142 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 143 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 144 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 145 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 146 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 147 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 148 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 149 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 150 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 151 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 152 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 77 | | MUSCLE SCHOALES, AL |
| 78 | | MUSCLE SCHOALES, AL |
| 79 | | MUSCLE SCHOALES, AL |
| 80 | | MUSCLE SCHOALES, AL |
| 81 | | MUSCLE SCHOALES, AL |
| 82 | | MUSCLE SCHOALES, AL |
| 83 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 84 | | MUSCLE SCHOALES, AL |
| 85 | | MUSCLE SCHOALES, AL |
| 86 | | MUSCLE SCHOALES, AL |
| 87 | | MUSCLE SCHOALES, AL |
| 88 | | MUSCLE SCHOALES, AL |
| 89 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 90 | | MUSCLE SCHOALES, AL |
| 91 | | MUSCLE SCHOALES, AL |
| 92 | | MUSCLE SCHOALES, AL |
| 93 | | MUSCLE SCHOALES, AL |
| 94 | | MUSCLE SCHOALES, AL |
| 95 | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS | MUSCLE SCHOALES, AL |
| 96 | | MUSCLE SCHOALES, AL |
| 97 | | MUSCLE SCHOALES, AL |
| 98 | | MUSCLE SCHOALES, AL |
| 99 | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS | MUSCLE SCHOALES, AL |
| 100 | | MUSCLE SCHOALES, AL |
| 101 | | MUSCLE SCHOALES, AL |
| 102 | | MUSCLE SCHOALES, AL |
| 103 | *AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS | MUSCLE SCHOALES, AL |
| 104 | | MUSCLE SCHOALES, AL |
| 105 | | MUSCLE SCHOALES, AL |
| 106 | | MUSCLE SCHOALES, AL |
| 107 | | MUSCLE SCHOALES, AL |
| 108 | | MUSCLE SCHOALES, AL |
| 109 | | MUSCLE SCHOALES, AL |
| 110 | | MUSCLE SCHOALES, AL |
| 111 | | MUSCLE SCHOALES, AL |
| 112 | | MUSCLE SCHOALES, AL |
| 113 | | JOLIET, ILLINOIS |
| 114 | | JOLIET, ILLINOIS |

TABLE F-3 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY |
|---|---|---|---|---|---|
| 77 | 0 | EDIBLE PART | | | NO |
| 78 | 0 | EDIBLE PART | | | NO |
| 79 | 0 | EDIBLE PART | | | NO |
| 80 | 0 | EDIBLE PART | | | NO |
| 81 | 0 | EDIBLE PART | | | NO |
| 82 | 0 | EDIBLE PART | | | NO |
| 83 | 25* | EDIBLE PART | | | *NO |
| 84 | 0 | EDIBLE PART | | | NO |
| 85 | 0 | EDIBLE PART | | | NO |
| 86 | 0 | EDIBLE PART | | | NO |
| 87 | 0 | EDIBLE PART | | | NO |
| 88 | 0 | EDIBLE PART | | | NO |
| 89 | 21.1* | EDIBLE PART | | | *NO |
| 90 | 0 | EDIBLE PART | | | NO |
| 91 | 0 | EDIBLE PART | | | NO |
| 92 | 0 | EDIBLE PART | | | NO |
| 93 | 0 | TOTAL PLANT | | | NO |
| 94 | 0 | TOTAL PLANT | | | NO |
| 95 | 15.4* | TOTAL PLANT | | | *NO |
| 96 | 0 | TOTAL PLANT | | | NO |
| 97 | 0 | TOTAL PLANT | | | NO |
| 98 | 0 | TOTAL PLANT | | | NO |
| 99 | 10* | TOTAL PLANT | | | *NO |
| 100 | 0 | TOTAL PLANT | | | NO |
| 101 | 0 | TOTAL PLANT | | | NO |
| 102 | 0 | TOTAL PLANT | | | NO |
| 103 | 12.5* | TOTAL PLANT | | | *NO |
| 104 | 0 | TOTAL PLANT | | | NO |
| 105 | 0 | TOTAL PLANT | | | NO |
| 106 | 0 | TOTAL PLANT | | | NO |
| 107 | 0 | TOTAL PLANT | | | NO |
| 108 | 0 | TOTAL PLANT | | | NO |
| 109 | 0 | TOTAL PLANT | | | NO |
| 110 | 0 | TOTAL PLANT | | | NO |
| 111 | 0 | TOTAL PLANT | | | NO |
| 112 | 0 | TOTAL PLANT | | | NO |
| 113 | 0 | GRAIN | 0 | STOVER | NO |
| 114 | 0 | GRAIN | 0 | STOVER | NO |

TABLE F-3 (cont.)

| | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Ni LOADING RATE (kg/ha) | SOIL EXTRACTANT | SOIL Ni CONCENTRTN mg/kg | PLANT Ni CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESIGN SUMMARY |
|---|---|---|---|---|---|---|---|---|---|
| 77 | | | 6.4 | 4.4 | 0.5 M HCL | 1.8 | 2.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 79 | | | 5.8 | 0 | 0.5 M HCL | 1 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 79 | | | 5.8 | 2.2 | 0.5 M HCL | 2.7 | 1.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 80 | | | 5.8 | 4.4 | 0.5 M HCL | 1.8 | 1.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 81 | | | 5.8 | 0 | 0.5 M HCL | 1 | 2.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 82 | | | 5.8 | 2.2 | 0.5 M HCL | 2.7 | 3 | LEAF | FIELD, SLUDGE, MATURITY |
| 83 | | | 5.8 | 4.4 | 0.5 M HCL | 1.8 | 2.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 84 | | | 5.8 | 0 | 0.5 M HCL | 1 | 2.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 85 | | | 5.8 | 2.2 | 0.5 M HCL | 2.7 | 2.8 | LEAF | FIELD, SLUDGE, MATURITY |
| 86 | | | 5.8 | 4.4 | 0.5 M HCL | 1.8 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 87 | | | 5.8 | 0 | 0.5 M HCL | 1 | 2.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 88 | | | 5.8 | 2.2 | 0.5 M HCL | 2.7 | 4.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 89 | | | 5.8 | 4.4 | 0.5 M HCL | 1.8 | 2.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 90 | | | 5.8 | 0 | 0.5 M HCL | 1 | 3.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 91 | | | 5.8 | 2.2 | 0.5 M HCL | 2.7 | 4.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 92 | | | 5.8 | 4.4 | 0.5 M HCL | 1.8 | 4.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 93 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 94 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3 | LEAF | FIELD, SLUDGE, MATURITY |
| 95 | | | 5.1 | 4.5 | .5 M HCL | 1.6 | 6.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 96 | | | 5.1 | 4.5 | .5 M HCL | 1.2 | 7.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 97 | | | 5.1 | 0 | .5 M HCL | 0.6 | 4.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 98 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 99 | | | 5.1 | 4.5 | .5 M HCL | 1.6 | 3.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 100 | | | 5.1 | 4.5 | .5 M HCL | 1.2 | 2.9 | LEAF | FIELD, SLUDGE, MATURITY |
| 101 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 102 | | | 5.1 | 0 | .5 M HCL | 0.6 | 4.6 | LEAF | FIELD, SLUDGE, MATURITY |
| 103 | | | 5.1 | 4.5 | .5 M HCL | 1.6 | 3.7 | LEAF | FIELD, SLUDGE, MATURITY |
| 104 | | | 5.1 | 4.5 | .5 M HCL | 1.2 | 4.1 | LEAF | FIELD, SLUDGE, MATURITY |
| 105 | | | 5.1 | 0 | .5 M HCL | 0.6 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 106 | | | 5.1 | 0 | .5 M HCL | 0.6 | 2.4 | LEAF | FIELD, SLUDGE, MATURITY |
| 107 | | | 5.1 | 4.5 | .5 M HCL | 1.6 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 108 | | | 5.1 | 4.5 | .5 M HCL | 1.2 | 2.2 | LEAF | FIELD, SLUDGE, MATURITY |
| 109 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3 | LEAF | FIELD, SLUDGE, MATURITY |
| 110 | | | 5.1 | 0 | .5 M HCL | 0.6 | 3.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 111 | | | 5.1 | 4.5 | .5 M HCL | 1.6 | 3.5 | LEAF | FIELD, SLUDGE, MATURITY |
| 112 | | | 5.1 | 4.5 | .5 M HCL | 1.2 | 3.3 | LEAF | FIELD, SLUDGE, MATURITY |
| 113 | | 0.85 | 7.8 | 0 | HCL-HF | 24 | 1.2 | LEAF | SLUDGE, FIELD, MATURITY |
| 114 | | 0.9 | 6.9 | 0 | HCL-HF | 27 | 0.9 | LEAF | SLUDGE, FIELD, MATURITY |

TABLE F-3 (cont.)

| | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE | CONTENT % | CONTENT % | CONTENT % |
|---|---|---|---|---|---|---|---|---|---|
| 77 | 112 | 112 | 0 | | SANGO | SiL | | | |
| 78 | 0 | 0 | | | SANGO | SiL | | | |
| 79 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 80 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 81 | 0 | 0 | | | SANGO | SiL | | | |
| 82 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 83 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 84 | 0 | 0 | | | SANGO | SiL | | | |
| 85 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 86 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 87 | 0 | 0 | | | SANGO | SiL | | | |
| 88 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 89 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 90 | 0 | 0 | | | SANGO | SiL | | | |
| 91 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 92 | 112 | 112 | 1 | | SANGO | SiL | | | |
| 93 | 0 | 0 | | | SANGO | SiL | | | |
| 94 | 0 | 0 | | | SANGO | SiL | | | |
| 95 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 96 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 97 | 0 | 0 | | | SANGO | SiL | | | |
| 98 | 0 | 0 | | | SANGO | SiL | | | |
| 99 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 100 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 101 | 0 | 0 | | | SANGO | SiL | | | |
| 102 | 0 | 0 | | | SANGO | SiL | | | |
| 103 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 104 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 105 | 0 | 0 | | | SANGO | SiL | | | |
| 106 | 0 | 0 | | | SANGO | SiL | | | |
| 107 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 108 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 109 | 0 | 0 | | | SANGO | SiL | | | |
| 110 | 0 | 0 | | | SANGO | SiL | | | |
| 111 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 112 | 224 | 224 | 0 | | SANGO | SiL | | | |
| 113 | 0 | 0 | NA | | BLOUNT | SiL | | | |
| 114 | 0 | 0 | NA | | BLOUNT | SiL | | | |

TABLE F-3 (cont.)

| | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING | SLUDGE CHEMICAL STABILIZATN |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 77 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 78 | | | | | | | | | |
| 79 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 80 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 81 | | | | | | | | | |
| 82 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 83 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 84 | | | | | | | | | |
| 85 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 86 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 87 | | | | | | | | | |
| 88 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 89 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 90 | | | | | | | | | |
| 91 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 92 | 1.5 | 2.1 | 40 | 1.3 | 1600 | 1800 | | | |
| 93 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 94 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 95 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 96 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 97 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 98 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 99 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 100 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 101 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 102 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 103 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 104 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 105 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 106 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 107 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 108 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 109 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 110 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 111 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 112 | 1.7 | 2.3 | 20 | 1.6 | 530 | 1800 | | | |
| 113 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |
| 114 | 4.5 | 5.9 | 316 | 3.5 | 1135 | 5059 | 0.03 | 2ND TRTMNT, ANAEROBIC DIGESTION | CENT POLY, FECL3 |

TABLE F-3 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 77 | GIORDANO & MAYS 1977 | KALE | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 78 | GIORDANO & MAYS 1977 | OKRA | | | | | | | | |
| 79 | GIORDANO & MAYS 1977 | OKRA | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 80 | GIORDANO & MAYS 1977 | OKRA | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 81 | GIORDANO & MAYS 1977 | PEPPER | | | | | | | | |
| 82 | GIORDANO & MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 83 | GIORDANO & MAYS 1977 | PEPPER | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 84 | GIORDANO & MAYS 1977 | TOMATO | | | | | | | | |
| 85 | GIORDANO & MAYS 1977 | TOMATO | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 86 | GIORDANO & MAYS 1977 | TOMATO | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 87 | GIORDANO & MAYS 1977 | SQUASH | | | | | | | | |
| 88 | GIORDANO & MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 89 | GIORDANO & MAYS 1977 | SQUASH | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 90 | GIORDANO & MAYS 1977 | LETTUCE | | | | | | | | |
| 91 | GIORDANO & MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 92 | GIORDANO & MAYS 1977 | LETTUCE | | 6.1 | | | 1.7 | 40 | 400 | 520 |
| 93 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 94 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 95 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 96 | GIORDANO&MAYS 1977 | LETTUCE | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 97 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 98 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 99 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 100 | GIORDANO&MAYS 1977 | PEPPER | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 101 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 102 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 103 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 104 | GIORDANO&MAYS 1977 | BEAN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 105 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 106 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 107 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 108 | GIORDANO&MAYS 1977 | CORN | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 109 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 110 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 111 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 112 | GIORDANO&MAYS 1977 | SQUASH | | 6.6 | | | 2.5 | 50 | 350 | 730 |
| 113 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |
| 114 | HINESLY 1985 | CORN | | | | | 3.4 | 263 | 2963 | 1422 |

TABLE F-3 (cont.)

| | COMMENTS | LOCATION OF STUDY |
|---|---|---|
| | | |
| 39 | | MUSCLE SCHOALES, AL |
| 40 | *DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT | MUSCLE SCHOALES, AL |
| 41 | | MUSCLE SCHOALES, AL |
| 42 | | MUSCLE SCHOALES, AL |
| 43 | *DOSE RESPONSE NOT CONSISTANT, PH<5.5 | MUSCLE SCHOALES, AL |
| 44 | | MUSCLE SCHOALES, AL |
| 45 | | MUSCLE SCHOALES, AL |
| 46 | | MUSCLE SCHOALES, AL |
| 47 | | MUSCLE SCHOALES, AL |
| 48 | | MUSCLE SCHOALES, AL |
| 49 | | MUSCLE SCHOALES, AL |
| 50 | | MUSCLE SCHOALES, AL |
| 51 | *DOSE RESPONSE & TISSUE NI CONCENTRATION NOT CONSISTANT | MUSCLE SCHOALES, AL |
| 52 | *DOSE RESPONSE & TISSUE NI CONCENTRATION NOT CONSISTANT | MUSCLE SCHOALES, AL |
| 53 | | MUSCLE SCHOALES, AL |
| 54 | *TISSUE NI NOT CONSISTANT, SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES | MUSCLE SCHOALES, AL |
| 55 | *TISSUE NI NOT CONSISTANT, SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES | MUSCLE SCHOALES, AL |
| 56 | *TISSUE NI NOT CONSISTANT, SLUDGE LOADING EXCEEDS AGRONOMIC RATES | MUSCLE SCHOALES, AL |
| 57 | | MUSCLE SCHOALES, AL |
| 58 | | MUSCLE SCHOALES, AL |
| 59 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 60 | | MUSCLE SCHOALES, AL |
| 61 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 62 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 63 | | MUSCLE SCHOALES, AL |
| 64 | | MUSCLE SCHOALES, AL |
| 65 | *NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS | MUSCLE SCHOALES, AL |
| 66 | | MUSCLE SCHOALES, AL |
| 67 | | MUSCLE SCHOALES, AL |
| 68 | | MUSCLE SCHOALES, AL |
| 69 | | MUSCLE SCHOALES, AL |
| 70 | | MUSCLE SCHOALES, AL |
| 71 | | MUSCLE SCHOALES, AL |
| 72 | | MUSCLE SCHOALES, AL |
| 73 | | MUSCLE SCHOALES, AL |
| 74 | | MUSCLE SCHOALES, AL |
| 75 | | MUSCLE SCHOALES, AL |
| 76 | | MUSCLE SCHOALES, AL |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 381 | Joliet, Ill. |
| 382 | Joliet, Ill. |
| 383 | Joliet, Ill. |
| 384 | Joliet, Ill. |
| 385 | Joliet, Ill. |
| 386 | Joliet, Ill. |
| 387 | Joliet, Ill. |
| 388 | Joliet, Ill. |
| 389 | Joliet, Ill. |
| 390 | Joliet, Ill. |
| 391 | Joliet, Ill. |
| 392 | Joliet, Ill. |
| 393 | Joliet, Ill. |
| 394 | Joliet, Ill. |
| 395 | Joliet, Ill. |
| * 396 | Joliet, Ill. |
| 397 | Joliet, Ill. |
| 398 | Joliet, Ill. |
| 399 | Joliet, Ill. |
| 400 | Joliet, Ill. |
| 401 | Joliet, Ill. |
| 402 | Joliet, Ill. |
| 403 | Joliet, Ill. |
| 404 | Joliet, Ill. |
| 405 | Joliet, Ill. |
| 406 | Joliet, Ill. |
| 407 | Joliet, Ill. |
| 408 | Joliet, Ill. |
| 409 | Joliet, Ill. |
| 410 | Joliet, Ill. |
| 411 | Joliet, Ill. |
| 412 | Joliet, Ill. |
| 413 | Joliet, Ill. |
| 414 | Joliet, Ill. |
| 415 | Joliet, Ill. |
| 416 | Joliet, Ill. |
| 417 | Joliet, Ill. |
| 418 | Joliet, Ill. |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Cs % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 419 | Hinesly, T.D. et al., 1978. #95 | Corn | H96 | | | | | |
| 420 | Hinesly, T.D. et al., 1978. #95 | Corn | R177 | | | | | |
| 421 | Hinesly, T.D. et al., 1978. #95 | Corn | B77 | | | | | |
| 422 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh43 | | | | | |
| 423 | Hinesly, T.D. et al., 1978. #95 | Corn | R806 | | | | | |
| 424 | Hinesly, T.D. et al., 1978. #95 | Corn | H98 | | | | | |
| 425 | Hinesly, T.D. et al., 1978. #95 | Corn | A619 | | | | | |
| 426 | Hinesly, T.D. et al., 1978. #95 | Corn | Mo17 | | | | | |
| 427 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh545 | | | | | |
| 428 | Hinesly, T.D. et al., 1978. #95 | Corn | B37 | | | | | |
| 429 | Hinesly, T.D. et al., 1978. #95 | Corn | R805 | | | | | |
| 430 | Hinesly, T.D. et al., 1978. #95 | Corn | Va26 | | | | | |
| 431 | Hinesly, T.D. et al., 1978. #95 | Corn | H100 | | | | | |
| 432 | Hinesly, T.D. et al., 1978. #95 | Corn | B73 | | | | | |
| 433 | Hinesly, T.D. et al., 1978. #95 | Corn | B14 | | | | | |
| 434 | Hinesly, T.D. et al., 1978. #95 | Corn | A632 | | | | | |
| 435 | Hinesly, T.D. et al., 1978. #95 | Corn | N28 | | | | | |
| 436 | Hinesly, T.D. et al., 1978. #95 | Corn | W64A | | | | | |
| 437 | Hinesly, T.D. et al., 1978. #95 | Corn | R802A | | | | | |
| 438 | Hinesly, T.D. et al., 1978. #95 | Corn | H99 | | | | | |
| 439 | Hinesly, T.D. et al., 1978. #95 | Corn | H96 | | | | | |
| 440 | Hinesly, T.D. et al., 1978. #95 | Corn | R177 | | | | | |
| 441 | Hinesly, T.D. et al., 1978. #95 | Corn | B77 | | | | | |
| 442 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh43 | | | | | |
| 443 | Hinesly, T.D. et al., 1978. #95 | Corn | R806 | | | | | |
| 444 | Hinesly, T.D. et al., 1978. #95 | Corn | H98 | | | | | |
| 445 | Hinesly, T.D. et al., 1978. #95 | Corn | A619 | | | | | |
| 446 | Hinesly, T.D. et al., 1978. #95 | Corn | Mo17 | | | | | |
| 447 | Hinesly, T.D. et al., 1978. #95 | Corn | Oh545 | | | | | |
| 448 | Hinesly, T.D. et al., 1978. #95 | Corn | B37 | | | | | |
| 449 | Hinesly, T.D. et al., 1978. #95 | Corn | R805 | | | | | |
| 450 | Hinesly, T.D. et al., 1978. #95 | Corn | Va26 | | | | | |
| 451 | Hinesly, T.D. et al., 1978. #95 | Corn | H100 | | | | | |
| 452 | Hinesly, T.D. et al., 1978. #95 | Corn | B73 | | | | | |
| 453 | Hinesly, T.D. et al., 1978. #95 | Corn | B14 | | | | | |
| 454 | Hinesly, T.D. et al., 1978. #95 | Corn | A632 | | | | | |
| 455 | Hinesly, T.D. et al., 1978. #95 | Corn | N28 | | | | | |
| 456 | Hinesly, T.D. et al., 1978. #95 | Corn | W64A | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 419 | | | | | | | | | | One-quarter maximum |
| 420 | | | | | | | | | | One-quarter maximum |
| 421 | | | | | | | | | | One-quarter maximum |
| 422 | | | | | | | | | | One-half maximum |
| 423 | | | | | | | | | | One-half maximum |
| 424 | | | | | | | | | | One-half maximum |
| 425 | | | | | | | | | | One-half maximum |
| 426 | | | | | | | | | | One-half maximum |
| 427 | | | | | | | | | | One-half maximum |
| 428 | | | | | | | | | | One-half maximum |
| 429 | | | | | | | | | | One-half maximum |
| 430 | | | | | | | | | | One-half maximum |
| 431 | | | | | | | | | | One-half maximum |
| 432 | | | | | | | | | | One-half maximum |
| 433 | | | | | | | | | | One-half maximum |
| 434 | | | | | | | | | | One-half maximum |
| 435 | | | | | | | | | | One-half maximum |
| 436 | | | | | | | | | | One-half maximum |
| 437 | | | | | | | | | | One-half maximum |
| 438 | | | | | | | | | | One-half maximum |
| 439 | | | | | | | | | | One-half maximum |
| 440 | | | | | | | | | | One-half maximum |
| 441 | | | | | | | | | | One-half maximum |
| 442 | | | | | | | | | | Maximum |
| 443 | | | | | | | | | | Maximum |
| 444 | | | | | | | | | | Maximum |
| 445 | | | | | | | | | | Maximum |
| 446 | | | | | | | | | | Maximum |
| 447 | | | | | | | | | | Maximum |
| 448 | | | | | | | | | | Maximum |
| 449 | | | | | | | | | | Maximum |
| 450 | | | | | | | | | | Maximum |
| 451 | | | | | | | | | | Maximum |
| 452 | | | | | | | | | | Maximum |
| 453 | | | | | | | | | | Maximum |
| 454 | | | | | | | | | | Maximum |
| 455 | | | | | | | | | | Maximum |
| 456 | | | | | | | | | | Maximum |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 419 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 420 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 421 | | 17.75 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 422 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 423 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 424 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 425 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 426 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 427 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 428 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 429 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 430 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 431 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 432 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 433 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 434 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 435 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 436 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 437 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 438 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 439 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 440 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 441 | | 35.5 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 442 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 443 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 444 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 445 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 446 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 447 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 448 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 449 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 450 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 451 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 452 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 453 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 454 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 455 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 456 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 419 | | | | | | | |
| 420 | | | | | | | |
| 421 | | | | | | | |
| 422 | | | | | | | |
| 423 | | | | | | | |
| 424 | | | | | | | |
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| 454 | | | | | | | |
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| 456 | | | | | | | |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 419 | | 188 | 43.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 420 | | 188 | 34.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 421 | | 188 | 32 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 422 | | 326 | 142.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 423 | | 326 | 156.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 424 | | 326 | 112.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 425 | | 326 | 62 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 426 | | 326 | 107.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 427 | | 326 | 89.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 428 | | 326 | 99 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 429 | | 326 | 91 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 430 | | 326 | 77.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 431 | | 326 | 65.9 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 432 | | 326 | 77.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 433 | | 326 | 71 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 434 | | 326 | 52.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 435 | | 326 | 56.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 436 | | 326 | 55.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 437 | | 326 | 65.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 438 | | 326 | 47.9 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 439 | | 326 | 63.5 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 440 | | 326 | 64.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 441 | | 326 | 43.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 442 | | 454 | 281.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 443 | | 454 | 268.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 444 | | 454 | 217.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 445 | | 454 | 193.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 446 | | 454 | 188.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 447 | | 454 | 170.6 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 448 | | 454 | 164.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 449 | | 454 | 148.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 450 | | 454 | 144.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 451 | | 454 | 140.1 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 452 | | 454 | 133.7 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 453 | | 454 | 130.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 454 | | 454 | 113 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 455 | | 454 | 109.4 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 456 | | 454 | 107.2 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 419 | | | NO | |
| 420 | | | NO | |
| 421 | | | NO | |
| 422 | | | NO | |
| 423 | | | NO | |
| 424 | | | NO | |
| 425 | | | NO | |
| 426 | | | NO | |
| 427 | | | NO | |
| 428 | | | NO | |
| 429 | | | NO | |
| 430 | | | NO | |
| 431 | | | NO | |
| 432 | | | NO | |
| 433 | | | NO | |
| 434 | | | NO | |
| 435 | | | NO | |
| 436 | | | NO | |
| 437 | | | NO | |
| 438 | | | NO | |
| 439 | | | NO | |
| 440 | | | NO | |
| 441 | | | NO | |
| 442 | | | NO | |
| 443 | | | NO | |
| 444 | | | NO | |
| 445 | | | NO | |
| 446 | | | NO | |
| 447 | | | NO | |
| 448 | | | NO | |
| 449 | | | NO | |
| 450 | | | NO | |
| 451 | | | NO | |
| 452 | | | NO | |
| 453 | | | NO | |
| 454 | | | NO | |
| 455 | | | NO | |
| 456 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 419 | Joliet, Ill. |
| 420 | Joliet, Ill. |
| 421 | Joliet, Ill. |
| 422 | Joliet, Ill. |
| 423 | Joliet, Ill. |
| 424 | Joliet, Ill. |
| 425 | Joliet, Ill. |
| 426 | Joliet, Ill. |
| 427 | Joliet, Ill. |
| 428 | Joliet, Ill. |
| 429 | Joliet, Ill. |
| 430 | Joliet, Ill. |
| 431 | Joliet, Ill. |
| 432 | Joliet, Ill. |
| 433 | Joliet, Ill. |
| 434 | Joliet, Ill. |
| 435 | Joliet, Ill. |
| 436 | Joliet, Ill. |
| 437 | Joliet, Ill. |
| 438 | Joliet, Ill. |
| 439 | Joliet, Ill. |
| 440 | Joliet, Ill. |
| 441 | Joliet, Ill. |
| 442 | Joliet, Ill. |
| 443 | Joliet, Ill. |
| 444 | Joliet, Ill. |
| 445 | Joliet, Ill. |
| 446 | Joliet, Ill. |
| 447 | Joliet, Ill. |
| 448 | Joliet, Ill. |
| 449 | Joliet, Ill. |
| 450 | Joliet, Ill. |
| 451 | Joliet, Ill. |
| 452 | Joliet, Ill. |
| 453 | Joliet, Ill. |
| 454 | Joliet, Ill. |
| 455 | Joliet, Ill. |
| 456 | Joliet, Ill. |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 457 | Hinesly, T.D. et al., 1978. #95 | Corn | R802A | | | | | |
| 458 | Hinesly, T.D. et al., 1978. #95 | Corn | H99 | | | | | |
| 459 | Hinesly, T.D. et al., 1978. #95 | Corn | H96 | | | | | |
| 460 | Hinesly, T.D. et al., 1978. #95 | Corn | R177 | | | | | |
| 461 | Hinesly, T.D. et al., 1978. #95 | Corn | B77 | | | | | |
| 462 | Hue, N.V., 1988. #104 | Sudangrass | Piper | | | | 0.97 | 5 |
| 463 | Hue, N.V., 1988. #104 | Sudangrass | Piper | | | | 0.97 | 5 |
| 464 | Hue, N.V., 1988. #104 | Sudangrass | Piper | | | | 0.97 | 5 |
| 465 | Hue, N.V., 1988. #104 | Sudangrass | Piper | | | | 0.97 | 5 |
| 466 | Kirkham, M.B., 1975 #125 | Corn | | | | | | |
| 467 | Kirkham, M.B., 1975 #125 | Corn | | | | | | |
| 468 | Kirkham, M.B., 1975 #125 | Corn | | | | | | 830 |
| 469 | Kirkham, M.B., 1983 #127 | Sorghum | Dekalb C-46 Plus | 6.7 | 7770 | | | 29.2 |
| 470 | Kirkham, M.B., 1983 #127 | Sorghum | Dekalb C-46 Plus | 6.7 | 7770 | | | 29.2 |
| 471 | MacLean, K.S. et al., 1987. #147 | Legume | | | | | | 8-17.6 |
| 472 | MacLean, K.S. et al., 1987. #147 | Legume | | | | | | 8-17.6 |
| 473 | MacLean, K.S. et al., 1987. #147 | GRASS | | | | | | 8-17.6 |
| 474 | MacLean, K.S. et al., 1987. #147 | GRASS | | | | | | 8-17.6 |
| 475 | Sikora, Lawrence J. et al., 1980. #214 | Oats | Clintford | 11.2 | 19 | | | 2 |
| 476 | Sikora, Lawrence J. et al., 1980. #214 | Oats | Clintford | 6.9 | 22 | | | 18 |
| 477 | Sikora, Lawrence J. et al., 1980. #214 | Wheat | Potomac | 11.2 | 19 | | | 2 |
| 478 | Sikora, Lawrence J. et al., 1980. #214 | Wheat | Potomac | 6.9 | 22 | | | 18 |
| 479 | Sikora, Lawrence J. et al., 1980. #214 | Chard | Fordhook Giant Swiss | 11.2 | 19 | | | 2 |
| 480 | Sikora, Lawrence J. et al., 1980. #214 | Chard | Fordhook Giant Swiss | 6.9 | 22 | | | 18 |
| 481 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 482 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 483 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 484 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 485 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 486 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 487 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 488 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 489 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 490 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 491 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 492 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 493 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 494 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 457 | | | | | | | | | | Maximum |
| 458 | | | | | | | | | | Maximum |
| 459 | | | | | | | | | | Maximum |
| 460 | | | | | | | | | | Maximum |
| 461 | | | | | | | | | | Maximum |
| 462 | | 440 | | 5 | 29 | | | 640 | | |
| 463 | | 440 | | 5 | 29 | | | 640 | | |
| 464 | | 440 | | 5 | 29 | | | 640 | | |
| 465 | | 440 | | 5 | 29 | | | 640 | | |
| 466 | | | | | | | | | | control |
| 467 | | | | | | | | | | supernatant |
| 468 | 5900 | 6020 | | | ND | 24000 | | 8390 | | sludge |
| 469 | 851 | 375 | | | 35.6 | 21300 | 124 | 1890 | | Sludge-treated soil |
| 470 | 851 | 375 | | | 35.6 | 21300 | 124 | 1890 | | Control |
| 471 | 31-130 | 398-678 | | | 28-56 | | 288-684 | 610-1398 | | Treated with sludge |
| 472 | 31-130 | 398-678 | | | 28-56 | | 288-684 | 610-1398 | | Untreated |
| 473 | 31-130 | 398-678 | | | 28-56 | | 288-684 | 610-1398 | | Treated with sludge |
| 474 | 31-130 | 398-678 | | | 28-56 | | 288-684 | 610-1398 | | Untreated |
| 475 | | 200 | | | | | | 400 | | Limed raw sludge |
| 476 | | 627 | | | | | | 2050 | | Digested sludge |
| 477 | | 200 | | | | | | 400 | | Limed raw sludge |
| 478 | | 627 | | | | | | 2050 | | Digested sludge |
| 479 | | 200 | | | | | | 400 | | Limed raw sludge |
| 480 | | 627 | | | | | | 2050 | | Digested sludge |
| 481 | | | | | | | | | | |
| 482 | | | | | | | | | | |
| 483 | | | | | | | | | | |
| 484 | | | | | | | | | | |
| 485 | | | | | | | | | | |
| 486 | | | | | | | | | | |
| 487 | | | | | | | | | | |
| 488 | | | | | | | | | | |
| 489 | | | | | | | | | | |
| 490 | | | | | | | | | | |
| 491 | | | | | | | | | | |
| 492 | | | | | | | | | | |
| 493 | | | | | | | | | | |
| 494 | | | | | | | | | | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 457 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 458 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 459 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 460 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 461 | | 71 | | 7 | Aeric Ochraqualf | Blount | silt loam |
| 462 | | 0 | 0 | 3 | Tropeptic Eutrustox | Wahiawa | silty clay |
| 463 | | 45 | 45 | 3 | Tropeptic Eutrustox | Wahiawa | silty clay |
| 464 | | 90 | 90 | 3 | Tropeptic Eutrustox | Wahiawa | silty clay |
| 465 | | 180 | 180 | 0 | Tropeptic Eutrustox | Wahiawa | silty clay |
| 466 | | 0 | | 8 | | Warsaw | silt loam |
| 467 | | | | 8 | | Warsaw | silt loam |
| 468 | | | 1010 | 8 | | Warsaw | silt loam |
| 469 | | 32 | 128 | | Typic Udifluvent | Haynie | vf sandy loam |
| 470 | | 32 | 128 | | Typic Udifluvent | Haynie | vf sandy loam |
| 471 | | 44.9(WET WT.) | 44.9(WET WT.) | 1-2 years | | | CL, SL |
| 472 | | 0 | 0 | 1-2 years | | | CL, SL |
| 473 | | | | | | | CL, SL |
| 474 | | | | | | | CL, SL |
| 475 | | | | | | Galestown-Evesboro | loamy sand |
| 476 | | | | | | | |
| 477 | | | | | | | |
| 478 | | | | | | | |
| 479 | | | | | | | |
| 480 | | | | | | | |
| 481 | | 0 | 0 | | | DUBLIN | L |
| 482 | | 0 | 0 | | | DUBLIN | L |
| 483 | | 0 | 0 | | | DUBLIN | L |
| 484 | | 0 | 0 | | | DUBLIN | L |
| 485 | | 0 | 0 | | | DUBLIN | L |
| 486 | | 0 | 0 | | | DUBLIN | L |
| 487 | | 0 | 0 | | | DUBLIN | L |
| 488 | | 0 | 0 | | | DUBLIN | L |
| 489 | | 0 | 0 | | | DUBLIN | L |
| 490 | | 0 | 0 | | | DUBLIN | L |
| 491 | | 0 | 0 | | | DUBLIN | L |
| 492 | | 0 | 0 | | | DUBLIN | L |
| 493 | | 0 | 0 | | | DUBLIN | L |
| 494 | | 0 | 0 | | | DUBLIN | L |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 457 | | | | | | | |
| 458 | | | | | | | |
| 459 | | | | | | | |
| 460 | | | | | | | |
| 461 | | | | | | | |
| 462 | | | | | 1.14 | 5.32 | 0 |
| 463 | | | | | 1.22 | 5.77 | 29 |
| 464 | | | | | 1.34 | 6.03 | 58 |
| 465 | | | | | 1.6 | 6.38 | 116 |
| 466 | | | | 21.1 | 3.9 | 6.2 | |
| 467 | | | | | | 5.9 | |
| 468 | | | | | | 5.9 | 10650 |
| 469 | | | | | | 5.9 | |
| 470 | | | | | | 7 | |
| 471 | | | | | 6.98 | 6.2 | |
| 472 | | | | | 7.48 | 6.05 | |
| 473 | | | | | 6.98 | 6.2 | |
| 474 | | | | | 7.48 | 6.05 | |
| 475 | | | | | | 6.7 | |
| 476 | | | | | | 6.7 | |
| 477 | | | | | | 6.7 | |
| 478 | | | | | | 6.7 | |
| 479 | | | | | | 6.7 | |
| 480 | | | | | | 6.7 | |
| 481 | | | | 20 | | 5.5 | 0 |
| 482 | | | | 20 | | 5.5 | 0 |
| 483 | | | | 20 | | 5.5 | 0 |
| 484 | | | | 20 | | 5.5 | 0 |
| 485 | | | | 20 | | 5.5 | 0 |
| 486 | | | | 20 | | 5.5 | 0 |
| 487 | | | | 20 | | 5.5 | 0 |
| 488 | | | | 20 | | 5.5 | 0 |
| 489 | | | | 20 | | 5.5 | 0 |
| 490 | | | | 20 | | 5.5 | 0 |
| 491 | | | | 20 | | 5.5 | 0 |
| 492 | | | | 20 | | 5.5 | 0 |
| 493 | | | | 20 | | 5.5 | 0 |
| 494 | | | | 20 | | 5.5 | 0 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 457 | | 454 | 104.9 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 458 | | 454 | 102.9 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 459 | | 454 | 94.3 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 460 | | 454 | 88 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 461 | | 454 | 61.8 | | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 462 | DTPA | 3.7 | 176 | ABOVE GROUND | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 463 | DTPA | 8.1 | 150 | ABOVE GROUND | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 464 | DTPA | 10.3 | 115 | ABOVE GROUND | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 465 | DTPA | 13.6 | 172 | ABOVE GROUND | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 466 | TOTAL | 158 | 67 | LEAF | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 467 | TOTAL | 988 | 202 | LEAF | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 468 | TOTAL | 2065 | 196 | LEAF | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 469 | | 10.2 | 37 | Leaf | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 470 | | 0.8 | 37 | Leaf | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 471 | .1 N HCL | 2.57 | 28.4 | Above Ground | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 472 | .1 N HCL | 2.2 | 25.9 | Above Ground | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 473 | .1 N HCL | 2.57 | 20.8 | Above Ground | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 474 | .1 N HCL | 2.2 | 23 | Above Ground | SLUDGE, FIELD, MATURITY | NOT REPORTED | |
| 475 | | 4.2 | 5.3 | Stover | SLUDGE, FIELD, MATURITY | | |
| 476 | | 14.5 | 71.4 | Stover | SLUDGE, FIELD, MATURITY | | |
| 477 | | 4.2 | 5.3 | Stover | SLUDGE, FIELD, MATURITY | | |
| 478 | | 14.5 | 69.7 | Stover | SLUDGE, FIELD, MATURITY | | |
| 479 | | 4.2 | 53 | Whole | SLUDGE, FIELD, MATURITY | | |
| 480 | | 14.5 | 254 | Whole | SLUDGE, FIELD, MATURITY | | |
| 481 | | | 72 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 482 | | | 58 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 483 | | | 71 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 484 | | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 485 | | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 486 | | | 116 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 487 | | | 68 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 488 | | | 90 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 489 | | | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 490 | | | 47 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 491 | | | 47 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 492 | | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 493 | | | 73 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 494 | | | 61 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 457 | | | NO | |
| 458 | | | NO | |
| 459 | | | NO | |
| 460 | | | NO | |
| 461 | | | NO | |
| 462 | | | NO | YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION |
| 463 | | | NO | YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION |
| 464 | | | NO | YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION |
| 465 | | | NO | YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION |
| 466 | | | NO | |
| 467 | | | NO | |
| 468 | | | NO | |
| 469 | | | NO | |
| 470 | | | NO | |
| 471 | | | NO | |
| 472 | | | NO | |
| 473 | | | NO | |
| 474 | | | NO | |
| 475 | | | NO | |
| 476 | | | NO | |
| 477 | | | NO | |
| 478 | | | NO | |
| 479 | | | NO | |
| 480 | | | NO | |
| 481 | | | NO | |
| 482 | | | NO | |
| 483 | | | NO | |
| 484 | | | NO | |
| 485 | | | NO | |
| 486 | | | NO | |
| 487 | | | NO | |
| 488 | | | NO | |
| 489 | | | NO | |
| 490 | | | NO | |
| 491 | | | NO | |
| 492 | | | NO | |
| 493 | | | NO | |
| 494 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 457 | Joliet, Ill. |
| 458 | Joliet, Ill. |
| 459 | Joliet, Ill. |
| 460 | Joliet, Ill. |
| 461 | Joliet, Ill. |
| 462 | OAHU, HAWAII |
| 463 | OAHU, HAWAII |
| 464 | OAHU, HAWAII |
| 465 | OAHU, HAWAII |
| 466 | Dayton, Ohio |
| 467 | Dayton, Ohio |
| 468 | Dayton, Ohio |
| 469 | Manhattan, Kansas |
| 470 | Manhattan, Kansas |
| 471 | Pictou county, Nova Scotia |
| 472 | Pictou county, Nova Scotia |
| 473 | Pictou county, Nova Scotia |
| 474 | Pictou county, Nova Scotia |
| 475 | Beltsville, Maryland |
| 476 | Beltsville, Maryland |
| 477 | Beltsville, Maryland |
| 478 | Beltsville, Maryland |
| 479 | Beltsville, Maryland |
| 480 | Beltsville, Maryland |
| 481 | BERKELEY, CALIFORNIA |
| 482 | BERKELEY, CALIFORNIA |
| 483 | BERKELEY, CALIFORNIA |
| 484 | BERKELEY, CALIFORNIA |
| 485 | BERKELEY, CALIFORNIA |
| 486 | BERKELEY, CALIFORNIA |
| 487 | BERKELEY, CALIFORNIA |
| 488 | BERKELEY, CALIFORNIA |
| 489 | BERKELEY, CALIFORNIA |
| 490 | BERKELEY, CALIFORNIA |
| 491 | BERKELEY, CALIFORNIA |
| 492 | BERKELEY, CALIFORNIA |
| 493 | BERKELEY, CALIFORNIA |
| 494 | BERKELEY, CALIFORNIA |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 495 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 496 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 497 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 498 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 499 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 500 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 501 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 502 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 503 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 504 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 505 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 506 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 507 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 508 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 509 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 510 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 511 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 512 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 513 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 514 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 515 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 516 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 517 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 518 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 519 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 520 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 521 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 522 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 523 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 524 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 525 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 526 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 527 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 528 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 529 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 37 |
| 530 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 531 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 532 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 495 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 496 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 497 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 498 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 499 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 500 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 501 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 502 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 503 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 504 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 505 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 506 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 507 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 508 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 509 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 510 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 511 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 512 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 513 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 514 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 515 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 516 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 517 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 518 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 519 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 520 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 521 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 522 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 523 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 524 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 525 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 526 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 527 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | PRIMARY |
| 528 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 529 | 1470 | 600 | 2.2 | 3.3 | 180 | 1.6 | 1090 | 3910 | 0.2 | SECONDARY |
| 530 | | | | | | | | | | |
| 531 | | | | | | | | | | |
| 532 | | | | | | | | | | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 495 | | 45 | 45 | 0 | | DUBLIN | L |
| 496 | | 45 | 90 | 0 | | DUBLIN | L |
| 497 | | 45 | 135 | 0 | | DUBLIN | L |
| 498 | | 45 | 180 | 0 | | DUBLIN | L |
| 499 | | 45 | 225 | 0 | | DUBLIN | L |
| 500 | | 45 | 270 | 0 | | DUBLIN | L |
| 501 | | 45 | 315 | 0 | | DUBLIN | L |
| 502 | | 90 | 90 | 0 | | DUBLIN | L |
| 503 | | 90 | 180 | 0 | | DUBLIN | L |
| 504 | | 90 | 270 | 0 | | DUBLIN | L |
| 505 | | 90 | 360 | 0 | | DUBLIN | L |
| 506 | | 90 | 450 | 0 | | DUBLIN | L |
| 507 | | 90 | 540 | 0 | | DUBLIN | L |
| 508 | | 90 | 630 | 0 | | DUBLIN | L |
| 509 | | 135 | 135 | 0 | | DUBLIN | L |
| 510 | | 135 | 270 | 0 | | DUBLIN | L |
| 511 | | 135 | 405 | 0 | | DUBLIN | L |
| 512 | | 135 | 540 | 0 | | DUBLIN | L |
| 513 | | 135 | 675 | 0 | | DUBLIN | L |
| 514 | | 135 | 810 | 0 | | DUBLIN | L |
| 515 | | 135 | 945 | 0 | | DUBLIN | L |
| 516 | | 180 | 180 | 0 | | DUBLIN | L |
| 517 | | 180 | 360 | 0 | | DUBLIN | L |
| 518 | | 180 | 540 | 0 | | DUBLIN | L |
| 519 | | 180 | 720 | 0 | | DUBLIN | L |
| 520 | | 180 | 900 | 0 | | DUBLIN | L |
| 521 | | 180 | 1080 | 0 | | DUBLIN | L |
| 522 | | 180 | 1260 | 0 | | DUBLIN | L |
| 523 | | 225 | 225 | 0 | | DUBLIN | L |
| 524 | | 225 | 450 | 0 | | DUBLIN | L |
| 525 | | 225 | 675 | 0 | | DUBLIN | L |
| 526 | | 225 | 900 | 0 | | DUBLIN | L |
| 527 | | 225 | 1125 | 0 | | DUBLIN | L |
| 528 | | 225 | 1350 | 0 | | DUBLIN | L |
| 529 | | 225 | 1575 | 0 | | DUBLIN | L |
| 530 | | 0 | 0 | | | DUBLIN | L |
| 531 | | 0 | 0 | | | DUBLIN | L |
| 532 | | 0 | 0 | | | DUBLIN | L |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 495 | | | | 20 | | 5 | 176 |
| 496 | | | | 20 | | 5 | 352 |
| 497 | | | | 20 | | 5 | 528 |
| 498 | | | | 20 | | 5 | 686 |
| 499 | | | | 20 | | 5 | 815 |
| 500 | | | | 20 | | 5 | 995 |
| 501 | | | | 20 | | 5 | 1210 |
| 502 | | | | 20 | | 5.2 | 352 |
| 503 | | | | 20 | | 5.2 | 704 |
| 504 | | | | 20 | | 5.2 | 1056 |
| 505 | | | | 20 | | 5.2 | 1373 |
| 506 | | | | 20 | | 5.2 | 1630 |
| 507 | | | | 20 | | 5.2 | 1989 |
| 508 | | | | 20 | | 5.2 | 2419 |
| 509 | | | | 20 | | 4.5 | 528 |
| 510 | | | | 20 | | 4.5 | 1056 |
| 511 | | | | 20 | | 4.5 | 1584 |
| 512 | | | | 20 | | 4.5 | 2058 |
| 513 | | | | 20 | | 4.5 | 2445 |
| 514 | | | | 20 | | 4.5 | 2984 |
| 515 | | | | 20 | | 4.5 | 3029 |
| 516 | | | | 20 | | 4.5 | 704 |
| 517 | | | | 20 | | 4.5 | 1408 |
| 518 | | | | 20 | | 4.5 | 2112 |
| 519 | | | | 20 | | 4.5 | 2746 |
| 520 | | | | 20 | | 4.5 | 3261 |
| 521 | | | | 20 | | 4.5 | 3979 |
| 522 | | | | 20 | | 4.5 | 4839 |
| 523 | | | | 20 | | NR | 880 |
| 524 | | | | 20 | | NR | 1760 |
| 525 | | | | 20 | | NR | 2640 |
| 526 | | | | 20 | | NR | 3432 |
| 527 | | | | 20 | | NR | 4076 |
| 528 | | | | 20 | | NR | 4974 |
| 529 | | | | 20 | | NR | 6050 |
| 530 | | | | 20 | | 5.5 | 0 |
| 531 | | | | 20 | | 5.5 | 0 |
| 532 | | | | 20 | | 5.5 | 0 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 495 | | | 76 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 496 | | | 81 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 497 | | | 90 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 498 | | | 100 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 499 | | | 127 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 500 | | | 147 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 501 | | | 149 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 502 | | | 92 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 503 | | | 85 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 504 | | | 115 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 505 | | | 131 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 506 | | | 127 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 507 | | | 333 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 508 | | | 236 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 509 | | | 81 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 510 | | | 159 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 511 | | | 215 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 512 | | | 259 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 513 | | | 351 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 514 | | | 435 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 515 | | | 462 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 516 | | | 113 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 517 | | | 150 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 518 | | | 248 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 519 | | | 341 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 520 | | | 402 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 521 | | | 455 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 522 | | | 820 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 523 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 524 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 525 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 526 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 527 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 528 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 529 | | | NR | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 530 | | | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 531 | | | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 532 | | | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 495 | | | NO | |
| 496 | | | NO | |
| 497 | | | NO | |
| 498 | | | NO | |
| 499 | | | NO | |
| 500 | | | NO | |
| 501 | | | NO | |
| 502 | | | NO | |
| 503 | | | NO | |
| 504 | | | NO | |
| 505 | | | NO | |
| 506 | | | NO | |
| 507 | | | NO | |
| 508 | | | NO | |
| 509 | | | NO | |
| 510 | | | NO | |
| 511 | | | NO | |
| 512 | | | NO | |
| 513 | | | NO | |
| 514 | | | NO | |
| 515 | | | NO | |
| 516 | | | NO | |
| 517 | | | NO | |
| 518 | | | NO | |
| 519 | | | NO | |
| 520 | | | NO | |
| 521 | | | NO | |
| 522 | | | NO | |
| 523 | | | NO | |
| 524 | | | NO | |
| 525 | | | NO | |
| 526 | | | NO | |
| 527 | | | NO | |
| 528 | | | NO | |
| 529 | | | NO | |
| 530 | | | NO | |
| 531 | | | NO | |
| 532 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 495 | BERKELEY, CALIFORNIA |
| 496 | BERKELEY, CALIFORNIA |
| 497 | BERKELEY, CALIFORNIA |
| 498 | BERKELEY, CALIFORNIA |
| 499 | BERKELEY, CALIFORNIA |
| 500 | BERKELEY, CALIFORNIA |
| 501 | BERKELEY, CALIFORNIA |
| 502 | BERKELEY, CALIFORNIA |
| 503 | BERKELEY, CALIFORNIA |
| 504 | BERKELEY, CALIFORNIA |
| 505 | BERKELEY, CALIFORNIA |
| 506 | BERKELEY, CALIFORNIA |
| 507 | BERKELEY, CALIFORNIA |
| 508 | BERKELEY, CALIFORNIA |
| 509 | BERKELEY, CALIFORNIA |
| 510 | BERKELEY, CALIFORNIA |
| 511 | BERKELEY, CALIFORNIA |
| 512 | BERKELEY, CALIFORNIA |
| 513 | BERKELEY, CALIFORNIA |
| 514 | BERKELEY, CALIFORNIA |
| 515 | BERKELEY, CALIFORNIA |
| 516 | BERKELEY, CALIFORNIA |
| 517 | BERKELEY, CALIFORNIA |
| 518 | BERKELEY, CALIFORNIA |
| 519 | BERKELEY, CALIFORNIA |
| 520 | BERKELEY, CALIFORNIA |
| 521 | BERKELEY, CALIFORNIA |
| 522 | BERKELEY, CALIFORNIA |
| 523 | BERKELEY, CALIFORNIA |
| 524 | BERKELEY, CALIFORNIA |
| 525 | BERKELEY, CALIFORNIA |
| 526 | BERKELEY, CALIFORNIA |
| 527 | BERKELEY, CALIFORNIA |
| 528 | BERKELEY, CALIFORNIA |
| 529 | BERKELEY, CALIFORNIA |
| 530 | BERKELEY, CALIFORNIA |
| 531 | BERKELEY, CALIFORNIA |
| 532 | BERKELEY, CALIFORNIA |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 533 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 534 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 535 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 536 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 537 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 538 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 539 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 540 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 541 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 542 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 543 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | |
| 544 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 545 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 546 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 547 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 548 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 549 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 550 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 551 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 552 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 553 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 554 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 555 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 556 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 557 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 558 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 559 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 560 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 561 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 562 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 563 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 564 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 565 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 566 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 567 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 568 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 569 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 570 | Vlamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 533 | | | | | | | | | | |
| 534 | | | | | | | | | | |
| 535 | | | | | | | | | | |
| 536 | | | | | | | | | | |
| 537 | | | | | | | | | | |
| 538 | | | | | | | | | | |
| 539 | | | | | | | | | | |
| 540 | | | | | | | | | | |
| 541 | | | | | | | | | | |
| 542 | | | | | | | | | | |
| 543 | | | | | | | | | | |
| 544 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 545 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 546 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 547 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 548 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 549 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 550 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 551 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 552 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 553 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 554 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 555 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 556 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 557 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 558 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 559 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 560 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 561 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 562 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 563 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 564 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 565 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 566 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 567 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 568 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 569 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 570 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 533 | | 0 | 0 | | | DUBLIN | L |
| 534 | | 0 | 0 | | | DUBLIN | L |
| 535 | | 0 | 0 | | | DUBLIN | L |
| 536 | | 0 | 0 | | | DUBLIN | L |
| 537 | | 0 | 0 | | | DUBLIN | L |
| 538 | | 0 | 0 | | | DUBLIN | L |
| 539 | | 0 | 0 | | | DUBLIN | L |
| 540 | | 0 | 0 | | | DUBLIN | L |
| 541 | | 0 | 0 | | | DUBLIN | L |
| 542 | | 0 | 0 | | | DUBLIN | L |
| 543 | | 0 | 0 | | | DUBLIN | L |
| 544 | | 45 | 45 | 0 | | DUBLIN | L |
| 545 | | 45 | 90 | 0 | | DUBLIN | L |
| 546 | | 45 | 135 | 0 | | DUBLIN | L |
| 547 | | 45 | 180 | 0 | | DUBLIN | L |
| 548 | | 45 | 225 | 0 | | DUBLIN | L |
| 549 | | 45 | 270 | 0 | | DUBLIN | L |
| 550 | | 45 | 315 | 0 | | DUBLIN | L |
| 551 | | 90 | 90 | 0 | | DUBLIN | L |
| 552 | | 90 | 180 | 0 | | DUBLIN | L |
| 553 | | 90 | 270 | 0 | | DUBLIN | L |
| 554 | | 90 | 360 | 0 | | DUBLIN | L |
| 555 | | 90 | 450 | 0 | | DUBLIN | L |
| 556 | | 90 | 540 | 0 | | DUBLIN | L |
| 557 | | 90 | 630 | 0 | | DUBLIN | L |
| 558 | | 135 | 135 | 0 | | DUBLIN | L |
| 559 | | 135 | 270 | 0 | | DUBLIN | L |
| 560 | | 135 | 405 | 0 | | DUBLIN | L |
| 561 | | 135 | 540 | 0 | | DUBLIN | L |
| 562 | | 135 | 675 | 0 | | DUBLIN | L |
| 563 | | 135 | 810 | 0 | | DUBLIN | L |
| 564 | | 135 | 945 | 0 | | DUBLIN | L |
| 565 | | 180 | 180 | 0 | | DUBLIN | L |
| 566 | | 180 | 360 | 0 | | DUBLIN | L |
| 567 | | 180 | 540 | 0 | | DUBLIN | L |
| 568 | | 180 | 720 | 0 | | DUBLIN | L |
| 569 | | 180 | 900 | 0 | | DUBLIN | L |
| 570 | | 180 | 1080 | 0 | | DUBLIN | L |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 533 | | | | 20 | | 5.5 | 0 |
| 534 | | | | 20 | | 5.5 | 0 |
| 535 | | | | 20 | | 5.5 | 0 |
| 536 | | | | 20 | | 5.5 | 0 |
| 537 | | | | 20 | | 5.5 | 0 |
| 538 | | | | 20 | | 5.5 | 0 |
| 539 | | | | 20 | | 5.5 | 0 |
| 540 | | | | 20 | | 5.5 | 0 |
| 541 | | | | 20 | | 5.5 | 0 |
| 542 | | | | 20 | | 5.5 | 0 |
| 543 | | | | 20 | | 5.5 | 0 |
| 544 | | | | 20 | | 7 | 20 |
| 545 | | | | 20 | | 7 | 40 |
| 546 | | | | 20 | | 7 | 60 |
| 547 | | | | 20 | | 7 | 92 |
| 548 | | | | 20 | | 7 | 109 |
| 549 | | | | 20 | | 7 | 130 |
| 550 | | | | 20 | | 7 | 152 |
| 551 | | | | 20 | | 7 | 40 |
| 552 | | | | 20 | | 7 | 79 |
| 553 | | | | 20 | | 7 | 119 |
| 554 | | | | 20 | | 7 | 183 |
| 555 | | | | 20 | | 7 | 218 |
| 556 | | | | 20 | | 7 | 259 |
| 557 | | | | 20 | | 7 | 302 |
| 558 | | | | 20 | | 7 | 59 |
| 559 | | | | 20 | | 7 | 119 |
| 560 | | | | 20 | | 7 | 178 |
| 561 | | | | 20 | | 7 | 275 |
| 562 | | | | 20 | | 7 | 325 |
| 563 | | | | 20 | | 7 | 388 |
| 564 | | | | 20 | | 7 | 454 |
| 565 | | | | 20 | | 7 | 99 |
| 566 | | | | 20 | | 7 | 198 |
| 567 | | | | 20 | | 7 | 297 |
| 568 | | | | 20 | | 7 | 426 |
| 539 | | | | 20 | | 7 | 494 |
| 570 | | | | 20 | | 7 | 577 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 533 | | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 534 | | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 535 | | | 98 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 536 | | | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 537 | | | 69 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 538 | | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 539 | | | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 540 | | | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 541 | | | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 542 | | | 96 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 543 | | | 45 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 544 | | | 66 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 545 | | | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 546 | | | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 547 | | | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 548 | | | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 549 | | | 93 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 550 | | | 54 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 551 | | | 69 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 552 | | | 49 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 553 | | | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 554 | | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 555 | | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 556 | | | 83 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 557 | | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 558 | | | 73 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 559 | | | 59 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 560 | | | 61 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 561 | | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 562 | | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 563 | | | 81 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 564 | | | 61 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 565 | | | 79 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 566 | | | 55 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 567 | | | 63 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 568 | | | 49 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 569 | | | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 570 | | | 89 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 533 | | | NO | |
| 534 | | | NO | |
| 535 | | | NO | |
| 536 | | | NO | |
| 537 | | | NO | |
| 538 | | | NO | |
| 539 | | | NO | |
| 540 | | | NO | |
| 541 | | | NO | |
| 542 | | | NO | |
| 543 | | | NO | |
| 544 | | | NO | |
| 545 | | | NO | |
| 546 | | | NO | |
| 547 | | | NO | |
| 548 | | | NO | |
| 549 | | | NO | |
| 550 | | | NO | |
| 551 | | | NO | |
| 552 | | | NO | |
| 553 | | | NO | |
| 554 | | | NO | |
| 555 | | | NO | |
| 556 | | | NO | |
| 557 | | | NO | |
| 558 | | | NO | |
| 559 | | | NO | |
| 560 | | | NO | |
| 561 | | | NO | |
| 562 | | | NO | |
| 563 | | | NO | |
| 564 | | | NO | |
| 565 | | | NO | |
| 566 | | | NO | |
| 567 | | | NO | |
| 568 | | | NO | |
| 569 | | | NO | |
| 570 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 533 | BERKELEY, CALIFORNIA |
| 534 | BERKELEY, CALIFORNIA |
| 535 | BERKELEY, CALIFORNIA |
| 536 | BERKELEY, CALIFORNIA |
| 537 | BERKELEY, CALIFORNIA |
| 538 | BERKELEY, CALIFORNIA |
| 539 | BERKELEY, CALIFORNIA |
| 540 | BERKELEY, CALIFORNIA |
| 541 | BERKELEY, CALIFORNIA |
| 542 | BERKELEY, CALIFORNIA |
| 543 | BERKELEY, CALIFORNIA |
| 544 | BERKELEY, CALIFORNIA |
| 545 | BERKELEY, CALIFORNIA |
| 546 | BERKELEY, CALIFORNIA |
| 547 | BERKELEY, CALIFORNIA |
| 548 | BERKELEY, CALIFORNIA |
| 549 | BERKELEY, CALIFORNIA |
| 550 | BERKELEY, CALIFORNIA |
| 551 | BERKELEY, CALIFORNIA |
| 552 | BERKELEY, CALIFORNIA |
| 553 | BERKELEY, CALIFORNIA |
| 554 | BERKELEY, CALIFORNIA |
| 555 | BERKELEY, CALIFORNIA |
| 556 | BERKELEY, CALIFORNIA |
| 557 | BERKELEY, CALIFORNIA |
| 558 | BERKELEY, CALIFORNIA |
| 559 | BERKELEY, CALIFORNIA |
| 560 | BERKELEY, CALIFORNIA |
| 561 | BERKELEY, CALIFORNIA |
| 562 | BERKELEY, CALIFORNIA |
| 563 | BERKELEY, CALIFORNIA |
| 564 | BERKELEY, CALIFORNIA |
| 565 | BERKELEY, CALIFORNIA |
| 566 | BERKELEY, CALIFORNIA |
| 567 | BERKELEY, CALIFORNIA |
| 568 | BERKELEY, CALIFORNIA |
| 569 | BERKELEY, CALIFORNIA |
| 570 | BERKELEY, CALIFORNIA |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 571 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 572 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 573 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 574 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 575 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 576 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 577 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 578 | Viamis, J. et al., 1985. #245 | Barley | MARIOUT | | | | | 8 |
| 579 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 580 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 581 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 582 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 583 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 584 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 585 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 586 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 587 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 588 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 589 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 590 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 591 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 592 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 593 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 594 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 595 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 596 | Rappaport, B.D. et al., 1987. #197 | Corn | Pioneer 3192 | | | | | |
| 597 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 598 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 599 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 600 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 601 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 602 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 603 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 604 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 605 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 606 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 607 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 608 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 571 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 572 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 573 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 574 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 575 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 576 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 577 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 578 | 40 | 180 | 1.2 | 1.1 | 40 | 0.4 | 250 | 440 | 1 | COMPOSTED |
| 579 | | | | | | | | | | |
| 580 | | | | | | | | | | |
| 581 | | | | | | | | | | |
| 582 | | | | | | | | | | |
| 583 | | | | | | | | | | |
| 584 | | | | | | | | | | |
| 585 | | | | | | | | | | |
| 586 | | | | | | | | | | |
| 587 | | | | | | | | | | |
| 588 | | | | | | | | | | |
| 589 | | | | | | | | | | |
| 590 | | | | | | | | | | |
| 591 | | | | | | | | | | |
| 592 | | | | | | | | | | |
| 593 | | | | | | | | | | |
| 594 | | | | | | | | | | |
| 595 | | | | | | | | | | |
| 596 | | | | | | | | | | |
| 597 | | | | | | | | 1987 | | |
| 598 | | | | | | | | 1987 | | |
| 599 | | | | | | | | 1987 | | |
| 600 | | | | | | | | 1987 | | |
| 601 | | | | | | | | 1987 | | |
| 602 | | | | | | | | 1987 | | |
| 603 | | | | | | | | 1987 | | |
| 604 | | | | | | | | 1987 | | |
| 605 | | | | | | | | 1987 | | |
| 606 | | | | | | | | 1987 | | |
| 607 | | | | | | | | 1987 | | |
| 608 | | | | | | | | 1987 | | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 571 | | 180 | 1260 | 0 | | DUBLIN | L |
| 572 | | 225 | 225 | 0 | | DUBLIN | L |
| 573 | | 225 | 450 | 0 | | DUBLIN | L |
| 574 | | 225 | 675 | 0 | | DUBLIN | L |
| 575 | | 225 | 900 | 0 | | DUBLIN | L |
| 576 | | 225 | 1125 | 0 | | DUBLIN | L |
| 577 | | 225 | 1350 | 0 | | DUBLIN | L |
| 578 | | 225 | 1575 | 0 | | DUBLIN | L |
| 579 | | | | | Typic Hapludult | Bojac | loamy sand |
| 580 | | | | | Typic Hapludult | Bojac | loamy sand |
| 581 | | | | | Typic Hapludult | Bojac | loamy sand |
| 582 | | | | | Typic Hapludult | Bojac | loamy sand |
| 583 | | | | | Typic Hapludult | Bojac | loamy sand |
| 584 | | | | | Typic Hapludult | Bojac | loamy sand |
| 585 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 586 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 587 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 588 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 589 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 590 | | | | | Rhodic Paleudult | Davidson | clay loam |
| 591 | | | | | Typic Hapludult | Groseclose | silt loam |
| 592 | | | | | Typic Hapludult | Groseclose | silt loam |
| 593 | | | | | Typic Hapludult | Groseclose | silt loam |
| 594 | | | | | Typic Hapludult | Groseclose | silt loam |
| 595 | | | | | Typic Hapludult | Groseclose | silt loam |
| 596 | | | | | Typic Hapludult | Groseclose | silt loam |
| 597 | | | 0 | 1 | Typic Hapludoll | Waukegan | silt loam |
| 598 | | | 60 | 1 | Typic Hapludoll | Waukegan | silt loam |
| 599 | | | 120 | 1 | Typic Hapludoll | Waukegan | silt loam |
| 600 | | | 180 | 1 | Typic Hapludoll | Waukegan | silt loam |
| 601 | | | 0 | 2 | Typic Hapludoll | Waukegan | silt loam |
| 602 | | | 60 | 2 | Typic Hapludoll | Waukegan | silt loam |
| 603 | | | 120 | 2 | Typic Hapludoll | Waukegan | silt loam |
| 604 | | | 180 | 2 | Typic Hapludoll | Waukegan | silt loam |
| 605 | | | 0 | 3 | Typic Hapludoll | Waukegan | silt loam |
| 606 | | | 60 | 3 | Typic Hapludoll | Waukegan | silt loam |
| 607 | | | 120 | 3 | Typic Hapludoll | Waukegan | silt loam |
| 608 | | | 180 | 3 | Typic Hapludoll | Waukegan | silt loam |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 571 | | | | 20 | | 7 | 664 |
| 572 | | | | 20 | | 7 | 119 |
| 573 | | | | 20 | | 7 | 238 |
| 574 | | | | 20 | | 7 | 356 |
| 575 | | | | 20 | | 7 | 518 |
| 576 | | | | 20 | | 7 | 602 |
| 577 | | | | 20 | | 7 | 706 |
| 578 | | | | 20 | | 7 | 815 |
| 579 | 64 | 27.8 | 8.2 | 5.4 | | 6.1 | 0 |
| 580 | 64 | 27.8 | 8.2 | 5.4 | | 6.2 | 125 |
| 581 | 64 | 27.8 | 8.2 | 5.4 | | 6.1 | 248 |
| 582 | 64 | 27.8 | 8.2 | 5.4 | | 5.8 | 372 |
| 583 | 64 | 27.8 | 8.2 | 5.4 | | 6 | 496 |
| 584 | 64 | 27.8 | 8.2 | 5.4 | | 6 | 620 |
| 585 | 15.3 | 47.1 | 37.6 | 12.5 | | 5.7 | 0 |
| 586 | 15.3 | 47.1 | 37.6 | 12.5 | | 6 | 125 |
| 587 | 15.3 | 47.1 | 37.6 | 12.5 | | 5.8 | 248 |
| 588 | 15.3 | 47.1 | 37.6 | 12.5 | | 5.9 | 372 |
| 589 | 15.3 | 47.1 | 37.6 | 12.5 | | 5.9 | 496 |
| 590 | 15.3 | 47.1 | 37.6 | 12.5 | | 5.9 | 620 |
| 591 | 20.7 | 59.3 | 20 | 9.3 | | 5.7 | 0 |
| 592 | 20.7 | 59.3 | 20 | 9.3 | | 6 | 125 |
| 593 | 20.7 | 59.3 | 20 | 9.3 | | 5.9 | 248 |
| 594 | 20.7 | 59.3 | 20 | 9.3 | | 5.9 | 372 |
| 595 | 20.7 | 59.3 | 20 | 9.3 | | 5.9 | 496 |
| 596 | 20.7 | 59.3 | 20 | 9.3 | | 5.9 | 620 |
| 597 | | | | | | 6.2 | 0 |
| 598 | | | | | | 6.2 | 106 |
| 599 | | | | | | 6.2 | 219 |
| 600 | | | | | | 6.2 | 348 |
| 601 | | | | | | 6.2 | 0 |
| 602 | | | | | | 6.2 | 106 |
| 603 | | | | | | 6.2 | 219 |
| 604 | | | | | | 6.2 | 348 |
| 605 | | | | | | 6.2 | 0 |
| 606 | | | | | | 6.2 | 106 |
| 607 | | | | | | 6.2 | 219 |
| 608 | | | | | | 6.2 | 348 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 571 | | | 68 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 572 | | | 84 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 573 | | | 58 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 574 | | | 66 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 575 | | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 576 | | | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 577 | | | 88 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 578 | | | 77 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 579 | | | 66 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 580 | | | 69 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 581 | | | 68 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 582 | | | 56 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 583 | | | 60 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 584 | | | 71 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 585 | | | 21 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 586 | | | 21 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 587 | | | 25 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 588 | | | 26 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 589 | | | 28 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 590 | | | 27 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 591 | | | 22 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 592 | | | 28 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 593 | | | 39 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 594 | | | 40 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 595 | | | 48 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 596 | | | 45 | Ear Leaf | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 597 | | | 20 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 598 | | | 89 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 599 | | | 101 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 600 | | | 140 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 601 | | | 32 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 602 | | | 73 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 603 | | | 119 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 604 | | | 153 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 605 | | | 19 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 606 | | | 67 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 607 | | | 87 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 608 | | | 121 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 571 | | | NO | |
| 572 | | | NO | |
| 573 | | | NO | |
| 574 | | | NO | |
| 575 | | | NO | |
| 576 | | | NO | |
| 577 | | | NO | |
| 578 | | | NO | |
| 579 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 580 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 581 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 582 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 583 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 584 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 585 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 586 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 587 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 588 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 589 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 590 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 591 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 592 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 593 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 594 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 595 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 596 | 0 | STOVER | NO | YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT |
| 597 | 0 | GRAIN | NO | GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 598 | 0 | GRAIN | NO | GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 599 | 0 | GRAIN | NO | GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 600 | 0 | GRAIN | NO | GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 601 | 0 | GRAIN | NO | GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 602 | 43* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 603 | 26* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 604 | 24* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 605 | 0 | GRAIN | NO | |
| 606 | 22* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 607 | 5* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |
| 608 | 8* | GRAIN | *NO | *GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 571 | BERKELEY, CALIFORNIA |
| 572 | BERKELEY, CALIFORNIA |
| 573 | BERKELEY, CALIFORNIA |
| 574 | BERKELEY, CALIFORNIA |
| 575 | BERKELEY, CALIFORNIA |
| 576 | BERKELEY, CALIFORNIA |
| 577 | BERKELEY, CALIFORNIA |
| 578 | BERKELEY, CALIFORNIA |
| 579 | COASTAL PLAIN VIRGINIA |
| 580 | COASTAL PLAIN VIRGINIA |
| 581 | COASTAL PLAIN VIRGINIA |
| 582 | COASTAL PLAIN VIRGINIA |
| 583 | COASTAL PLAIN VIRGINIA |
| 584 | COASTAL PLAIN VIRGINIA |
| 585 | PIEDMONT VIRGINIA |
| 586 | PIEDMONT VIRGINIA |
| 587 | PIEDMONT VIRGINIA |
| 588 | PIEDMONT VIRGINIA |
| 589 | PIEDMONT VIRGINIA |
| 590 | PIEDMONT VIRGINIA |
| 591 | FOOTHILLS VIRGINIA |
| 592 | FOOTHILLS VIRGINIA |
| 593 | FOOTHILLS VIRGINIA |
| 594 | FOOTHILLS VIRGINIA |
| 595 | FOOTHILLS VIRGINIA |
| 596 | FOOTHILLS VIRGINIA |
| 597 | MINNESOTA |
| 598 | MINNESOTA |
| 599 | MINNESOTA |
| 600 | MINNESOTA |
| 601 | MINNESOTA |
| 602 | MINNESOTA |
| 603 | MINNESOTA |
| 604 | MINNESOTA |
| 605 | MINNESOTA |
| 606 | MINNESOTA |
| 607 | MINNESOTA |
| 608 | MINNESOTA |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 609 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 610 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 611 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 612 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 613 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 614 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 615 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 616 | BIDWELL AND DOWDY, 1987 | CORN | | | | | | 139 |
| 617 | BIDWELL AND DOWDY, 1987 | Corn | | | | | | |
| 618 | BIDWELL AND DOWDY, 1987 | Corn | | | | | | |
| 619 | BIDWELL AND DOWDY, 1987 | Corn | | | | | | |
| 620 | BIDWELL AND DOWDY, 1987 | Corn | | | | | | |
| 621 | RAPPAPORT ET AL 1987 | Corn | | | | | | |
| 622 | RAPPAPORT ET AL 1987 | Corn | | | | | | |
| 623 | RAPPAPORT ET AL 1987 | Corn | | | | | | |
| 624 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 625 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 626 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 627 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 628 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 629 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 630 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 631 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 632 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 633 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 634 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 635 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 636 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 637 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 638 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 639 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 640 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 641 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 642 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 643 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 644 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 645 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 646 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 609 | | | | | | | | 1987 | | |
| 610 | | | | | | | | 1987 | | |
| 611 | | | | | | | | 1987 | | |
| 612 | | | | | | | | 1987 | | |
| 613 | | | | | | | | 1987 | | |
| 614 | | | | | | | | 1987 | | |
| 615 | | | | | | | | 1987 | | |
| 616 | | | | | | | | 1987 | | |
| 617 | | | | | | | | | | Control |
| 618 | | | | | | | | | | Year 1, Years 2 and 3 |
| 619 | | | | | | | | | | Year 1, Years 2 and 3 |
| 620 | | | | | | | | | | Year 1, Years 2 and 3 |
| 621 | | | | | | | | | | |
| 622 | | | | | | | | | | |
| 623 | | | | | | | | | | |
| 624 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 625 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 626 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 627 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 628 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 629 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 630 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 631 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 632 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 633 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 634 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 635 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 636 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 637 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 638 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 639 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 640 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 641 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 642 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 643 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 644 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 645 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 646 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 609 | | | 0 | 4 | Typic Hapludoll | Waukegan | silt loam |
| 610 | | | 60 | 4 | Typic Hapludoll | Waukegan | silt loam |
| 611 | | | 120 | 4 | Typic Hapludoll | Waukegan | silt loam |
| 612 | | | 180 | 4 | Typic Hapludoll | Waukegan | silt loam |
| 613 | | | 0 | 5 | Typic Hapludoll | Waukegan | silt loam |
| 614 | | | 60 | 5 | Typic Hapludoll | Waukegan | silt loam |
| 615 | | | 120 | 5 | Typic Hapludoll | Waukegan | silt loam |
| 616 | | | 180 | 5 | Typic Hapludoll | Waukegan | silt loam |
| 617 | | 0 | 0 | 6 | Typic Hapludoll | Waukegan | silt loam |
| 618 | | 30,15 | 60 | 6 | Typic Hapludoll | Waukegan | silt loam |
| 619 | | 60,30 | 120 | 6 | Typic Hapludoll | Waukegan | silt loam |
| 620 | | 90,45 | 180 | 6 | Typic Hapludoll | Waukegan | silt loam |
| 621 | | 0 | | | Typic Ochraqualfs | Acredale | silt loam |
| 622 | | 42 | | | Typic Ochraqualfs | Acredale | silt loam |
| 623 | | 84 | | | Typic Ochraqualfs | Acredale | silt loam |
| 624 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 625 | | 22.5 | 22.5 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 626 | | 45 | 45 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 627 | | 90 | 90 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 628 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 629 | | 22.5 | 45 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 630 | | 45 | 90 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 631 | | 90 | 180 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 632 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 633 | | 22.5 | 68 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 634 | | 45 | 135 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 635 | | 90 | 271 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 636 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 637 | | 22.5 | 90 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 638 | | 45 | 180 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 639 | | 90 | 361 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 640 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 641 | | 22.5 | 113 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 642 | | 45 | 226 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 643 | | 90 | 451 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 644 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 645 | | 22.5 | 135 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 646 | | 45 | 271 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 609 | | | | | | 6.2 | 0 |
| 610 | | | | | | 6.2 | 106 |
| 611 | | | | | | 6.2 | 219 |
| 612 | | | | | | 6.2 | 348 |
| 613 | | | | | | 6.2 | 0 |
| 614 | | | | | | 6.2 | 106 |
| 615 | | | | | | 6.2 | 219 |
| 616 | | | | | | 6.2 | 348 |
| 617 | | | | | | 6.2 | 0 |
| 618 | | | | | | 6.2 | 106 |
| 619 | | | | | | 6.2 | 219 |
| 620 | | | | | | 6.2 | 348 |
| 621 | 37.8 | 52.3 | 9.9 | 6.9 | | 6.6 | 0 |
| 622 | 37.8 | 52.3 | 9.9 | 6.9 | | 6.6 | 124 |
| 623 | 37.8 | 52.3 | 9.9 | 6.9 | | 6.6 | 248 |
| 624 | | | | 40 | | 7.5 | 0 |
| 625 | | | | 40 | | 7.4 | 80 |
| 626 | | | | 40 | | 7.4 | 160 |
| 627 | | | | 40 | | 7.2 | 320 |
| 628 | | | | 40 | | 7.1 | 0 |
| 629 | | | | 40 | | 7 | 160 |
| 630 | | | | 40 | | 7.1 | 320 |
| 631 | | | | 40 | | 7.1 | 640 |
| 632 | | | | 40 | | 7.3 | 0 |
| 633 | | | | 40 | | 7.2 | 240 |
| 634 | | | | 40 | | 7.1 | 480 |
| 635 | | | | 40 | | 7.1 | 960 |
| 636 | | | | 40 | | 7.1 | 0 |
| 637 | | | | 40 | | 7 | 320 |
| 638 | | | | 40 | | 6.9 | 640 |
| 639 | | | | 40 | | 6.8 | 1280 |
| 640 | | | | 40 | | 7.2 | 0 |
| 641 | | | | 40 | | 6.9 | 400 |
| 642 | | | | 40 | | 6.8 | 800 |
| 643 | | | | 40 | | 6.6 | 1600 |
| 644 | | | | 40 | | 7 | 0 |
| 645 | | | | 40 | | 16.9 | 480 |
| 646 | | | | 40 | | 6.6 | 960 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 609 | | | 31 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 610 | | | 88 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 611 | | | 105 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 612 | | | 107 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 613 | | | 26 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 614 | | | 112 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 615 | | | 114 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 616 | | | 154 | Stover | SLUDGE, FIELD, MATURITY | 0 | STOVER |
| 617 | | | 18.5 | Stover | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 618 | | | 66.6 | Stover | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 619 | | | 75.8 | Stover | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 620 | | | 105 | Stover | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 621 | | 0.2 | 14 | Earleaf | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 622 | | | 27 | Earleaf | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 623 | | 25 | 31 | Earleaf | SLUDGE, FIELD, MATURITY | 0 | Stover |
| 624 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 625 | 4 N HNO3 | | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 626 | 4 N HNO3 | | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 627 | 4 N HNO3 | | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 628 | 4 N HNO3 | | 14 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 629 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 630 | 4 N HNO3 | | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 631 | 4 N HNO3 | | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 632 | 4 N HNO3 | | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 633 | 4 N HNO3 | | 17 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 634 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 635 | 4 N HNO3 | | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 636 | 4 N HNO3 | | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 637 | 4 N HNO3 | | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 638 | 4 N HNO3 | | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 639 | 4 N HNO3 | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 640 | 4 N HNO3 | | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 641 | 4 N HNO3 | | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 642 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 643 | 4 N HNO3 | | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 644 | 4 N HNO3 | | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 645 | 4 N HNO3 | | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 646 | 4 N HNO3 | | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 609 | 0 | GRAIN | NO | |
| 610 | 0 | GRAIN | NO | |
| 611 | 0 | GRAIN | NO | |
| 612 | 0 | GRAIN | NO | |
| 613 | 0 | GRAIN | NO | |
| 614 | 0 | GRAIN | NO | |
| 615 | 0 | GRAIN | NO | |
| 616 | 0 | GRAIN | NO | |
| 617 | 0 | GRAIN | NO | |
| 618 | 0 | GRAIN | NO | |
| 619 | 0 | GRAIN | NO | |
| 620 | 0 | GRAIN | NO | |
| 621 | | | NO | |
| 622 | | | NO | |
| 623 | | | NO | |
| 624 | | | NO | |
| 625 | | | NO | |
| 626 | | | NO | |
| 627 | | | NO | |
| 628 | | | NO | |
| 629 | | | NO | |
| 630 | | | NO | |
| 631 | | | NO | |
| 632 | | | NO | |
| 633 | | | NO | |
| 634 | | | NO | |
| 635 | | | NO | |
| 636 | | | NO | |
| 637 | | | NO | |
| 638 | | | NO | |
| 639 | | | NO | |
| 640 | | | NO | |
| 641 | | | NO | |
| 642 | | | NO | |
| 643 | | | NO | |
| 644 | | | NO | |
| 645 | | | NO | |
| 646 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 609 | MINNESOTA |
| 610 | MINNESOTA |
| 611 | MINNESOTA |
| 612 | MINNESOTA |
| 613 | MINNESOTA |
| 614 | MINNESOTA |
| 615 | MINNESOTA |
| 616 | MINNESOTA |
| 617 | MINNESOTA |
| 618 | MINNESOTA |
| 619 | MINNESOTA |
| 620 | MINNESOTA |
| 621 | Atlantic Coastal Plain |
| 622 | Atlantic Coastal Plain |
| 623 | Atlantic Coastal Plain |
| 624 | Riverside, California |
| 625 | Riverside, California |
| 626 | Riverside, California |
| 627 | Riverside, California |
| 628 | Riverside, California |
| 629 | Riverside, California |
| 630 | Riverside, California |
| 631 | Riverside, California |
| 632 | Riverside, California |
| 633 | Riverside, California |
| 634 | Riverside, California |
| 635 | Riverside, California |
| 636 | Riverside, California |
| 637 | Riverside, California |
| 638 | Riverside, California |
| 639 | Riverside, California |
| 640 | Riverside, California |
| 641 | Riverside, California |
| 642 | Riverside, California |
| 643 | Riverside, California |
| 644 | Riverside, California |
| 645 | Riverside, California |
| 646 | Riverside, California |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 647 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 648 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 649 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 650 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 651 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 652 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 653 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 654 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 655 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 656 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 657 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 658 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 659 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 660 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 661 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 662 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 663 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 664 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 665 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 666 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 667 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 668 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 669 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 670 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 671 | CHANG ET AL 1983 | BARLEY | | | 72 | | | 53 |
| 672 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 673 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 674 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 675 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 676 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 677 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 678 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 679 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 680 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 681 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 682 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 683 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 684 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 647 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 648 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 649 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 650 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 651 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 652 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 653 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 654 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 655 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 656 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 657 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 658 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 659 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 660 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 661 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 662 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 663 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 664 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 665 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 666 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 667 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 668 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 669 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 670 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 671 | 1437 | 896 | | 0.5 | 373 | 0.8 | 1153 | 3548 | 60 | AEROBICALLY DIG. COMPOSTED |
| 672 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 673 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 674 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 675 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 676 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 677 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 678 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 679 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 680 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 681 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 682 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 683 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 684 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 647 | | 90 | 541 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 648 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 649 | | 22.5 | 22.5 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 650 | | 45 | 45 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 651 | | 90 | 90 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 652 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 653 | | 22.5 | 45 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 654 | | 45 | 90 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 655 | | 90 | 180 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 656 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 657 | | 22.5 | 68 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 658 | | 45 | 135 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 659 | | 90 | 271 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 660 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 661 | | 22.5 | 90 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 662 | | 45 | 180 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 663 | | 90 | 361 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 664 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 665 | | 22.5 | 113 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 666 | | 45 | 226 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 667 | | 90 | 451 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 668 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 669 | | 22.5 | 135 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 670 | | 45 | 271 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 671 | | 90 | 541 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 672 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 673 | | 16 | 16 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 674 | | 30 | 30 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 675 | | 60 | 60 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 676 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 677 | | 16 | 32 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 678 | | 30 | 61 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 679 | | 60 | 120 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 680 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 681 | | 16 | 47 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 682 | | 30 | 92 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 683 | | 60 | 180 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 684 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 647 | | | | 40 | | 6.4 | 1920 |
| 648 | | | | 16 | | 6.3 | 0 |
| 649 | | | | 16 | | 6.5 | 80 |
| 650 | | | | 16 | | 6.6 | 160 |
| 651 | | | | 16 | | 6.7 | 320 |
| 652 | | | | 16 | | 6.3 | 0 |
| 653 | | | | 16 | | 6.5 | 160 |
| 654 | | | | 16 | | 6.5 | 320 |
| 655 | | | | 16 | | 6.5 | 640 |
| 656 | | | | 16 | | 6.6 | 0 |
| 657 | | | | 16 | | 7 | 240 |
| 658 | | | | 16 | | 6.9 | 480 |
| 659 | | | | 16 | | 6.9 | 960 |
| 660 | | | | 16 | | 6.7 | 0 |
| 661 | | | | 16 | | 6.8 | 320 |
| 662 | | | | 16 | | 6.7 | 640 |
| 663 | | | | 16 | | 6.7 | 1280 |
| 664 | | | | 16 | | 6.9 | 0 |
| 665 | | | | 16 | | 6.7 | 400 |
| 666 | | | | 16 | | 6.8 | 800 |
| 667 | | | | 16 | | 6.7 | 1600 |
| 668 | | | | 16 | | 7 | 0 |
| 669 | | | | 16 | | 6.7 | 480 |
| 670 | | | | 16 | | 6.6 | 960 |
| 671 | | | | 16 | | 6.3 | 1920 |
| 672 | | | | 40 | | 7.2 | 0 |
| 673 | | | | 40 | | 6.7 | 68 |
| 674 | | | | 40 | | 6 | 130 |
| 675 | | | | 40 | | 5.7 | 252 |
| 676 | | | | 40 | | 7.5 | 0 |
| 677 | | | | 40 | | 6.6 | 135 |
| 678 | | | | 40 | | 5.9 | 261 |
| 679 | | | | 40 | | 5.7 | 504 |
| 680 | | | | 40 | | 7.2 | 0 |
| 681 | | | | 40 | | 6.4 | 203 |
| 682 | | | | 40 | | 6 | 391 |
| 683 | | | | 40 | | 6.1 | 756 |
| 684 | | | | 40 | | 7.1 | 0 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 647 | 4 N HNO3 | | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 648 | 4 N HNO3 | | 16 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 649 | 4 N HNO3 | | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 650 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 651 | 4 N HNO3 | | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 652 | 4 N HNO3 | | 13 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 653 | 4 N HNO3 | | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 654 | 4 N HNO3 | | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 655 | 4 N HNO3 | | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 656 | 4 N HNO3 | | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 657 | 4 N HNO3 | | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 658 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 659 | 4 N HNO3 | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 660 | 4 N HNO3 | | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 661 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 662 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 663 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 664 | 4 N HNO3 | | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 665 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 666 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 667 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 668 | 4 N HNO3 | | 22 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 669 | 4 N HNO3 | | 47 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 670 | 4 N HNO3 | | 56 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 671 | 4 N HNO3 | | 57 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 672 | 4 N HNO3 | | 17 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 673 | 4 N HNO3 | | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 674 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 675 | 4 N HNO3 | | 49 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 676 | 4 N HNO3 | | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 677 | 4 N HNO3 | | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 678 | 4 N HNO3 | | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 679 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 680 | 4 N HNO3 | | 16 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 681 | 4 N HNO3 | | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 682 | 4 N HNO3 | | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 683 | 4 N HNO3 | | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 684 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 647 | | | NO | |
| 648 | | | NO | |
| 649 | | | NO | |
| 650 | | | NO | |
| 651 | | | NO | |
| 652 | | | NO | |
| 653 | | | NO | |
| 654 | | | NO | |
| 655 | | | NO | |
| 656 | | | NO | |
| 657 | | | NO | |
| 658 | | | NO | |
| 659 | | | NO | |
| 660 | | | NO | |
| 661 | | | NO | |
| 662 | | | NO | |
| 663 | | | NO | |
| 664 | | | NO | |
| 665 | | | NO | |
| 666 | | | NO | |
| 667 | | | NO | |
| 668 | | | NO | |
| 669 | | | NO | |
| 670 | | | NO | |
| 671 | | | NO | |
| 672 | | | NO | |
| 673 | | | NO | |
| 674 | | | NO | |
| 675 | | | NO | |
| 676 | | | NO | |
| 677 | | | NO | |
| 678 | | | NO | |
| 679 | | | NO | |
| 680 | | | NO | |
| 681 | | | NO | |
| 682 | | | NO | |
| 683 | | | NO | |
| 684 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 647 | Riverside, California |
| 648 | Riverside, California |
| 649 | Riverside, California |
| 650 | Riverside, California |
| 651 | Riverside, California |
| 652 | Riverside, California |
| 653 | Riverside, California |
| 654 | Riverside, California |
| 655 | Riverside, California |
| 656 | Riverside, California |
| 657 | Riverside, California |
| 658 | Riverside, California |
| 659 | Riverside, California |
| 660 | Riverside, California |
| 661 | Riverside, California |
| 662 | Riverside, California |
| 663 | Riverside, California |
| 664 | Riverside, California |
| 665 | Riverside, California |
| 666 | Riverside, California |
| 667 | Riverside, California |
| 668 | Riverside, California |
| 669 | Riverside, California |
| 670 | Riverside, California |
| 671 | Riverside, California |
| 672 | Riverside, California |
| 673 | Riverside, California |
| 674 | Riverside, California |
| 675 | Riverside, California |
| 676 | Riverside, California |
| 677 | Riverside, California |
| 678 | Riverside, California |
| 679 | Riverside, California |
| 680 | Riverside, California |
| 681 | Riverside, California |
| 682 | Riverside, California |
| 683 | Riverside, California |
| 684 | Riverside, California |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 685 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 686 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 687 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 688 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 689 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 690 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 691 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 126 |
| 692 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 693 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 694 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 695 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 696 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 697 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 698 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 699 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 700 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 701 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 702 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 703 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 704 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 705 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 706 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 707 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 708 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 709 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 710 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 711 | CHANG ET AL 1983 | BARLEY | | | 75 | | | 150 |
| 712 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 713 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 714 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 715 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 716 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 717 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 718 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 719 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 720 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 721 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 722 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 685 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 686 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 687 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 688 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 689 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 690 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 691 | 2092 | 1600 | | 8.5 | 592 | 1.5 | 781 | 4265 | 2.1 | ANAEROBICALLY DIGESTED |
| 692 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 693 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 694 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 695 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 696 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 697 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 698 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 699 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 700 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 701 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 702 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 703 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 704 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 705 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 706 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 707 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 708 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 709 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 710 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 711 | 2053 | 1745 | | 8.5 | 608 | 1.5 | 693 | 4368 | 2.1 | ANAEROBICALLY DIGESTED |
| 712 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 713 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 714 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 715 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 716 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 717 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 718 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 719 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 720 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 721 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 722 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 685 | | 16 | 34 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 686 | | 30 | 122 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 687 | | 60 | 240 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 688 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 689 | | 16 | 50 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 690 | | 30 | 152 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 691 | | 60 | 300 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 692 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 693 | | 16 | 16 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 694 | | 32 | 32 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 695 | | 59 | 59 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 696 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 697 | | 16 | 32 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 698 | | 32 | 64 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 699 | | 59 | 119 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 700 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 701 | | 16 | 48 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 702 | | 32 | 96 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 703 | | 59 | 177 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 704 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 705 | | 16 | 64 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 706 | | 32 | 128 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 707 | | 59 | 236 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 708 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 709 | | 16 | 80 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 710 | | 32 | 160 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 711 | | 59 | 295 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 712 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 713 | | 16 | 16 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 714 | | 33 | 33 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 715 | | 63 | 63 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 716 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 717 | | 16 | 31 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 718 | | 33 | 66 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 719 | | 63 | 126 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 720 | | 0 | 0 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 721 | | 16 | 47 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 722 | | 33 | 96 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 685 | | | | 40 | | 6.3 | 271 |
| 686 | | | | 40 | | 6 | 522 |
| 687 | | | | 40 | | 5.9 | 1008 |
| 688 | | | | 40 | | 7.3 | 0 |
| 689 | | | | 40 | | 6.1 | 339 |
| 690 | | | | 40 | | 5.9 | 652 |
| 691 | | | | 40 | | 5.5 | 1262 |
| 692 | | | | 16 | | 6.1 | 0 |
| 693 | | | | 16 | | 5.6 | 67 |
| 694 | | | | 16 | | 5.4 | 133 |
| 695 | | | | 16 | | 5.3 | 249 |
| 696 | | | | 16 | | 6.2 | 0 |
| 697 | | | | 16 | | 5.8 | 134 |
| 698 | | | | 16 | | 5.6 | 265 |
| 699 | | | | 16 | | 5.3 | 497 |
| 700 | | | | 16 | | 6.6 | 0 |
| 701 | | | | 16 | | 5.7 | 200 |
| 702 | | | | 16 | | 5.7 | 398 |
| 703 | | | | 16 | | 5.6 | 746 |
| 704 | | | | 16 | | 6.8 | 0 |
| 705 | | | | 16 | | 6 | 267 |
| 706 | | | | 16 | | 5.9 | 530 |
| 707 | | | | 16 | | 5.8 | 995 |
| 708 | | | | 16 | | 6.9 | 0 |
| 709 | | | | 16 | | 5.9 | 334 |
| 710 | | | | 16 | | 5.8 | 663 |
| 711 | | | | 16 | | 5.5 | 1244 |
| 712 | | | | 40 | | 7.4 | 0 |
| 713 | | | | 40 | | 6.9 | 65 |
| 714 | | | | 40 | | 6.4 | 140 |
| 715 | | | | 40 | | 6.1 | 252 |
| 716 | | | | 40 | | 5.7 | 0 |
| 717 | | | | 40 | | 6.8 | 130 |
| 718 | | | | 40 | | 6.6 | 279 |
| 719 | | | | 40 | | 6.3 | 503 |
| 720 | | | | 40 | | 7.1 | 0 |
| 721 | | | | 40 | | 6.9 | 196 |
| 722 | | | | 40 | | 6.6 | 419 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 685 | 4 N HNO3 | | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 686 | 4 N HNO3 | | 47 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 687 | 4 N HNO3 | | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 688 | 4 N HNO3 | | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 689 | 4 N HNO3 | | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 690 | 4 N HNO3 | | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 691 | 4 N HNO3 | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 692 | 4 N HNO3 | | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 693 | 4 N HNO3 | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 694 | 4 N HNO3 | | 50 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 695 | 4 N HNO3 | | 53 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 696 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 697 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 698 | 4 N HNO3 | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 699 | 4 N HNO3 | | 50 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 700 | 4 N HNO3 | | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 701 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 702 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 703 | 4 N HNO3 | | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 704 | 4 N HNO3 | | 18 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 705 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 706 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 707 | 4 N HNO3 | | 44 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 708 | 4 N HNO3 | | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 709 | 4 N HNO3 | | 43 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 710 | 4 N HNO3 | | 51 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 711 | 4 N HNO3 | | 82 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 712 | 4 N HNO3 | | 29 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 713 | 4 N HNO3 | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 714 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 715 | 4 N HNO3 | | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 716 | 4 N HNO3 | | 20 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 717 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 718 | 4 N HNO3 | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 719 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 720 | 4 N HNO3 | | 23 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 721 | 4 N HNO3 | | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 722 | 4 N HNO3 | | 27 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 685 | | | NO | |
| 686 | | | NO | |
| 687 | | | NO | |
| 688 | | | NO | |
| 689 | | | NO | |
| 690 | | | NO | |
| 691 | | | NO | |
| 692 | | | NO | |
| 693 | | | NO | |
| 694 | | | NO | |
| 695 | | | NO | |
| 696 | | | NO | |
| 697 | | | NO | |
| 698 | | | NO | |
| 699 | | | NO | |
| 700 | | | NO | |
| 701 | | | NO | |
| 702 | | | NO | |
| 703 | | | NO | |
| 704 | | | NO | |
| 705 | | | NO | |
| 706 | | | NO | |
| 707 | | | NO | |
| 708 | | | NO | |
| 709 | | | NO | |
| 710 | | | NO | |
| 711 | | | NO | |
| 712 | | | NO | |
| 713 | | | NO | |
| 714 | | | NO | |
| 715 | | | NO | |
| 716 | | | NO | |
| 717 | | | NO | |
| 718 | | | NO | |
| 719 | | | NO | |
| 720 | | | NO | |
| 721 | | | NO | |
| 722 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 685 | Riverside, California |
| 686 | Riverside, California |
| 687 | Riverside, California |
| 688 | Riverside, California |
| 689 | Riverside, California |
| 690 | Riverside, California |
| 691 | Riverside, California |
| 692 | Riverside, California |
| 693 | Riverside, California |
| 694 | Riverside, California |
| 695 | Riverside, California |
| 696 | Riverside, California |
| 697 | Riverside, California |
| 698 | Riverside, California |
| 699 | Riverside, California |
| 700 | Riverside, California |
| 701 | Riverside, California |
| 702 | Riverside, California |
| 703 | Riverside, California |
| 704 | Riverside, California |
| 705 | Riverside, California |
| 706 | Riverside, California |
| 707 | Riverside, California |
| 708 | Riverside, California |
| 709 | Riverside, California |
| 710 | Riverside, California |
| 711 | Riverside, California |
| 712 | Riverside, California |
| 713 | Riverside, California |
| 714 | Riverside, California |
| 715 | Riverside, California |
| 716 | Riverside, California |
| 717 | Riverside, California |
| 718 | Riverside, California |
| 719 | Riverside, California |
| 720 | Riverside, California |
| 721 | Riverside, California |
| 722 | Riverside, California |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 723 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 724 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 725 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 726 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 727 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 728 | CHANG ET AL 1983 | BARLEY | | | 70 | | | 83 |
| 729 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 83 |
| 730 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 83 |
| 731 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 83 |
| 732 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 733 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 734 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 735 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 736 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 737 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 738 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 739 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 740 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 741 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 742 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 743 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 744 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 745 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 746 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 747 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 748 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 749 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 750 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 751 | Chang, A.C. et al., 1983 #33 | BARLEY | | | 70 | | | 86 |
| 752 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 753 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 754 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 755 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 756 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 757 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 758 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 759 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 760 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 723 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 724 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 725 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 726 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 727 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 728 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 729 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 730 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 731 | 2561 | 1293 | | 4.5 | 542 | 1.1 | 930 | 4154 | 2.8 | ANAEROBICALLY DIGESTED |
| 732 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 733 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 734 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 735 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 736 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 737 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 738 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 739 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 740 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 741 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 742 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 743 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 744 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 745 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 746 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 747 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 748 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 749 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 750 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 751 | 2639 | 1363 | | 4.5 | 534 | 1.1 | 902 | 4002 | 2.8 | ANAEROBICALLY DIGESTED |
| 752 | | | | | | | | | | Unlimed sludge, 1976 |
| 753 | | | | | | | | | | Unlimed sludge, 1976 |
| 754 | | | | | | | | | | Unlimed sludge, 1976 |
| 755 | | | | | | | | | | Unlimed sludge, 1976 |
| 756 | | | | | | | | | | Unlimed sludge, 1976 |
| 757 | | | | | | | | | | Unlimed sludge, 1976 |
| 758 | | | | | | | | | | Unlimed sludge, 1976 |
| 759 | | | | | | | | | | Unlimed sludge, 1976 |
| 760 | | | | | | | | | | Unlimed sludge, 1977 |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 723 | | 63 | 189 | 0 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 724 | | 0 | 0 | 1 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 725 | | 0 | 47 | 1 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 726 | | 0 | 96 | 1 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 727 | | 0 | 189 | 1 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 728 | | 0 | 0 | 2 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 729 | | 0 | 47 | 2 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 730 | | 0 | 96 | 2 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 731 | | 0 | 189 | 2 | XEROLLIC CALCIOTHID | DOMINO | LOAM |
| 732 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 733 | | 16 | 16 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 734 | | 32 | 32 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 735 | | 66 | 66 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 736 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 737 | | 16 | 33 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 738 | | 32 | 64 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 739 | | 66 | 131 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 740 | | 0 | 0 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 741 | | 16 | 49 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 742 | | 32 | 96 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 743 | | 66 | 197 | 0 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 744 | | 0 | 0 | 1 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 745 | | 0 | 49 | 1 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 746 | | 0 | 96 | 1 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 747 | | 0 | 197 | 1 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 748 | | 0 | 0 | 2 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 749 | | 0 | 49 | 2 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 750 | | 0 | 96 | 2 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 751 | | 0 | 197 | 2 | TYPIC HALOXERALF | GREENFIELD | SANDY LOAM |
| 752 | | 0 | | | Fluventic Haploxerolls | Sultan | silt loam |
| 753 | | 22.4 | 0 | | Fluventic Haploxerolls | Sultan | silt loam |
| 754 | | 44.8 | 22.4 | | Fluventic Haploxerolls | Sultan | silt loam |
| 755 | | 89.6 | 44.8 | | Fluventic Haploxerolls | Sultan | silt loam |
| 756 | | 0 | 89.6 | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 757 | | 22.4 | 0 | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 758 | | 44.8 | 22.4 | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 759 | | 89.6 | 44.8 | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 760 | | 0 | 89.6 | | Fluventic Haploxerolls | Sultan | silt loam |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 723 | | | | 40 | | 6.4 | 755 |
| 724 | | | | 40 | | 7.2 | 0 |
| 725 | | | | 40 | | 6.6 | 196 |
| 726 | | | | 40 | | 6.5 | 419 |
| 727 | | | | 40 | | 6.4 | 755 |
| 728 | | | | 40 | | 7.5 | 0 |
| 729 | | | | 40 | | 6.9 | 196 |
| 730 | | | | 40 | | 6.7 | 419 |
| 731 | | | | 40 | | 6.5 | 755 |
| 732 | | | | 16 | | 6 | 0 |
| 733 | | | | 16 | | 5.8 | 65 |
| 734 | | | | 16 | | 5.7 | 132 |
| 735 | | | | 16 | | 5.7 | 269 |
| 736 | | | | 16 | | 6.5 | 0 |
| 737 | | | | 16 | | 6.4 | 130 |
| 738 | | | | 16 | | 6.2 | 264 |
| 739 | | | | 16 | | 6.1 | 538 |
| 740 | | | | 16 | | 6.5 | 0 |
| 741 | | | | 16 | | 6.3 | 196 |
| 742 | | | | 16 | | 6.1 | 397 |
| 743 | | | | 16 | | 6 | 807 |
| 744 | | | | 16 | | 6.5 | 0 |
| 745 | | | | 16 | | 6.3 | 196 |
| 746 | | | | 16 | | 6.1 | 397 |
| 747 | | | | 16 | | 6 | 807 |
| 748 | | | | 16 | | 6.8 | 0 |
| 749 | | | | 16 | | 6.4 | 196 |
| 750 | | | | 16 | | 6.2 | 397 |
| 751 | | | | 16 | | 6.2 | 807 |
| 752 | | | | 13.7 | | 4.6 | 0 |
| 753 | | | | 13.7 | | 4.6 | 55 |
| 754 | | | | 13.7 | | 4.6 | 110 |
| 755 | | | | 13.7 | | 4.6 | 220 |
| 756 | | | | 9.1 | | 4.7 | 0 |
| 757 | | | | 9.1 | | 4.7 | 55 |
| 758 | | | | 9.1 | | 4.7 | 110 |
| 759 | | | | 9.1 | | 4.7 | 220 |
| 760 | | | | 13.7 | | 4.6 | 0 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 723 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 724 | 4 N HNO3 | | 21 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 725 | 4 N HNO3 | | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 726 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 727 | 4 N HNO3 | | 35 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 728 | 4 N HNO3 | | 25 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 729 | 4 N HNO3 | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 730 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 731 | 4 N HNO3 | | 41 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 732 | 4 N HNO3 | | 30 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 733 | 4 N HNO3 | | 26 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 734 | 4 N HNO3 | | 40 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 735 | 4 N HNO3 | | 52 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 736 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 737 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 738 | 4 N HNO3 | | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 739 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 740 | 4 N HNO3 | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 741 | 4 N HNO3 | | 31 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 742 | 4 N HNO3 | | 33 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 743 | 4 N HNO3 | | 38 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 744 | 4 N HNO3 | | 19 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 745 | 4 N HNO3 | | 28 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 746 | 4 N HNO3 | | 32 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 747 | 4 N HNO3 | | 34 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 748 | 4 N HNO3 | | 24 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 749 | 4 N HNO3 | | 37 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 750 | 4 N HNO3 | | 39 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 751 | 4 N HNO3 | | 46 | LEAF | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 752 | 0 | 2.2 | 28 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 753 | 55 | 10.3 | 114.7 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 754 | 110 | 17 | 182.7 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 755 | 220 | 49.4 | 423.9 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 756 | 0 | 3.4 | 28.7 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 757 | 55 | 8 | 136.6 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 758 | 110 | 19.6 | 193 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 759 | 220 | 34.6 | 375 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 760 | 0 | | 49.7 | Leaf | SLUDGE, FIELD, MATURITY | | |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 723 | | | NO | |
| 724 | | | NO | |
| 725 | | | NO | |
| 726 | | | NO | |
| 727 | | | NO | |
| 728 | | | NO | |
| 729 | | | NO | |
| 730 | | | NO | |
| 731 | | | NO | |
| 732 | | | NO | |
| 733 | | | NO | |
| 734 | | | NO | |
| 735 | | | NO | |
| 736 | | | NO | |
| 737 | | | NO | |
| 738 | | | NO | |
| 739 | | | NO | |
| 740 | | | NO | |
| 741 | | | NO | |
| 742 | | | NO | |
| 743 | | | NO | |
| 744 | | | NO | |
| 745 | | | NO | |
| 746 | | | NO | |
| 747 | | | NO | |
| 748 | | | NO | |
| 749 | | | NO | |
| 750 | | | NO | |
| 751 | | | NO | |
| 752 | | | NO | YIELD NOT DETERMINED |
| 753 | | | NO | YIELD NOT DETERMINED |
| 754 | | | NO | YIELD NOT DETERMINED |
| 755 | | | NO | YIELD NOT DETERMINED |
| 756 | | | NO | YIELD NOT DETERMINED |
| 757 | | | NO | YIELD NOT DETERMINED |
| 758 | | | NO | YIELD NOT DETERMINED |
| 759 | | | NO | YIELD NOT DETERMINED |
| 760 | | | NO | YIELD NOT DETERMINED |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| 723 | Riverside, California |
| 724 | Riverside, California |
| 725 | Riverside, California |
| 726 | Riverside, California |
| 727 | Riverside, California |
| 728 | Riverside, California |
| 729 | Riverside, California |
| 730 | Riverside, California |
| 731 | Riverside, California |
| 732 | Riverside, California |
| 733 | Riverside, California |
| 734 | Riverside, California |
| 735 | Riverside, California |
| 736 | Riverside, California |
| 737 | Riverside, California |
| 738 | Riverside, California |
| 739 | Riverside, California |
| 740 | Riverside, California |
| 741 | Riverside, California |
| 742 | Riverside, California |
| 743 | Riverside, California |
| 744 | Riverside, California |
| 745 | Riverside, California |
| 746 | Riverside, California |
| 747 | Riverside, California |
| 748 | Riverside, California |
| 749 | Riverside, California |
| 750 | Riverside, California |
| 751 | Riverside, California |
| 752 | Puyallup, Washington |
| 753 | Puyallup, Washington |
| 754 | Puyallup, Washington |
| 755 | Puyallup, Washington |
| 756 | Puyallup, Washington |
| 757 | Puyallup, Washington |
| 758 | Puyallup, Washington |
| 759 | Puyallup, Washington |
| 760 | Puyallup, Washington |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 761 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 762 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 763 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 764 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 765 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 766 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 767 | Pepper,I.L. et al., 1988 #185 | Corn | Pride 110 | | | | | |
| 768 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 769 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 770 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 771 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 772 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 773 | Schauer, P.S. et al., 1980 #211 | Lettuce | Salad Bowl | 4.7 | 67.5 | | | 21 |
| 774 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 775 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 776 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 777 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 778 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 779 | Schauer, P.S. et al., 1980 #211 | Radish | Cherrybelle | 4.7 | 67.5 | | | 21 |
| 780 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 781 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 782 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 783 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 784 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 785 | Schauer, P.S. et al., 1980 #211 | Carrot | Danvers | 4.7 | 67.5 | | | 21 |
| 786 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 787 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 788 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 789 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 790 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 791 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 792 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 793 | Latterell, J.J. et al., 1978 #138 | Snap Bean | Tendergreen | | | | 2.61 | 6 |
| 794 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 795 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 796 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 797 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 798 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 761 | | | | | | | | | | Unlimed sludge, 1977 |
| 762 | | | | | | | | | | Unlimed sludge, 1977 |
| 763 | | | | | | | | | | Unlimed sludge, 1977 |
| 764 | | | | | | | | | | Unlimed sludge, 1977 |
| 765 | | | | | | | | | | Unlimed sludge, 1977 |
| 766 | | | | | | | | | | Unlimed sludge, 1977 |
| 767 | | | | | | | | | | Unlimed sludge, 1977 |
| 768 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 769 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 770 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 771 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 772 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 773 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 774 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 775 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 776 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 777 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 778 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 779 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 780 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 781 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 782 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 783 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 784 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 785 | | 2520 | | | 560 | | | 1630 | | ANAEROBICALLY DIGESTED |
| 786 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 787 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 788 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 789 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 790 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 791 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 792 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 793 | 110 | 190 | | | 15 | | 510 | 1080 | | Anaerobically Digested |
| 794 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 795 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 796 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 797 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 798 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 761 | | 22.4 | | | Fluventic Halpoxerolls | Sultan | silt loam |
| 762 | | 44.8 | | | Fluventic Halpoxerolls | Sultan | silt loam |
| 763 | | 89.6 | | | Fluventic Halpoxerolls | Sultan | silt loam |
| 764 | | 0 | | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 765 | | 22.4 | | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 766 | | 44.8 | | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 767 | | 89.6 | | | Aquic Xerofluvents | Puyallup | fine sandy loam |
| 768 | | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 769 | | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 770 | | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 771 | | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 772 | | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 773 | | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 774 | | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 775 | | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 776 | | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 777 | | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 778 | | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 779 | | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 780 | | 0 | 0 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 781 | | 20 | 20 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 782 | | 60 | 60 | 0 | Typic Dystrochrept | Bridgehampton | silt loam |
| 783 | | 0 | 0 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 784 | | 20 | 20 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 785 | | 60 | 60 | 1 | Typic Dystrochrept | Bridgehampton | silt loam |
| 786 | | | 0 | NA | Udorthentic Haploboroll | Hubbard | coarse sand |
| 787 | | | 0 | NA | Udorthentic Haploboroll | Hubbard | coarse sand |
| 788 | | | 122 | 0 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 789 | | | 225 | 0 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 790 | | | 450 | 0 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 791 | | | 350 | 1 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 792 | | | 700 | 1 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 793 | | | 1400 | 1 | Udorthentic Haploboroll | Hubbard | coarse sand |
| 794 | | 0 | 0 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL |
| 795 | | 25 | 25 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL |
| 796 | | 50 | 50 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL |
| 797 | | 100 | 100 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL |
| 798 | | 200 | 200 | 0 | TYPIC TAPLUDOLL | WAUKEGAN | SiL |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 761 | | | | 13.7 | | 4.6 | 55 |
| 762 | | | | 13.7 | | 4.6 | 110 |
| 763 | | | | 13.7 | | 4.6 | 220 |
| 764 | | | | 9.1 | | 4.7 | 0 |
| 765 | | | | 9.1 | | 4.7 | 55 |
| 766 | | | | 9.1 | | 4.7 | 110 |
| 767 | | | | 9.1 | | 4.7 | 220 |
| 768 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 769 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 770 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 771 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 772 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 773 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 774 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 775 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 776 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 777 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 778 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 779 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 780 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 781 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 782 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 783 | 34 | 58 | 8 | | 2.8 | 5.6 | 0 |
| 784 | 34 | 58 | 8 | | 2.8 | 5.6 | 33 |
| 785 | 34 | 58 | 8 | | 2.8 | 5.6 | 99 |
| 786 | | | | | 1.2 | 5.3 | 0 |
| 787 | | | | | 1.2 | 5.3 | 0 |
| 788 | | | | | 1.2 | 5.3 | 149 |
| 789 | | | | | 1.2 | 5.3 | 298 |
| 790 | | | | | 1.2 | 5.3 | 597 |
| 791 | | | | | 1.4 | 5.3 | 379 |
| 792 | | | | | 1.9 | 5.3 | 756 |
| 793 | | | | | 3.2 | 5.3 | 1518 |
| 794 | | | | | | 6.5 | 0 |
| 795 | | | | | | 6.5 | 52.5 |
| 796 | | | | | | 6.5 | 105 |
| 797 | | | | | | 6.5 | 210 |
| 798 | | | | | | 6.5 | 420 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 761 | 112 | | 136.8 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 762 | 224 | | 338 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 763 | 448 | | 587.7 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 764 | 0 | | 55.8 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 765 | 112 | | 186 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 766 | 224 | | 486.3 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 767 | 448 | | 677.3 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 768 | DTPA | 3.4 | 50 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 769 | DTPA | 5.9 | 66 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 770 | DTPA | 11.7 | 90 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 771 | DTPA | 4.6 | 46 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 772 | DTPA | 8.2 | 73 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 773 | DTPA | 15.2 | 133 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 774 | DTPA | 3.4 | 62 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 775 | DTPA | 5.9 | 73 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 776 | DTPA | 11.7 | 74 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 777 | DTPA | 4.6 | 70 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 778 | DTPA | 8.2 | 88 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 779 | DTPA | 15.2 | 164 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 780 | DTPA | 3.4 | 32 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 781 | DTPA | 5.9 | 42 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 782 | DTPA | 11.7 | 59 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 783 | DTPA | 4.6 | 40 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 784 | DTPA | 8.2 | 55 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 785 | DTPA | 15.2 | 79 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 786 | DTPA | | 32 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 787 | DTPA | | 30 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 788 | DTPA | | 57 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 789 | DTPA | | 59 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 790 | DTPA | | 60 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 791 | DTPA | | 59 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 792 | DTPA | | 92 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 793 | DTPA | | 117 | Leaf | SLUDGE, FIELD, MATURITY | | |
| 794 | | N.L. | 205 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 795 | | N.L. | 203 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 796 | | N.L. | 223 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 797 | | N.L. | 278 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 798 | | N.L. | 331 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 761 | | | NO | YIELD NOT DETERMINED |
| 762 | | | NO | YIELD NOT DETERMINED |
| 763 | | | NO | YIELD NOT DETERMINED |
| 764 | | | NO | YIELD NOT DETERMINED |
| 765 | | | NO | YIELD NOT DETERMINED |
| 766 | | | NO | YIELD NOT DETERMINED |
| 767 | | | NO | YIELD NOT DETERMINED |
| 768 | | | NO | YIELD NOT DETERMINED |
| 769 | | | NO | YIELD NOT DETERMINED |
| 770 | | | NO | YIELD NOT DETERMINED |
| 771 | | | NO | YIELD NOT DETERMINED |
| 772 | | | NO | YIELD NOT DETERMINED |
| 773 | | | NO | YIELD NOT DETERMINED |
| 774 | | | NO | YIELD NOT DETERMINED |
| 775 | | | NO | YIELD NOT DETERMINED |
| 776 | | | NO | YIELD NOT DETERMINED |
| 777 | | | NO | YIELD NOT DETERMINED |
| 778 | | | NO | YIELD NOT DETERMINED |
| 779 | | | NO | YIELD NOT DETERMINED |
| 780 | | | NO | YIELD NOT DETERMINED |
| 781 | | | NO | YIELD NOT DETERMINED |
| 782 | | | NO | YIELD NOT DETERMINED |
| 783 | | | NO | YIELD NOT DETERMINED |
| 784 | | | NO | YIELD NOT DETERMINED |
| 785 | | | NO | YIELD NOT DETERMINED |
| 786 | | | NO | YIELD NOT DETERMINED |
| 787 | | | NO | YIELD NOT DETERMINED |
| 788 | | | NO | YIELD NOT DETERMINED |
| 789 | | | NO | YIELD NOT DETERMINED |
| 790 | | | NO | YIELD NOT DETERMINED |
| 791 | | | NO | YIELD NOT DETERMINED |
| 792 | | | NO | YIELD NOT DETERMINED |
| 793 | | | NO | YIELD NOT DETERMINED |
| 794 | | | NO | |
| 795 | | | NO | |
| 796 | | | NO | |
| 797 | | | NO | |
| 798 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 761 | Puyallup, Washington |
| 762 | Puyallup, Washington |
| 763 | Puyallup, Washington |
| 764 | Puyallup, Washington |
| 765 | Puyallup, Washington |
| 766 | Puyallup, Washington |
| 767 | Puyallup, Washington |
| 768 | KINGSTON, RHODE ISLAND |
| 769 | KINGSTON, RHODE ISLAND |
| 770 | KINGSTON, RHODE ISLAND |
| 771 | KINGSTON, RHODE ISLAND |
| 772 | KINGSTON, RHODE ISLAND |
| 773 | KINGSTON, RHODE ISLAND |
| 774 | KINGSTON, RHODE ISLAND |
| 775 | KINGSTON, RHODE ISLAND |
| 776 | KINGSTON, RHODE ISLAND |
| 777 | KINGSTON, RHODE ISLAND |
| 778 | KINGSTON, RHODE ISLAND |
| 779 | KINGSTON, RHODE ISLAND |
| 780 | KINGSTON, RHODE ISLAND |
| 781 | KINGSTON, RHODE ISLAND |
| 782 | KINGSTON, RHODE ISLAND |
| 783 | KINGSTON, RHODE ISLAND |
| 784 | KINGSTON, RHODE ISLAND |
| 785 | KINGSTON, RHODE ISLAND |
| 786 | Elk River, Minnesota |
| 787 | Elk River, Minnesota |
| 788 | Elk River, Minnesota |
| 789 | Elk River, Minnesota |
| 790 | Elk River, Minnesota |
| 791 | Elk River, Minnesota |
| 792 | Elk River, Minnesota |
| 793 | Elk River, Minnesota |
| 794 | MINNESOTA |
| 795 | MINNESOTA |
| 796 | MINNESOTA |
| 797 | MINNESOTA |
| 798 | MINNESOTA |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 799 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 800 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 801 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 802 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 803 | HAM &DOWDY 1978 | SOYBEAN | MERRILL | | | 1.41 | 4.98 | 12 |
| 804 | WILLIAMS 1977 | CARROT | | | | | | |
| 805 | WILLIAMS 1977 | CARROT | | | | | | |
| 806 | WILLIAMS 1977 | CARROT | | | | | | |
| 807 | WILLIAMS 1977 | CARROT | | | | | | |
| 808 | WILLIAMS 1977 | CARROT | | | | | | |
| 809 | WILLIAMS 1977 | CARROT | | | | | | |
| 810 | WILLIAMS 1977 | CARROT | | | | | | |
| 811 | WILLIAMS 1977 | CARROT | | | | | | |
| 812 | WILLIAMS 1977 | BEET | | | | | | |
| 813 | WILLIAMS 1977 | BEET | | | | | | |
| 814 | WILLIAMS 1977 | BEET | | | | | | |
| 815 | WILLIAMS 1977 | BEET | | | | | | |
| 816 | WILLIAMS 1977 | BEET | | | | | | |
| 817 | WILLIAMS 1977 | BEET | | | | | | |
| 818 | WILLIAMS 1977 | BEET | | | | | | |
| 819 | WILLIAMS 1977 | BEET | | | | | | |
| 820 | WILLIAMS 1977 | ONION | | | | | | |
| 821 | WILLIAMS 1977 | ONION | | | | | | |
| 822 | WILLIAMS 1977 | ONION | | | | | | |
| 823 | WILLIAMS 1977 | ONION | | | | | | |
| 824 | WILLIAMS 1977 | ONION | | | | | | |
| 825 | WILLIAMS 1977 | ONION | | | | | | |
| 826 | WILLIAMS 1977 | ONION | | | | | | |
| 827 | WILLIAMS 1977 | ONION | | | | | | |
| 828 | WILLIAMS 1977 | ONION | | | | | | |
| 829 | WILLIAMS 1977 | ONION | | | | | | |
| 830 | WILLIAMS 1977 | ONION | | | | | | |
| 831 | WILLIAMS 1977 | ONION | | | | | | |
| 832 | WILLIAMS 1977 | ONION | | | | | | |
| 833 | WILLIAMS 1977 | ONION | | | | | | |
| 834 | WILLIAMS 1977 | ONION | | | | | | |
| 835 | WILLIAMS 1977 | ONION | | | | | | |
| 836 | WILLIAMS 1977 | SWEDE | | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| 799 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 800 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 801 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 802 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 803 | 1100 | 2020 | 1.6 | 2.73 | 4.4 | 4.37 | 2560 | 2130 | AIR DRY | ANAEROBIC DIGESTED |
| 804 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 805 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 806 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 807 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 808 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 809 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 810 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 811 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 812 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 813 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 814 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 815 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 816 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 817 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 818 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 819 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 820 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 821 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 822 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 823 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 824 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 825 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 826 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 827 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 828 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 829 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 830 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 831 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 832 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 833 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 834 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 835 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 836 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 799 | | 0 | 0 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL |
| 800 | | 25 | 25 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL |
| 801 | | 50 | 50 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL |
| 802 | | 100 | 100 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL |
| 803 | | 200 | 200 | 1 | TYPIC TAPLUDOLL | WAUKEGAN | SIL |
| 804 | | 0 | 0 | 8 | | | LS |
| 805 | | 56 | 56 | 8 | | | LS |
| 806 | | 112 | 112 | 8 | | | LS |
| 807 | | 224 | 224 | 8 | | | LS |
| 808 | | 0 | 0 | 8 | | | LS |
| 809 | | 56 | 56 | 8 | | | LS |
| 810 | | 112 | 112 | 8 | | | LS |
| 811 | | 224 | 224 | 8 | | | LS |
| 812 | | 0 | 0 | 9 | | | LS |
| 813 | | 56 | 56 | 9 | | | LS |
| 814 | | 112 | 112 | 9 | | | LS |
| 815 | | 224 | 224 | 9 | | | LS |
| 816 | | 0 | 0 | 9 | | | LS |
| 817 | | 56 | 56 | 9 | | | LS |
| 818 | | 112 | 112 | 9 | | | LS |
| 819 | | 224 | 224 | 9 | | | LS |
| 820 | | 0 | 0 | 10 | | | LS |
| 821 | | 56 | 56 | 10 | | | LS |
| 822 | | 112 | 112 | 10 | | | LS |
| 823 | | 224 | 224 | 10 | | | LS |
| 824 | | 0 | 0 | 10 | | | LS |
| 825 | | 56 | 56 | 10 | | | LS |
| 826 | | 112 | 112 | 10 | | | LS |
| 827 | | 224 | 224 | 10 | | | LS |
| 828 | | 0 | 0 | 13 | | | LS |
| 829 | | 56 | 56 | 13 | | | LS |
| 830 | | 112 | 112 | 13 | | | LS |
| 831 | | 224 | 224 | 13 | | | LS |
| 832 | | 0 | 0 | 13 | | | LS |
| 833 | | 56 | 56 | 13 | | | LS |
| 834 | | 112 | 112 | 13 | | | LS |
| 835 | | 224 | 224 | 13 | | | LS |
| 836 | | 0 | 0 | 11 | | | LS |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 799 | | | | | | 6.5 | 0 |
| 800 | | | | | | 6.5 | 52.5 |
| 801 | | | | | | 6.5 | 105 |
| 802 | | | | | | 6.5 | 210 |
| 803 | | | | | | 6.5 | 420 |
| 804 | | | | | 1.2 | 5.8 | 0 |
| 805 | | | | | 1.2 | 5.8 | 640 |
| 806 | | | | | 1.2 | 5.8 | 1280 |
| 807 | | | | | 1.2 | 5.8 | 2560 |
| 808 | | | | | 1.2 | 6.6 | 0 |
| 809 | | | | | 1.2 | 6.6 | 640 |
| 810 | | | | | 1.2 | 6.6 | 1280 |
| 811 | | | | | 1.2 | 6.6 | 2560 |
| 812 | | | | | 1.2 | 6.2 | 0 |
| 813 | | | | | 1.2 | 6.2 | 640 |
| 814 | | | | | 1.2 | 6.2 | 1280 |
| 815 | | | | | 1.2 | 6.2 | 2560 |
| 816 | | | | | 1.2 | 7 | 0 |
| 817 | | | | | 1.2 | 7 | 640 |
| 818 | | | | | 1.2 | 7 | 1280 |
| 819 | | | | | 1.2 | 7 | 2560 |
| 820 | | | | | 1.2 | 6.2 | 0 |
| 821 | | | | | 1.2 | 6.2 | 640 |
| 822 | | | | | 1.2 | 6.2 | 1280 |
| 823 | | | | | 1.2 | 6.2 | 2560 |
| 824 | | | | | 1.2 | 7 | 0 |
| 825 | | | | | 1.2 | 7 | 640 |
| 826 | | | | | 1.2 | 7 | 1280 |
| 827 | | | | | 1.2 | 7 | 2560 |
| 828 | | | | | 1.2 | 6.3 | 0 |
| 829 | | | | | 1.2 | 6.3 | 640 |
| 830 | | | | | 1.2 | 6.3 | 1280 |
| 831 | | | | | 1.2 | 6.3 | 2560 |
| 832 | | | | | 1.2 | 6.8 | 0 |
| 833 | | | | | 1.2 | 6.8 | 640 |
| 834 | | | | | 1.2 | 6.8 | 1280 |
| 835 | | | | | 1.2 | 6.8 | 2560 |
| 836 | | | | | 1.2 | 6.7 | 0 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 799 | | N.L. | 42 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 800 | | N.L. | 64 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 801 | | N.L. | 66 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 802 | | N.L. | 75 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 803 | | N.L. | 64 | LEAF | SLUDGE, FIELD, MATURITY | 0 | GRAIN |
| 804 | .5 M HOAC | 29 | N.L. | | SLUDGE, FIELD, MATURITY | 0 | ROOT |
| 805 | .5 M HOAC | 112 | N.L. | | SLUDGE, FIELD, MATURITY | 94.5 | ROOT |
| 806 | .5 M HOAC | 212 | N.L. | | SLUDGE, FIELD, MATURITY | 99.3 | ROOT |
| 807 | .5 M HOAC | 350 | N.L. | | SLUDGE, FIELD, MATURITY | 100 | ROOT |
| 808 | .5 M HOAC | 29 | N.L. | | SLUDGE, FIELD, MATURITY | 0 | ROOT |
| 809 | .5 M HOAC | 112 | N.L. | | SLUDGE, FIELD, MATURITY | 36 | ROOT |
| 810 | .5 M HOAC | 212 | N.L. | | SLUDGE, FIELD, MATURITY | 69.4 | ROOT |
| 811 | .5 M HOAC | 350 | N.L. | | SLUDGE, FIELD, MATURITY | 93.2 | ROOT |
| 812 | .5 M HOAC | NL | 83 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 0 | ROOT TUBER |
| 813 | .5 M HOAC | NL | 95 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 86.1 | ROOT TUBER |
| 814 | .5 M HOAC | NL | 124 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 92.9 | ROOT TUBER |
| 815 | .5 M HOAC | NL | 93 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 96.7 | ROOT TUBER |
| 816 | .5 M HOAC | NL | 48 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 0 | ROOT TUBER |
| 817 | .5 M HOAC | NL | 72 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 0 | ROOT TUBER |
| 818 | .5 M HOAC | NL | 67 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 0 | ROOT TUBER |
| 819 | .5 M HOAC | NL | 112 | ROOT TUBER | SLUDGE, FIELD, MATURITY | 52.8 | ROOT TUBER |
| 820 | | NL | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 821 | | NL | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 822 | | NL | NL | | SLUDGE, FIELD, MATURITY | 77.6 | BULB |
| 823 | | NL | NL | | SLUDGE, FIELD, MATURITY | 93.9 | BULB |
| 824 | | NL | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 825 | | NL | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 826 | | NL | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 827 | | NL | NL | | SLUDGE, FIELD, MATURITY | 38.1 | BULB |
| 828 | | NL | 46 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 829 | | NL | 141 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 830 | | NL | 139 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 831 | | NL | NL | BULB | SLUDGE, FIELD, MATURITY | 99 | BULB |
| 832 | | NL | 54 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 833 | | NL | 71 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 834 | | NL | 114 | BULB | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 835 | | NL | 136 | BULB | SLUDGE, FIELD, MATURITY | 36.4 | BULB |
| 836 | .5 M HOAC | 31 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 799 | | | NO | |
| 800 | | | NO | |
| 801 | | | NO | |
| 802 | | | NO | |
| 803 | | | NO | |
| 804 | | | NO | |
| 805 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 806 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 807 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 808 | | | NO | |
| 809 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 810 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 811 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 812 | | | NO | |
| 813 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 814 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 815 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 816 | | | NO | |
| 817 | | | NO | |
| 818 | | | NO | |
| 819 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 820 | | | NO | |
| 821 | | | NO | |
| 822 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 823 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 824 | | | NO | |
| 825 | | | NO | |
| 826 | | | NO | |
| 827 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 828 | | | NO | |
| 829 | | | NO | |
| 830 | | | NO | |
| 831 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 832 | | | NO | |
| 833 | | | NO | |
| 834 | | | NO | |
| 835 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 836 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 799 | MINNESOTA |
| 800 | MINNESOTA |
| 801 | MINNESOTA |
| 802 | MINNESOTA |
| 803 | MINNESOTA |
| 804 | WOODTHORNE, U.K. |
| 805 | WOODTHORNE, U.K. |
| 806 | WOODTHORNE, U.K. |
| 807 | WOODTHORNE, U.K. |
| 808 | WOODTHORNE, U.K. |
| 809 | WOODTHORNE, U.K. |
| 810 | WOODTHORNE, U.K. |
| 811 | WOODTHORNE, U.K. |
| 812 | WOODTHORNE, U.K. |
| 813 | WOODTHORNE, U.K. |
| 814 | WOODTHORNE, U.K. |
| 815 | WOODTHORNE, U.K. |
| 816 | WOODTHORNE, U.K. |
| 817 | WOODTHORNE, U.K. |
| 818 | WOODTHORNE, U.K. |
| 819 | WOODTHORNE, U.K. |
| 820 | WOODTHORNE, U.K. |
| 821 | WOODTHORNE, U.K. |
| 822 | WOODTHORNE, U.K. |
| 823 | WOODTHORNE, U.K. |
| 824 | WOODTHORNE, U.K. |
| 825 | WOODTHORNE, U.K. |
| 826 | WOODTHORNE, U.K. |
| 827 | WOODTHORNE, U.K. |
| 828 | WOODTHORNE, U.K. |
| 829 | WOODTHORNE, U.K. |
| 830 | WOODTHORNE, U.K. |
| 831 | WOODTHORNE, U.K. |
| 832 | WOODTHORNE, U.K. |
| 833 | WOODTHORNE, U.K. |
| 834 | WOODTHORNE, U.K. |
| 835 | WOODTHORNE, U.K. |
| 836 | WOODTHORNE, U.K. |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 837 | WILLIAMS 1977 | SWEDE | | | | | | |
| 838 | WILLIAMS 1977 | SWEDE | | | | | | |
| 839 | WILLIAMS 1977 | SWEDE | | | | | | |
| 840 | WILLIAMS 1977 | SWEDE | | | | | | |
| 841 | WILLIAMS 1977 | SWEDE | | | | | | |
| 842 | WILLIAMS 1977 | SWEDE | | | | | | |
| 843 | WILLIAMS 1977 | SWEDE | | | | | | |
| 844 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 845 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 846 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 847 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 848 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 849 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 850 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 851 | WILLIAMS 1977 | LETTUCE | | | | | | |
| 852 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 853 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 854 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 855 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 856 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 857 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 858 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 859 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 860 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 861 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 862 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 863 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 864 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 865 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 866 | KING & MORRIS 1972 | RYE | | | | | 1.42 | |
| 867 | WEBBER 1972 | RED BEET | | | | | | |
| 868 | WEBBER 1972 | RED BEET | | | | | | |
| 869 | WEBBER 1972 | RED BEET | | | | | | |
| 870 | WEBBER 1972 | RED BEET | | | | | | |
| 871 | WEBBER 1972 | RED BEET | | | | | | |
| 872 | WEBBER 1972 | RED BEET | | | | | | |
| 873 | WEBBER 1972 | CELERY | | | | | | |
| 874 | WEBBER 1972 | CELERY | | | | | | |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 837 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 838 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 839 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 840 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 841 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 842 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 843 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 844 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 845 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 846 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 847 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 848 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 849 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 850 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 851 | | 100 | | | 5100 | | | 11400 | AIR DRIED | |
| 852 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 853 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 854 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 855 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 856 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 857 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 858 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 859 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 860 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 861 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 862 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 863 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 864 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 865 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 866 | | 453 | | 2.96 | 25 | 0.79 | | 2415 | 0.06 | ANAEROBICALLY DIGESTED |
| 867 | | | | | | | | | | |
| 868 | 240 | 1100 | | | 210 | | | 3000 | | |
| 869 | 60 | 4600 | | | 58 | | | 48000 | | |
| 870 | 60 | 4600 | | | 58 | | | 48000 | | |
| 871 | 240 | 1100 | | | 210 | | | 3000 | | |
| 872 | 60 | 4600 | | | 58 | | | 48000 | | |
| 873 | | | | | | | | | | |
| 874 | 240 | 1100 | | | 210 | | | 3000 | | |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 837 | | 56 | 56 | 11 | | | LS |
| 838 | | 112 | 112 | 11 | | | LS |
| 839 | | 224 | 224 | 11 | | | LS |
| 840 | | 0 | 0 | 11 | | | LS |
| 841 | | 56 | 56 | 11 | | | LS |
| 842 | | 112 | 112 | 11 | | | LS |
| 843 | | 224 | 224 | 11 | | | LS |
| 844 | | 0 | 0 | 12 | | | LS |
| 845 | | 56 | 56 | 12 | | | LS |
| 846 | | 112 | 112 | 12 | | | LS |
| 847 | | 224 | 224 | 12 | | | LS |
| 848 | | 0 | 0 | 12 | | | LS |
| 849 | | 56 | 56 | 12 | | | LS |
| 850 | | 112 | 112 | 12 | | | LS |
| 851 | | 224 | 224 | 12 | | | LS |
| 852 | | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 853 | | 26.5 | 26.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 854 | | 52.5 | 52.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 855 | | 60 | 60 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 856 | | 120 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 857 | | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 858 | | 15.1 | 41.6 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 859 | | 30 | 82.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 860 | | 60 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 861 | | 120 | 240 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 862 | | 0 | 0 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 863 | | 15.1 | 41.6 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 864 | | 30 | 82.5 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 865 | | 60 | 120 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 866 | | 120 | 240 | 0 | TYPIC HAPLUDULT | CECIL | SCL |
| 867 | | 0 | 0 | 0 | | | |
| 868 | | 125.5 | 125.5 | 2 | | | |
| 869 | | 125.5 | 125.5 | 2 | | | |
| 870 | | 125.5 | 125.5 | 2 | | | |
| 871 | | 31.4 | 94.2 | 0 | | | |
| 872 | | 31.4 | 94.2 | 0 | | | |
| 873 | | 0 | 0 | 0 | | | |
| 874 | | 125.5 | 125.5 | 2 | | | |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 837 | | | | | 1.2 | 6.7 | 640 |
| 838 | | | | | 1.2 | 6.7 | 1280 |
| 839 | | | | | 1.2 | 6.7 | 2560 |
| 840 | | | | | 1.2 | 7.2 | 0 |
| 841 | | | | | 1.2 | 7.2 | 640 |
| 842 | | | | | 1.2 | 7.2 | 1280 |
| 843 | | | | | 1.2 | 7.2 | 2560 |
| 844 | | | | | 1.2 | 6.5 | 0 |
| 845 | | | | | 1.2 | 6.5 | 640 |
| 846 | | | | | 1.2 | 6.5 | 1280 |
| 847 | | | | | 1.2 | 6.5 | 2560 |
| 848 | | | | | 1.2 | 7 | 0 |
| 849 | | | | | 1.2 | 7 | 640 |
| 850 | | | | | 1.2 | 7 | 1280 |
| 851 | | | | | 1.2 | 7 | 2560 |
| 852 | | | | | | 5.2 | 0 |
| 853 | | | | | | NR | 71 |
| 854 | | | | | | NR | 142 |
| 855 | | | | | | NR | 180 |
| 856 | | | | | | NR | 360 |
| 857 | | | | | | 5.2 | 0 |
| 858 | | | | | | 5.1 | 171 |
| 859 | | | | | | NR | 342 |
| 860 | | | | | | 4.5 | 486 |
| 861 | | | | | | 4.2 | 972 |
| 862 | | | | | | LIMED | 0 |
| 863 | | | | | | LIMED | 171 |
| 864 | | | | | | LIMED | 342 |
| 865 | | | | | | LIMED | 486 |
| 866 | | | | | | LIMED | 972 |
| 867 | | | | | | 6.1 | 0 |
| 868 | | | | | | NR | 377 |
| 869 | | | | | | NR | 1004 |
| 870 | | | | | | NR | 2008 |
| 871 | | | | | | NR | 283 |
| 872 | | | | | | NR | 1004 |
| 873 | | | | | | 6.1 | 0 |
| 874 | | | | | | NR | 377 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 837 | .5 M HOAC | 90 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 838 | .5 M HOAC | 168 | NL | | SLUDGE, FIELD, MATURITY | 70.3 | BULB |
| 839 | .5 M HOAC | 278 | NL | | SLUDGE, FIELD, MATURITY | 100 | BULB |
| 840 | .5 M HOAC | 31 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 841 | .5 M HOAC | 90 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 842 | .5 M HOAC | 168 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 843 | .5 M HOAC | 278 | NL | | SLUDGE, FIELD, MATURITY | 0 | BULB |
| 844 | .5 M HOAC | 47 | NL | | SLUDGE, FIELD, MATURITY | 0 | LEAF |
| 845 | .5 M HOAC | 115 | NL | | SLUDGE, FIELD, MATURITY | 0 | LEAF |
| 846 | .5 M HOAC | 194 | NL | | SLUDGE, FIELD, MATURITY | 30 | LEAF |
| 847 | .5 M HOAC | 334 | NL | | SLUDGE, FIELD, MATURITY | 96.3 | LEAF |
| 848 | .5 M HOAC | 47 | NL | | SLUDGE, FIELD, MATURITY | 0 | LEAF |
| 849 | .5 M HOAC | 115 | NL | | SLUDGE, FIELD, MATURITY | 0 | LEAF |
| 850 | .5 M HOAC | 194 | NL | | SLUDGE, FIELD, MATURITY | 23.7 | LEAF |
| 851 | .5 M HOAC | 334 | NL | | SLUDGE, FIELD, MATURITY | 28.4 | LEAF |
| 852 | | NR | NR | | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 853 | | NR | NR | | SLUDGE, FIELD, MATURITY | 34* | FORAGE |
| 854 | | NR | NR | | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 855 | | NR | NR | | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 856 | | NR | NR | | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 857 | | NR | 32 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 858 | | NR | 150 | FORAGE | SLUDGE, FIELD, MATURITY | 41* | FORAGE |
| 859 | | NR | 232 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 860 | | NR | 340 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 861 | | NR | 775 | FORAGE | SLUDGE, FIELD, MATURITY | 80 | FORAGE |
| 862 | | NR | 30 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 863 | | NR | 106 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 864 | | NR | 186 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 865 | | NR | 251 | FORAGE | SLUDGE, FIELD, MATURITY | 0 | FORAGE |
| 866 | | NR | 579 | FORAGE | SLUDGE, FIELD, MATURITY | 58 | FORAGE |
| 867 | .5 M HOAC | 8.9 | | | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 868 | .5 M HOAC | 91 | | | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 869 | .5 M HOAC | 465 | | | SLUDGE, FIELD, MATURITY | 58 | TOTAL BIOMASS |
| 870 | .5 M HOAC | 744 | | | SLUDGE, FIELD, MATURITY | 100 | TOTAL BIOMASS |
| 871 | .5 M HOAC | 61 | | | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 872 | .5 M HOAC | 147 | | | SLUDGE, FIELD, MATURITY | 0 | TOTAL BIOMASS |
| 873 | .5 M HOAC | 8.9 | | | SLUDGE, FIELD, MATURITY | 0 | STALKS |
| 874 | .5 M HOAC | 91 | | | SLUDGE, FIELD, MATURITY | 0 | STALKS |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 837 | | | NO | |
| 838 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 839 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 840 | | | NO | |
| 841 | | | NO | |
| 842 | | | NO | |
| 843 | | | NO | |
| 844 | | | NO | |
| 845 | | | NO | |
| 846 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 847 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 848 | | | NO | |
| 849 | | | NO | |
| 850 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 851 | | | POSSIBLE | SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400) |
| 852 | | | NO | |
| 853 | | | NO* | *DOSE RESPONSE NOT CONSISTENT |
| 854 | | | NO | |
| 855 | | | NO | |
| 856 | | | NO | |
| 857 | | | NO | |
| 858 | | | NO* | *DOSE RESPONSE & TISSUE ZN CONCENTRATION ARE NOT CONSISTENT, PH<5.5 |
| 859 | | | NO | |
| 860 | | | NO | |
| 861 | | | POSSIBLE | PH<5.5 (=4.2) |
| 862 | | | NO | |
| 863 | | | NO | |
| 864 | | | NO | |
| 865 | | | NO | |
| 866 | | | POSSIBLE | LOADING IN EXCESS OF AGRONOMIC RATES, PH UNKNOWN AND QUESTIONABLE |
| 867 | | | NO | |
| 868 | | | NO | |
| 869 | | | POSSIBLE | HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED |
| 870 | | | POSSIBLE | HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED |
| 871 | | | NO | |
| 872 | | | NO | |
| 873 | | | NO | |
| 874 | | | NO | |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 837 | WOODTHORNE, U.K. |
| 838 | WOODTHORNE, U.K. |
| 839 | WOODTHORNE, U.K. |
| 840 | WOODTHORNE, U.K. |
| 841 | WOODTHORNE, U.K. |
| 842 | WOODTHORNE, U.K. |
| 843 | WOODTHORNE, U.K. |
| 844 | WOODTHORNE, U.K. |
| 845 | WOODTHORNE, U.K. |
| 846 | WOODTHORNE, U.K. |
| 847 | WOODTHORNE, U.K. |
| 848 | WOODTHORNE, U.K. |
| 849 | WOODTHORNE, U.K. |
| 850 | WOODTHORNE, U.K. |
| 851 | WOODTHORNE, U.K. |
| 852 | GEORGIA |
| 853 | GEORGIA |
| 854 | GEORGIA |
| 855 | GEORGIA |
| 856 | GEORGIA |
| 857 | GEORGIA |
| 858 | GEORGIA |
| 859 | GEORGIA |
| 860 | GEORGIA |
| 861 | GEORGIA |
| 862 | GEORGIA |
| 863 | GEORGIA |
| 864 | GEORGIA |
| 865 | GEORGIA |
| 866 | GEORGIA |
| 867 | LEEDS, U.K. |
| 868 | LEEDS, U.K. |
| 869 | LEEDS, U.K. |
| 870 | LEEDS, U.K. |
| 871 | LEEDS, U.K. |
| 872 | LEEDS, U.K. |
| 873 | LEEDS, U.K. |
| 874 | LEEDS, U.K. |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 875 | WEBBER 1972 | CELERY | | | | | | |
| 876 | WEBBER 1972 | CELERY | | | | | | |
| 877 | WEBBER 1972 | CELERY | | | | | | |
| 878 | WEBBER 1972 | CELERY | | | | | | |
| 879 | WEBBER 1972 | CELERY | | | | | | |
| 880 | WEBBER 1972 | | | | | | | |
| 881 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 882 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 883 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 |
| 884 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 |
| 885 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 |
| 886 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 887 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 888 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 |
| 889 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 |
| 890 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 |
| 891 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 892 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 893 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 |
| 894 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 |
| 895 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 |
| 896 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 897 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 307 |
| 898 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.3 | 3.3 | 307 |
| 899 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.6 | 3.3 | 307 |
| 900 | PIETZ ET AL. 1983 | CORN | PIONEER 3517 | 7.6 | 46 | 1.5 | 3.3 | 307 |
| 901 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 902 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 903 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 904 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 905 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 906 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 907 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 908 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 909 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 910 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 911 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 912 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 875 | 60 | 4600 | | | 58 | | | 48000 | | |
| 876 | 60 | 4600 | | | 58 | | | 48000 | | |
| 877 | 240 | 1100 | | | 210 | | | 3000 | | |
| 878 | 60 | 4600 | | | 58 | | | 48000 | | |
| 879 | | | | | | | | | | |
| 880 | | | | | | | | | | |
| 881 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 882 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 883 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 884 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 885 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 886 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 887 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 888 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 889 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 890 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 891 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 892 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 893 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 894 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 895 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 896 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 897 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 898 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 899 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 900 | 3505 | 1471 | 5.1 | 5.1 | 369 | 3.42 | 1258 | 4872 | 0.04 | SECONDARY, ANAER DIGEST, LAGOON |
| 901 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON |
| 902 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 903 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 904 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 905 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 906 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 907 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 908 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 909 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 910 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 911 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 912 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 875 | | 125.5 | 125.5 | 2 | | | |
| 876 | | 125.5 | 125.5 | 2 | | | |
| 877 | | 31.4 | 94.2 | 0 | | | |
| 878 | | 31.4 | 94.2 | 0 | | | |
| 879 | | | | | | | |
| 880 | | | | | | | |
| 881 | POLYMER,FECL3 | 0 | 0 | | STRIP MINE SPOIL | | |
| 882 | POLYMER,FECL3 | 0 | 0 | | STRIP MINE SPOIL | | |
| 883 | POLYMER,FECL3 | 0 | 0 | | STRIP MINE SPOIL | | |
| 884 | POLYMER,FECL3 | 0 | 0 | | STRIP MINE SPOIL | | |
| 885 | POLYMER,FECL3 | 0 | 0 | | STRIP MINE SPOIL | | |
| 886 | POLYMER,FECL3 | 3 | 3 | | STRIP MINE SPOIL | | |
| 887 | POLYMER,FECL3 | 12.8 | 15.8 | 0 | STRIP MINE SPOIL | | |
| 888 | POLYMER,FECL3 | 12.4 | 28.1 | 0 | STRIP MINE SPOIL | | |
| 889 | POLYMER,FECL3 | 14.3 | 42.4 | 0 | STRIP MINE SPOIL | | |
| 890 | POLYMER,FECL3 | 19.5 | 61.9 | 0 | STRIP MINE SPOIL | | |
| 891 | POLYMER,FECL3 | 6 | 6 | 0 | STRIP MINE SPOIL | | |
| 892 | POLYMER,FECL3 | 25.5 | 31.5 | 0 | STRIP MINE SPOIL | | |
| 893 | POLYMER,FECL3 | 29.8 | 61.3 | 0 | STRIP MINE SPOIL | | |
| 894 | POLYMER,FECL3 | 28.6 | 89.9 | 0 | STRIP MINE SPOIL | | |
| 895 | POLYMER,FECL3 | 39 | 128.9 | 0 | STRIP MINE SPOIL | | |
| 896 | POLYMER,FECL3 | 11.9 | 11.9 | 0 | STRIP MINE SPOIL | | |
| 897 | POLYMER,FECL3 | 51 | 62.9 | 0 | STRIP MINE SPOIL | | |
| 898 | POLYMER,FECL3 | 59.6 | 122.5 | 0 | STRIP MINE SPOIL | | |
| 899 | POLYMER,FECL3 | 57.1 | 179.6 | 0 | STRIP MINE SPOIL | | |
| 900 | POLYMER,FECL3 | 78 | 257.6 | 0 | STRIP MINE SPOIL | | |
| 901 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 902 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 903 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 904 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 905 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 906 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 907 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 908 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 909 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 910 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 911 | POLYMER,FECL3 | 0 | 0 | 0 | STRIP MINE SPOIL | | |
| 912 | POLYMER,FECL3 | 16.1 | 78 | 0 | STRIP MINE SPOIL | | |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 875 | | | | | | NR | 1004 |
| 876 | | | | | | NR | 2008 |
| 877 | | | | | | NR | 283 |
| 878 | | | | | | NR | 377 |
| 879 | | | | | | | |
| 880 | | | | | | | |
| 881 | | | | 12.6 | 0.25 | 7.8 | 0 |
| 882 | | | | 12.6 | 0.25 | 7.8 | 0 |
| 883 | | | | 12.6 | 0.33 | 7.8 | 0 |
| 884 | | | | 12.6 | 0.33 | 7.8 | 0 |
| 885 | | | | 12.6 | 0.33 | 7.8 | 0 |
| 886 | | | | 12.6 | 0.33 | 7.8 | 15 |
| 887 | | | | 12.6 | 0.27 | 7.8 | 79 |
| 888 | | | | 12.6 | 0.41 | 7.8 | 142 |
| 889 | | | | 12.6 | 0.41 | 7.8 | 212 |
| 890 | | | | 12.6 | 0.59 | 7.8 | 331 |
| 891 | | | | 12.6 | 0.35 | 7.8 | 30 |
| 892 | | | | 12.6 | 0.3 | 7.8 | 158 |
| 893 | | | | 12.6 | 0.3 | 7.8 | 284 |
| 894 | | | | 12.6 | 0.5 | 7.8 | 424 |
| 895 | | | | 12.6 | 0.5 | 7.8 | 662 |
| 896 | | | | 12.6 | 0.33 | 7.8 | 60 |
| 897 | | | | 12.6 | 0.33 | 7.8 | 316 |
| 898 | | | | 12.6 | 0.76 | 7.8 | 568 |
| 899 | | | | 12.6 | 0.76 | 7.8 | 848 |
| 900 | | | | 12.6 | 1.22 | 7.8 | 1324 |
| 901 | | | | | 0.33 | 7.5 | 0 |
| 902 | | | | | 0.44 | 7.5 | 0 |
| 903 | | | | | 0.44 | 7.5 | 0 |
| 904 | | | | | 0.36 | 7.5 | 0 |
| 905 | | | | | 0.36 | 7.5 | 0 |
| 906 | | | | | 0.46 | 7.5 | 0 |
| 907 | | | | | 0.46 | 7.5 | 0 |
| 908 | | | | | 0.73 | 7.5 | 0 |
| 909 | | | | | 0.73 | 7.5 | 0 |
| 910 | | | | | 0.7 | 7.5 | 0 |
| 911 | | | | | 0.7 | 7.5 | 0 |
| 912 | | | | | 0.59 | 7.5 | 415 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 875 | .5 M HOAC | 465 | | | SLUDGE, FIELD, MATURITY | 0 | STALKS |
| 876 | .5 M HOAC | 744 | | | SLUDGE, FIELD, MATURITY | 58 | STALKS |
| 877 | .5 M HOAC | 61 | | | SLUDGE, FIELD, MATURITY | 0 | STALKS |
| 878 | .5 M HOAC | 147 | | | SLUDGE, FIELD, MATURITY | 0 | STALKS |
| 879 | | | | | | | |
| 880 | | | | | | | |
| 881 | 0.1 M HCl | 3.4 | 15 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 882 | 0.1 M HCl | 4.5 | 13 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 883 | 0.1 M HCl | 3.9 | 21 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 884 | 0.1 M HCl | 9.5 | 33 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 885 | 0.1 M HCl | 9.4 | 33 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 886 | 0.1 M HCl | 4.3 | 34 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 887 | 0.1 M HCl | 6.5 | 43 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 888 | 0.1 M HCl | 20.8 | 74 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 889 | 0.1 M HCl | 30.6 | 109 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 890 | 0.1 M HCl | 18.1 | 81 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 891 | 0.1 M HCl | 3.7 | 43 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 892 | 0.1 M HCl | 9.1 | 51 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 893 | 0.1 M HCl | 50.3 | 93 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 894 | 0.1 M HCl | 43.3 | 124 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 895 | 0.1 M HCl | 32.6 | 132 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 896 | 0.1 M HCl | 3.6 | 80 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 897 | 0.1 M HCl | 10.3 | 72 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 898 | 0.1 M HCl | 114 | 121 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 899 | 0.1 M HCl | 82 | 191 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 900 | 0.1 M HCl | 77.5 | 200 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 901 | 0.1 M HCl | 14 | 49 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 902 | 0.1 M HCl | 20.4 | 65 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 903 | 0.1 M HCl | 25.8 | 42 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 904 | 0.1 M HCl | 22.5 | 54 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 905 | 0.1 M HCl | 22.3 | 53 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 906 | 0.1 M HCl | 28.1 | 34 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 907 | 0.1 M HCl | 33.4 | 56 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 908 | 0.1 M HCl | 42 | 88 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 909 | 0.1 M HCl | 58.6 | 24 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 910 | 0.1 M HCl | 58.3 | 28 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 911 | 0.1 M HCl | 74.5 | 31 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 912 | 0.1 M HCl | 49.6 | 114 | LEAF | FIELD, SLUDGE, MATURITY | 29.5* | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| | | | | |
| 875 | | | NO | |
| 876 | | | POSSIBLE | HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED |
| 877 | | | NO | |
| 878 | | | NO | |
| 879 | | | | |
| 880 | | | | |
| 881 | 0 | STOVER | NO | |
| 882 | 0 | STOVER | NO | |
| 883 | 0 | STOVER | NO | |
| 884 | 0 | STOVER | NO | |
| 885 | 0 | STOVER | NO | |
| 886 | 0 | STOVER | NO | |
| 887 | 0 | STOVER | NO | |
| 888 | 0 | STOVER | NO | |
| 889 | 0 | STOVER | NO | |
| 890 | 0 | STOVER | NO | |
| 891 | 0 | STOVER | NO | |
| 892 | 0 | STOVER | NO | |
| 893 | 0 | STOVER | NO | |
| 894 | 0 | STOVER | NO | |
| 895 | 0 | STOVER | NO | |
| 896 | 0 | STOVER | NO | |
| 897 | 0 | STOVER | NO | |
| 898 | 0 | STOVER | NO | |
| 899 | 0 | STOVER | NO | |
| 900 | 0 | STOVER | NO | |
| 901 | 0 | STOVER | NO | |
| 902 | 0 | STOVER | NO | |
| 903 | 0 | STOVER | NO | |
| 904 | 0 | STOVER | NO | |
| 905 | 0 | STOVER | NO | |
| 906 | 0 | STOVER | NO | |
| 907 | 0 | STOVER | NO | |
| 908 | 0 | STOVER | NO | |
| 909 | 0 | STOVER | NO | |
| 910 | 0 | STOVER | NO | |
| 911 | 0 | STOVER | NO | |
| 912 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 875 | LEEDS, U.K. |
| 876 | LEEDS, U.K. |
| 877 | LEEDS, U.K. |
| 878 | LEEDS, U.K. |
| 879 | |
| 880 | |
| 881 | FULTON COUNTY, ILLINOIS |
| 882 | FULTON COUNTY, ILLINOIS |
| 883 | FULTON COUNTY, ILLINOIS |
| 884 | FULTON COUNTY, ILLINOIS |
| 885 | FULTON COUNTY, ILLINOIS |
| 886 | FULTON COUNTY, ILLINOIS |
| 887 | FULTON COUNTY, ILLINOIS |
| 888 | FULTON COUNTY, ILLINOIS |
| 889 | FULTON COUNTY, ILLINOIS |
| 890 | FULTON COUNTY, ILLINOIS |
| 891 | FULTON COUNTY, ILLINOIS |
| 892 | FULTON COUNTY, ILLINOIS |
| 893 | FULTON COUNTY, ILLINOIS |
| 894 | FULTON COUNTY, ILLINOIS |
| 895 | FULTON COUNTY, ILLINOIS |
| 896 | FULTON COUNTY, ILLINOIS |
| 897 | FULTON COUNTY, ILLINOIS |
| 898 | FULTON COUNTY, ILLINOIS |
| 899 | FULTON COUNTY, ILLINOIS |
| 900 | FULTON COUNTY, ILLINOIS |
| 901 | FULTON COUNTY, ILLINOIS |
| 902 | FULTON COUNTY, ILLINOIS |
| 903 | FULTON COUNTY, ILLINOIS |
| 904 | FULTON COUNTY, ILLINOIS |
| 905 | FULTON COUNTY, ILLINOIS |
| 906 | FULTON COUNTY, ILLINOIS |
| 907 | FULTON COUNTY, ILLINOIS |
| 908 | FULTON COUNTY, ILLINOIS |
| 909 | FULTON COUNTY, ILLINOIS |
| 910 | FULTON COUNTY, ILLINOIS |
| 911 | FULTON COUNTY, ILLINOIS |
| 912 | FULTON COUNTY, ILLINOIS |

TABLE F-4 (cont.)

| | LITERATURE CITATION | PLANT NAME | CULTIVAR | SLUDGE pH | SLUDGE VOL SOLIDS % | SLUDGE Al % | SLUDGE Ca % | SLUDGE Cd mg/kg |
|---|---|---|---|---|---|---|---|---|
| 913 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 914 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 915 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 916 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 917 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 918 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 919 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 920 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 921 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 922 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 923 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 924 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 925 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 926 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 927 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 928 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 929 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 930 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 931 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 932 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 933 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |
| 934 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 935 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 936 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 937 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 938 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 265 |
| 939 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 940 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 46 | 1.4 | 3.3 | 160 |
| 941 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 942 | PIETZ ET AL. 1991 | CORN | PIONEER 3517 | 7.6 | 20 | 3.1 | 0.71 | 71 |
| 943 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 30 | 3.1 | 0.71 | 71 |
| 944 | PIETZ ET AL. 1991 | CORN | PIONEER 3377 | 7.6 | 20 | 0.67 | 3.9 | 53 |

TABLE F-4 (cont.)

| | SLUDGE Cr mg/kg | SLUDGE Cu mg/kg | SLUDGE Fe % | SLUDGE N % | SLUDGE Ni mg/kg | SLUDGE P mg/kg | SLUDGE Pb mg/kg | SLUDGE Zn mg/kg | SLUDGE SOLIDS CONTNT | SLUDGE BIOLOGICAL PROCESSING |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| 913 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 914 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 915 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 916 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 917 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 918 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 919 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 920 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 921 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 922 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 923 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON |
| 924 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 925 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 926 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 927 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 928 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 929 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 930 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 931 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 932 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 933 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |
| 934 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.045 | SECONDARY, ANAER DIGEST, LAGOON |
| 935 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 936 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.054 | SECONDARY, ANAER DIGEST, LAGOON |
| 937 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 938 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.052 | SECONDARY, ANAER DIGEST, LAGOON |
| 939 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.05 | SECONDARY, ANAER DIGEST, LAGOON |
| 940 | 3505 | 1471 | 4.3 | 4.5 | 425 | 3.42 | 850 | 3600 | 0.046 | SECONDARY, ANAER DIGEST, LAGOON |
| 941 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.66 | SECONDARY, ANAER DIGEST, LAGOON |
| 942 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.65 | SECONDARY, ANAER DIGEST, LAGOON |
| 943 | 775 | 460 | 2.2 | 0.5 | 116 | 0.87 | 293 | 1100 | 0.3 | SECONDARY, ANAER DIGEST, LAGOON |
| 944 | 679 | 454 | 1.9 | 0.5 | 121 | 0.62 | 259 | 1146 | 0.69 | SECONDARY, ANAER DIGEST, LAGOON |

TABLE F-4 (cont.)

| | SLUDGE CHEMICAL STABILIZATN | ANNL SLUDGE LOADNG RATE Mg/ha | CUMML SLUDGE LOADNG RATE Mg/ha | YEARS SINCE LAST APPLICATN | SOIL TAXONOMIC NAME | SOIL SERIES NAME | SOIL TEXTURE |
|---|---|---|---|---|---|---|---|
| 913 | POLYMER,FECL3 | 19.9 | 97.9 | 0 | STRIP MINE SPOIL | | |
| 914 | POLYMER,FECL3 | 17.4 | 115.3 | 0 | STRIP MINE SPOIL | | |
| 915 | POLYMER,FECL3 | 11.4 | 126.7 | 0 | STRIP MINE SPOIL | | |
| 916 | POLYMER,FECL3 | 16.8 | 143.5 | 0 | STRIP MINE SPOIL | | |
| 917 | POLYMER,FECL3 | 17.9 | 161.4 | 0 | STRIP MINE SPOIL | | |
| 918 | POLYMER,FECL3 | 16.8 | 178.2 | 0 | STRIP MINE SPOIL | | |
| 919 | POLYMER,FECL3 | 16.8 | 195 | 0 | STRIP MINE SPOIL | | |
| 920 | POLYMER,FECL3 | 16.8 | 211.8 | 0 | STRIP MINE SPOIL | | |
| 921 | POLYMER,FECL3 | 16.8 | 228.6 | 0 | STRIP MINE SPOIL | | |
| 922 | POLYMER,FECL3 | 16.8 | 245.4 | 0 | STRIP MINE SPOIL | | |
| 923 | POLYMER,FECL3 | 32.2 | 161.1 | 0 | STRIP MINE SPOIL | | |
| 924 | POLYMER,FECL3 | 39.8 | 200.9 | 0 | STRIP MINE SPOIL | | |
| 925 | POLYMER,FECL3 | 34.8 | 235.7 | 0 | STRIP MINE SPOIL | | |
| 926 | POLYMER,FECL3 | 22.8 | 258.5 | 0 | STRIP MINE SPOIL | | |
| 927 | POLYMER,FECL3 | 34.9 | 293.4 | 0 | STRIP MINE SPOIL | | |
| 928 | POLYMER,FECL3 | 35.8 | 329.2 | 0 | STRIP MINE SPOIL | | |
| 929 | POLYMER,FECL3 | 33.6 | 362.8 | 0 | STRIP MINE SPOIL | | |
| 930 | POLYMER,FECL3 | 33.6 | 396.4 | 0 | STRIP MINE SPOIL | | |
| 931 | POLYMER,FECL3 | 33.6 | 430 | 0 | STRIP MINE SPOIL | | |
| 932 | POLYMER,FECL3 | 33.6 | 463.6 | 0 | STRIP MINE SPOIL | | |
| 933 | POLYMER,FECL3 | 33.6 | 497.2 | 0 | STRIP MINE SPOIL | | |
| 934 | POLYMER,FECL3 | 64.3 | 321.9 | 0 | STRIP MINE SPOIL | | |
| 935 | POLYMER,FECL3 | 79.7 | 401.6 | 0 | STRIP MINE SPOIL | | |
| 936 | POLYMER,FECL3 | 69.8 | 471.4 | 0 | STRIP MINE SPOIL | | |
| 937 | POLYMER,FECL3 | 45.5 | 516.9 | 0 | STRIP MINE SPOIL | | |
| 938 | POLYMER,FECL3 | 68.8 | 585.7 | 0 | STRIP MINE SPOIL | | |
| 939 | POLYMER,FECL3 | 71.7 | 657.4 | 0 | STRIP MINE SPOIL | | |
| 940 | POLYMER,FECL3 | 67.2 | 724.6 | 0 | STRIP MINE SPOIL | | |
| 941 | POLYMER,FECL3 | 67.2 | 791.8 | 0 | STRIP MINE SPOIL | | |
| 942 | POLYMER,FECL3 | 67.2 | 859 | 0 | STRIP MINE SPOIL | | |
| 943 | POLYMER,FECL3 | 67.2 | 926.2 | 0 | STRIP MINE SPOIL | | |
| 944 | POLYMER,FECL3 | 67.2 | 993.4 | 0 | STRIP MINE SPOIL | | |

TABLE F-4 (cont.)

| | SAND CONTENT % | SILT CONTENT % | CLAY CONTENT % | SOIL CEC cmol/kg | SOIL OC % | SOIL pH | CUMM Zn LOADING RATE (kg/ha) |
|---|---|---|---|---|---|---|---|
| 913 | | | | | 0.94 | 7.5 | 508 |
| 914 | | | | | 0.94 | 7.5 | 592 |
| 915 | | | | | 0.67 | 7.5 | 635 |
| 916 | | | | | 0.67 | 7.5 | 695 |
| 917 | | | | | 0.87 | 7.5 | 746 |
| 918 | | | | | 0.87 | 7.5 | 795 |
| 919 | | | | | 1.41 | 7.5 | 851 |
| 920 | | | | | 1.41 | 7.5 | 890 |
| 921 | | | | | 1.25 | 7.5 | 940 |
| 922 | | | | | 1.25 | 7.5 | 973 |
| 923 | | | | | 0.94 | 7.5 | 830 |
| 924 | | | | | 0.94 | 7.5 | 1016 |
| 925 | | | | | 1.56 | 7.5 | 1184 |
| 926 | | | | | 1.56 | 7.5 | 1270 |
| 927 | | | | | 1.04 | 7.5 | 1390 |
| 928 | | | | | 1.04 | 7.5 | 1492 |
| 929 | | | | | 1.48 | 7.5 | 1590 |
| 930 | | | | | 1.48 | 7.5 | 1702 |
| 931 | | | | | 2.15 | 7.5 | 1780 |
| 932 | | | | | 2.15 | 7.5 | 1880 |
| 933 | | | | | 1.9 | 7.5 | 1946 |
| 934 | | | | | 1.22 | 7.5 | 1660 |
| 935 | | | | | 3.02 | 7.5 | 2032 |
| 936 | | | | | 3.02 | 7.5 | 2368 |
| 937 | | | | | 1.58 | 7.5 | 2540 |
| 938 | | | | | 1.58 | 7.5 | 2780 |
| 939 | | | | | 2.38 | 7.5 | 2984 |
| 940 | | | | | 2.38 | 7.5 | 3180 |
| 941 | | | | | 3.47 | 7.5 | 3404 |
| 942 | | | | | 3.47 | 7.5 | 3560 |
| 943 | | | | | 2.77 | 7.5 | 3760 |
| 944 | | | | | 2.77 | 7.5 | 3892 |

TABLE F-4 (cont.)

| | SOIL EXTRACTANT | SOIL Zn CONCENTRTN mg/kg | PLANT Zn CONCENTRTN mg/kg | PLANT TISSUE SAMPLED | DESCRIPTION OF EXPERIMENTAL DESIGN | YIELD REDUCTION % | YIELD COMPONENT MEASURED |
|---|---|---|---|---|---|---|---|
| 913 | 0.1 M HCl | 59.7 | 101 | LEAF | FIELD, SLUDGE, MATURITY | NA | GRAIN |
| 914 | 0.1 M HCl | 133 | 97 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 915 | 0.1 M HCl | 90.6 | 76 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 916 | 0.1 M HCl | 82.2 | 53 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 917 | 0.1 M HCl | 118 | 60 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 918 | 0.1 M HCl | 113 | 94 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 919 | 0.1 M HCl | 171 | 88 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 920 | 0.1 M HCl | 196 | 34 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 921 | 0.1 M HCl | 175 | 41 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 922 | 0.1 M HCl | 174 | 38 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 923 | 0.1 M HCl | 89.1 | 201 | LEAF | FIELD, SLUDGE, MATURITY | 21.5* | GRAIN |
| 924 | 0.1 M HCl | 102 | 197 | LEAF | FIELD, SLUDGE, MATURITY | NA | GRAIN |
| 925 | 0.1 M HCl | 268 | 183 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 926 | 0.1 M HCl | 211 | 115 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 927 | 0.1 M HCl | 195 | 132 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 928 | 0.1 M HCl | 269 | 121 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 929 | 0.1 M HCl | 261 | 174 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 930 | 0.1 M HCl | 317 | 128 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 931 | 0.1 M HCl | 326 | 55 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 932 | 0.1 M HCl | 293 | 42 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 933 | 0.1 M HCl | 335 | 41 | LEAF | FIELD, SLUDGE, MATURITY | 43.7* | GRAIN |
| 934 | 0.1 M HCl | 182 | 317 | LEAF | FIELD, SLUDGE, MATURITY | 23* | GRAIN |
| 935 | 0.1 M HCl | 214 | 346 | LEAF | FIELD, SLUDGE, MATURITY | NA | GRAIN |
| 936 | 0.1 M HCl | 358 | 325 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 937 | 0.1 M HCl | 442 | 252 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 938 | 0.1 M HCl | 332 | 245 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 939 | 0.1 M HCl | 534 | 294 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 940 | 0.1 M HCl | 491 | 298 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 941 | 0.1 M HCl | 689 | 195 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 942 | 0.1 M HCl | 398 | 87 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 943 | 0.1 M HCl | 492 | 64 | LEAF | FIELD, SLUDGE, MATURITY | 0 | GRAIN |
| 944 | 0.1 M HCl | 519 | 48 | LEAF | FIELD, SLUDGE, MATURITY | 59.2* | GRAIN |

TABLE F-4 (cont.)

| | YIELD REDUCTION % | YIELD COMPONENT MEASURED | METAL PHYTOTOXICITY | COMMENTS |
|---|---|---|---|---|
| 913 | NA | STOVER | NO | |
| 914 | 0 | STOVER | NO | |
| 915 | 0 | STOVER | NO | |
| 916 | 0 | STOVER | NO | |
| 917 | 0 | STOVER | NO | |
| 918 | 0 | STOVER | NO | |
| 919 | 0 | STOVER | NO | |
| 920 | 0 | STOVER | NO | |
| 921 | 0 | STOVER | NO | |
| 922 | 0 | STOVER | NO | |
| 923 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS |
| 924 | NA | STOVER | NO | |
| 925 | 0 | STOVER | NO | |
| 926 | 0 | STOVER | NO | |
| 927 | 0 | STOVER | NO | |
| 928 | 0 | STOVER | NO | |
| 929 | 0 | STOVER | NO | |
| 930 | 0 | STOVER | NO | |
| 931 | 0 | STOVER | NO | |
| 932 | 0 | STOVER | NO | |
| 933 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS |
| 934 | 0 | STOVER | *NO | *DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS |
| 935 | NA | STOVER | NO | |
| 936 | 0 | STOVER | NO | |
| 937 | 0 | STOVER | NO | |
| 938 | 0 | STOVER | NO | |
| 939 | 0 | STOVER | NO | |
| 940 | 0 | STOVER | NO | |
| 941 | 0 | STOVER | NO | |
| 942 | 0 | STOVER | NO | |
| 943 | 0 | STOVER | NO | |
| 944 | 0 | STOVER | *NO | *DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTENT, OTHER FACTORS |

TABLE F-4 (cont.)

| | LOCATION OF STUDY |
|---|---|
| | |
| 913 | FULTON COUNTY, ILLINOIS |
| 914 | FULTON COUNTY, ILLINOIS |
| 915 | FULTON COUNTY, ILLINOIS |
| 916 | FULTON COUNTY, ILLINOIS |
| 917 | FULTON COUNTY, ILLINOIS |
| 918 | FULTON COUNTY, ILLINOIS |
| 919 | FULTON COUNTY, ILLINOIS |
| 920 | FULTON COUNTY, ILLINOIS |
| 921 | FULTON COUNTY, ILLINOIS |
| 922 | FULTON COUNTY, ILLINOIS |
| 923 | FULTON COUNTY, ILLINOIS |
| 924 | FULTON COUNTY, ILLINOIS |
| 925 | FULTON COUNTY, ILLINOIS |
| 926 | FULTON COUNTY, ILLINOIS |
| 927 | FULTON COUNTY, ILLINOIS |
| 928 | FULTON COUNTY, ILLINOIS |
| 929 | FULTON COUNTY, ILLINOIS |
| 930 | FULTON COUNTY, ILLINOIS |
| 931 | FULTON COUNTY, ILLINOIS |
| 932 | FULTON COUNTY, ILLINOIS |
| 933 | FULTON COUNTY, ILLINOIS |
| 934 | FULTON COUNTY, ILLINOIS |
| 935 | FULTON COUNTY, ILLINOIS |
| 936 | FULTON COUNTY, ILLINOIS |
| 937 | FULTON COUNTY, ILLINOIS |
| 938 | FULTON COUNTY, ILLINOIS |
| 939 | FULTON COUNTY, ILLINOIS |
| 940 | FULTON COUNTY, ILLINOIS |
| 941 | FULTON COUNTY, ILLINOIS |
| 942 | FULTON COUNTY, ILLINOIS |
| 943 | FULTON COUNTY, ILLINOIS |
| 944 | FULTON COUNTY, ILLINOIS |

# APPENDIX G

## Accumulation of Pollutant in Treated Soil, and Calculation of Square Wave for the Ground Water Pathway

# APPENDIX G

## ACCUMULATION OF POLLUTANT IN TREATED SOIL, AND CALCULATION OF "SQUARE WAVE" FOR GROUND-WATER PATHWAY

Derivation of reference application rates is based on the concept that both metals and organic pollutants accumulate in soil with repeated application of sewage sludge. It is assumed that all competing loss processes for pollutant in soil can be approximated as first-order, and that coefficients describing the rate of loss to each process can be summed to yield a total or "lumped" coefficient for first-order loss.

For organic pollutants, it is assumed that sewage sludge will be applied repeatedly until steady-state is achieved. In other words, organic pollutants will accumulate in the soil until total yearly losses through erosion, degradation, leaching, and volatilization (which are assumed to be proportional to the concentration in soil) catch up with yearly loadings of pollutant to soil.

All loss processes are assumed to be first-order, and are combined into a "lumped" first-order loss process for which losses at any time t can be described as:

$$\frac{dM_t}{dt} = -K_{tot} M_t \qquad (1)$$

where:

$M_t$ = mass of pollutant in treated soil at time t (kg/ha)
$K_{tot}$ = lumped, first-order loss rate for pollutant ($yr^{-1}$)

Figure G-1 shows expected concentrations of BAP in treated soil as a function of time, based on a unit yearly loading of 1 kg/ha and a yearly total loss rate of 0.484. At the beginning of each year, a new application of sludge raises the concentration by about 1 kg/ha. Subsequent losses to leaching, degradation, erosion, and volatilization (at total estimated rate of $K_{tot}$=0.484 $yr^{-1}$) then reduce the concentration until the next year's application. If pollutant loading to

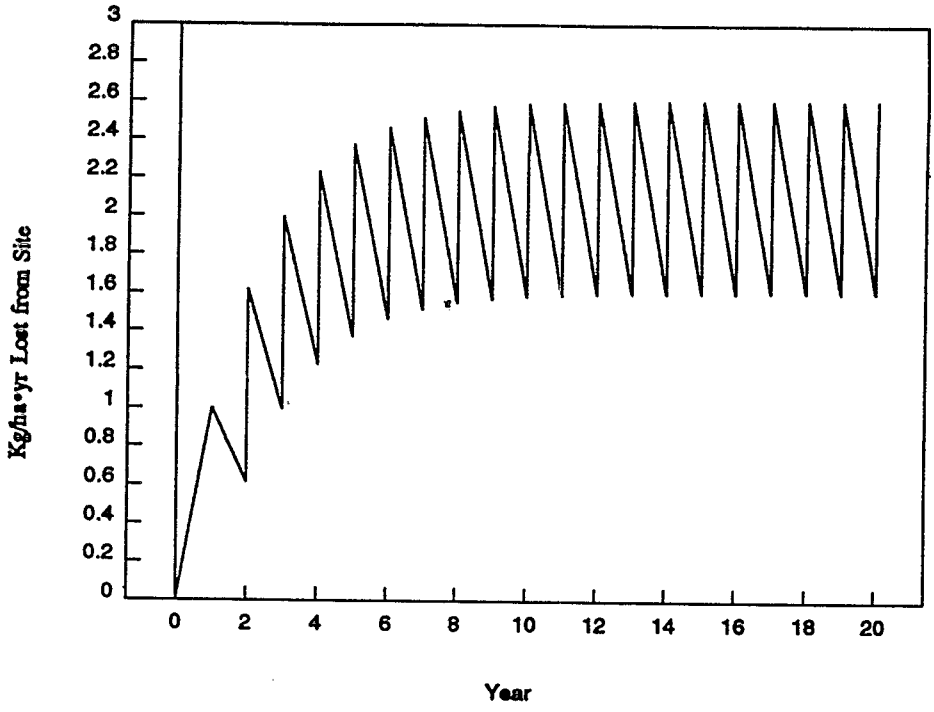



**Figure G-1. BAP in soil by time (kg/ha), per annual loading (1 kg/ha).**

treated soil is approximated as a continuous process, the mass of pollutant in soil after t years of sewage sludge applications can be approximated by:

$$M_t = \int_0^t AR\, e^{-K_{tot}x}\, dx$$

$$= \frac{AR}{K_{tot}} \left(1 - e^{-K_{tot}\, t}\right) \qquad (2)$$

where:

| | | |
|---|---|---|
| $M_t$ | = | mass of pollutant in treated soil at time t (kg/ha) |
| AR | = | annual loading of pollutant to soil (kg/ha•yr) |
| $K_{tot}$ | = | lumped, first-order loss rate for pollutant ($yr^{-1}$) |

As t approaches infinity $M_t$ approaches $AR/K_{tot}$ and yearly loss approaches yearly loading.

Figure G-2 plots annual losses of BAP as a function of the number of repeat applications of sewage sludge (and 1 kg/ha.annual loading of BAP). As can be seen from the graph, the theoretical limit of 1 kg/ha annual loss has been nearly achieved after about 10 years of repeat applications. Because BAP has the lowest estimated total loss rate of any organic pollutant considered in this analysis, other organic pollutants should approach steady-state conditions more quickly. Calculation of reference application of pollutant is based on the assumption that steady-state has been achieved.

For metals, the reference application of pollution is expressed in terms of cumulative loadings. According to the loss coefficients calculated for metals in this analysis, arsenic is lost most rapidly from treated soil, and lead least rapidly. Figure G-3 shows how the cumulative loading of arsenic in treated soil would vary with 50 years of repeat applications of sludge with 1 kg/ha loading of arsenic. With a total loss rate of 0.12 per year, arsenic approaches a steady-state concentration equal to about 8 times its annual loading. Figure G-4 shows corresponding yearly losses of arsenic. After about 10-20 years, yearly losses closely approximate yearly loadings of 1 kg/ha. Lead, the least mobile of the metals evaluated, is depleted from treated soil at an estimated annual rate of only 0.0073 per year. Under an idealized scenario of unlimited applications of sludge (not used for this analysis) and a unit loading of 1 kg/ha, the accumulation of lead in soil would be described by Figure G-5. Because of its low rate of loss,

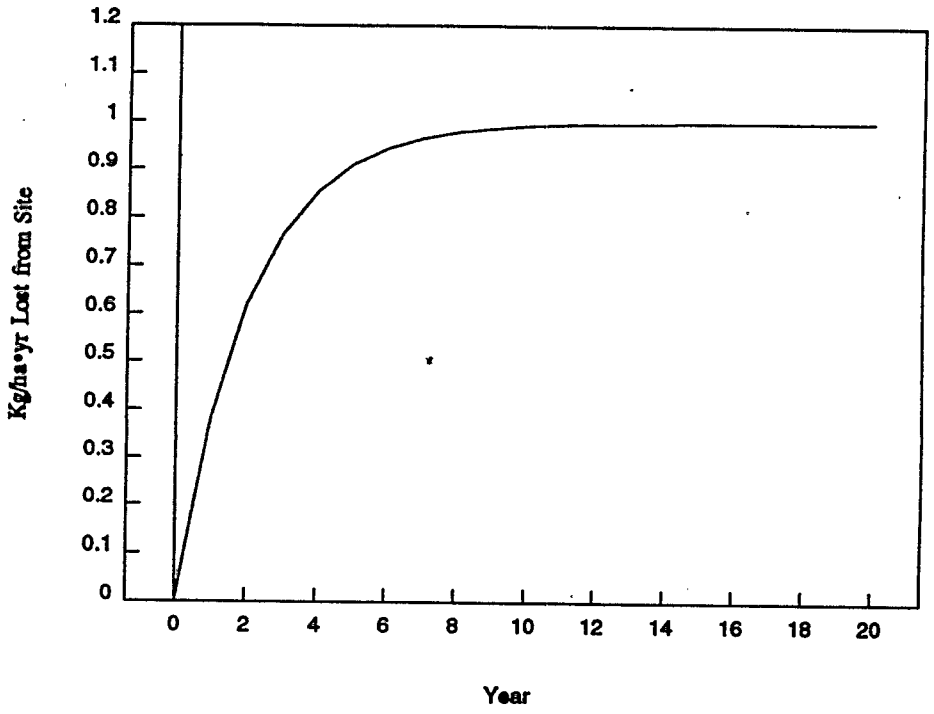



**Figure G-2. Annual loss of BAP from soil (kg/ha•yr), per annual loading (1 kg/ha).**

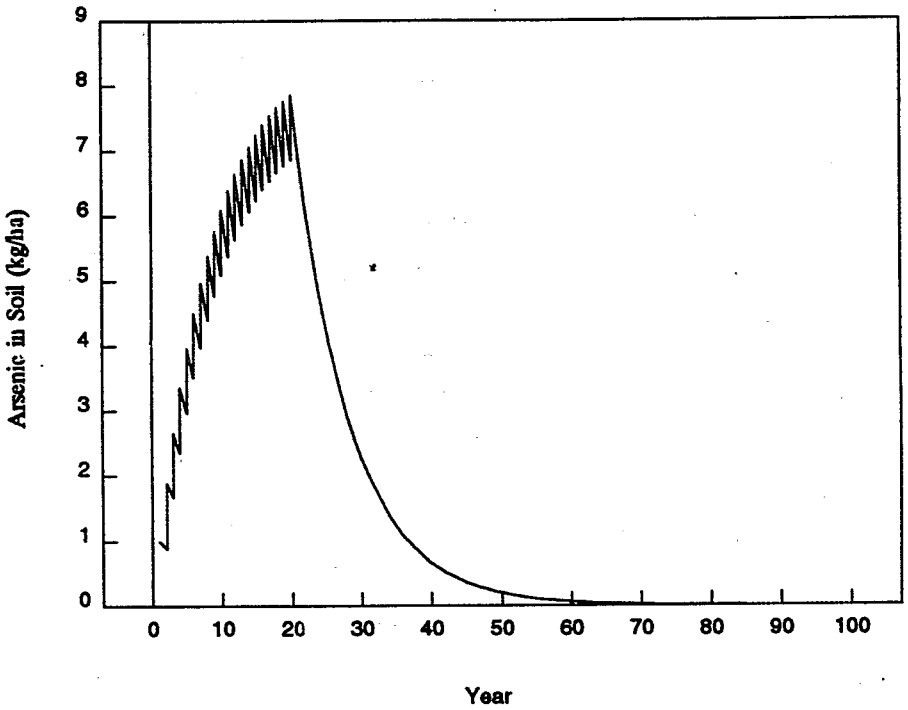



**Figure G-3. Arsenic in soil as function of time given 20 applications (1 kg/ha•yr).**

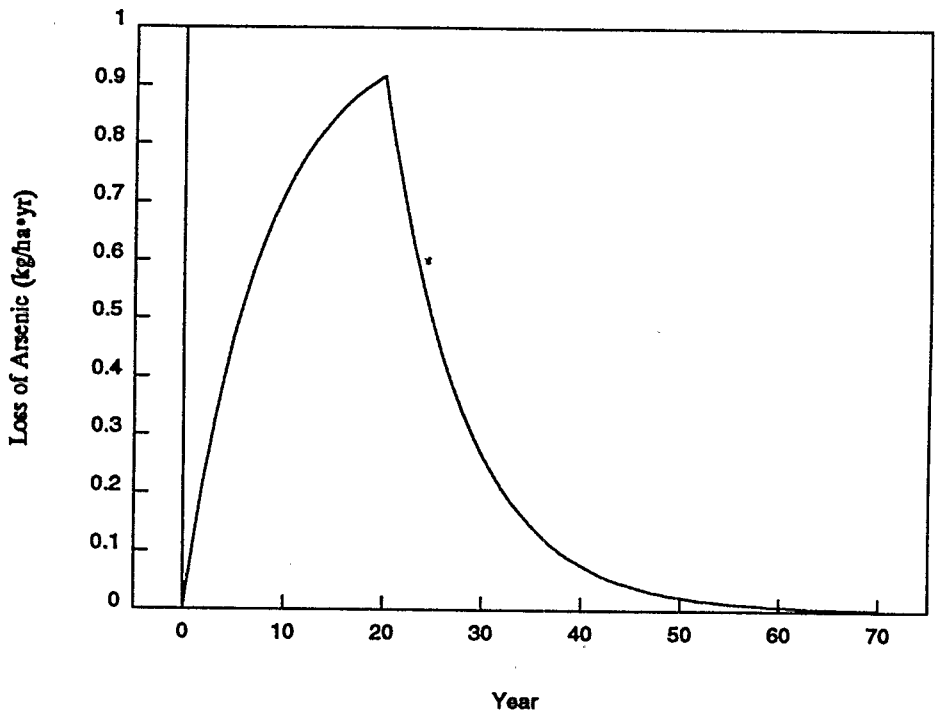



**Figure G-4. Loss of arsenic per year (kg/ha•yr), assuming limit of 20 applications (1 kg/ha•yr).**

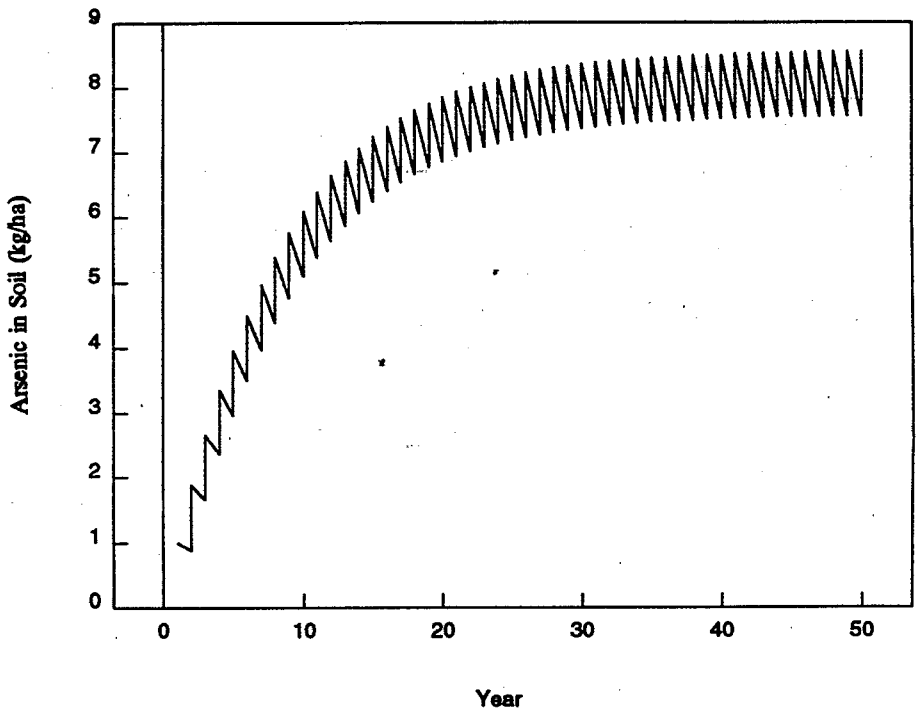



**Figure G-5. Arsenic in soil as function of time, given unlimited applications (1 kg/ha).**

lead concentrations would increase significantly each year for the first 500-600 years of repeat applications. As shown in Figure G-6, yearly losses would not begin to approximate yearly loadings for several centuries.

Reference application rates of pollutant for metals are based on cumulative loadings to treated soil, but the contamination of well-water or surface water bodies is also affected by the period of time in which this cumulative loading takes place. Assumptions are therefore required if maximum allowable cumulative loadings are to be calculated. It is assumed that metals are loaded into treated soil through 20 consecutive, yearly applications of sewage sludge; after 20 years, applications are discontinued. Figure G-7 and Figure G-8 show how these assumptions affect the predicted concentration and annual losses of arsenic for these calculations. With 20 consecutive loadings of arsenic at 1 kg/ha, yearly concentrations and losses are expected to increase each year, until they reach a maximum of about 0.9 kg/ha in the 20th year. Thereafter, annual losses decline as the store of accumulated arsenic is depleted from the soil.

Ideally, derivation of reference application rates would be based on functions similar to the one graphed in Figure G-8, but for computational reasons a simplified loading is used as input for the unsaturated zone (VADOFT) component of the ground-water model. It is assumed that pollutant is loaded into the top of the unsaturated zone as a "square wave" of constant magnitude and finite duration. To capture the risks associated with the peak rate at which pollutant leaves the soil layer, the peak loss rate (calculated for the 20th year of application) is used for the calculations. To conserve mass, the assumed duration of this loading is constrained so that the product of the loss rate and the length of the square wave is equal to the cumulative total mass of pollutant loading for the site. For arsenic, the peak loss rate is calculated as:

$$L_{max} = 1 - e^{(-0.20 \times 20)}$$
$$= 0.909 (kg/ha \cdot yr) \quad (3)$$

where:

$L_{max}$ = maximum loss rate of pollutant (kg/ha•yr)

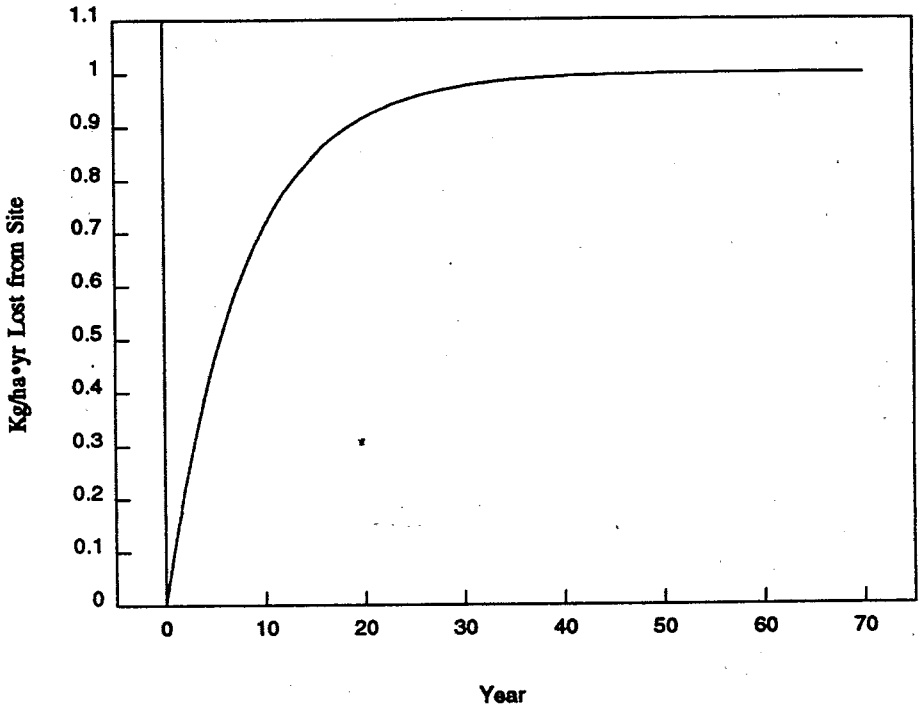



**Figure G-6. Total loss of arsenic per year, per annual loading (1 kg/ha).**

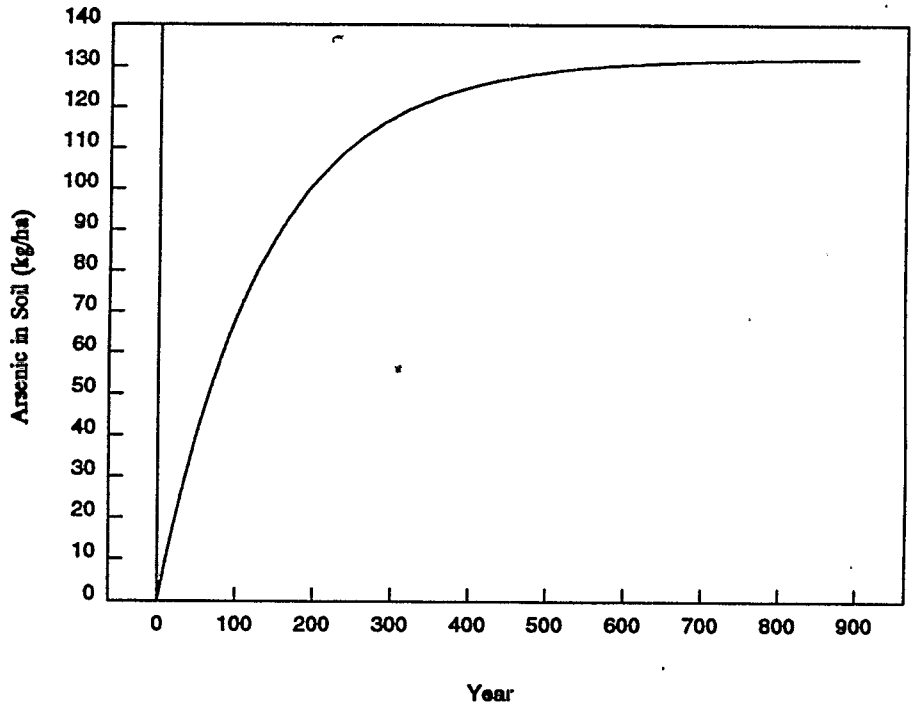



**Figure G-7. Lead in soil by time (kg/ha), given unlimited applications (1 kg/ha).**

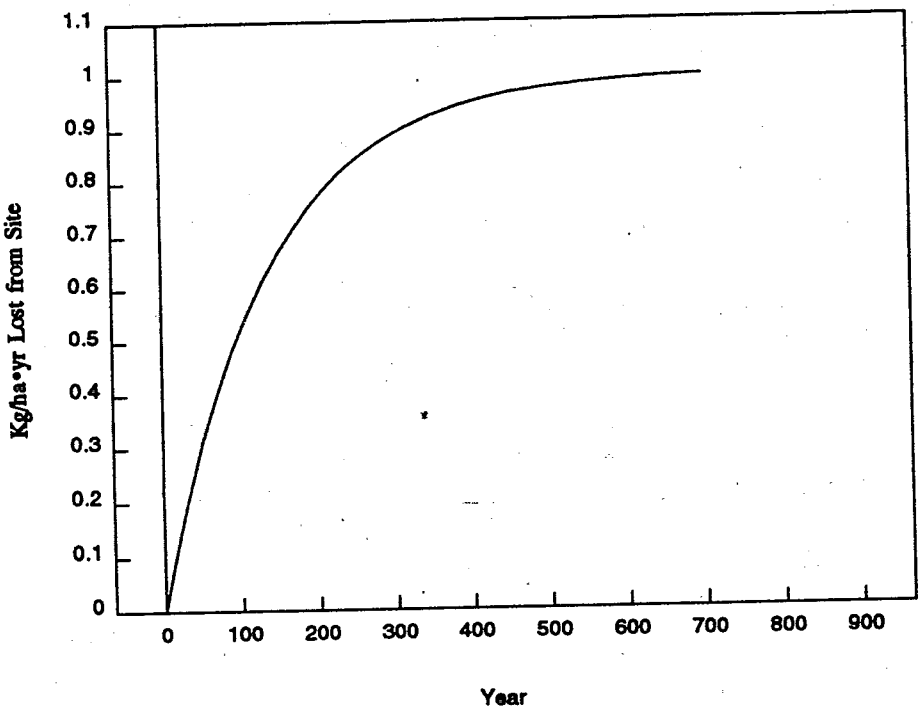



**Figure G-8. Total loss of lead per year (hg/ha•yr), per annual loading (1 kg/ha).**

At this maximum rate, a cumulative loading of 20 kg/ha would be depleted in:

$$\frac{\sum A_Y(\text{kg/ha})}{L_{MAX}(\text{kg/ha}\cdot\text{yr})} = \frac{20}{0.909} = 22\text{yr} \qquad (4)$$

where:

$L_{max}$ = maximum loss rate of pollutant (kg/ha•yr)

The square wave thus computed for arsenic is included in Figure G-8.

As mentioned earlier, reference application rates for organic pollutants on land application sites are derived for steady-state conditions. At steady state, the amplitude of the "square wave" pulse for the groundwater pathway model is therefore equal to the unit loading of pollutant (1 kg/ha) multiplied by the fraction of annual loss attributable to leaching. The length of the square wave is equal to the length of the simulation (300 years). For landfills and surface impoundments, both organic and metal pollutants are regulated based on the concentration of pollutant in the sludge. Steady-state assumptions are therefore inappropriate, and the loading of both organic and metal pollutants to the unsaturated zone is represented as a square wave. In summary, all of the calculations in our derivation of reference application rates are based on the assumption that pollutant losses to competing loss processes can be described as first-order. All calculations within the mass balance, air pathway, and erosion pathway components of our model are based on first-order loss processes. Calculation of a reference application rate for the groundwater pathway also involves the assumption that losses are first-order, but a simplifying step is required in executing the groundwater pathway model. For metals in land-applied sewage sludge, and for both metals and organic pollutants in sewage sludge disposed in landfills or surface impoundments, the pollutant pulse into the unsaturated zone is approximated as a square wave. Dimensions of this square wave pulse are set to approximate conditions based on first-order, mass balance calculations.

# APPENDIX H

## Partitioning of Pollutants Among Air, Water, and Solids in Soil

# APPENDIX H

## PARTITIONING OF POLLUTANT AMONG AIR, WATER, AND SOLIDS IN SOIL

Calculations used to derive reference application rates for ground water, surface water, and air pathways are based on the assumption that equilibrium is maintained between concentrations of pollutant in the air-filled pore space, the water-filled pore-space, and the solid particles of soil. Equilibrium partitioning between dissolved and gaseous phases is described by Henry's Law constants; partitioning between adsorbed and dissolved phases is described by soil-water partition coefficients. From these assumptions and the definitions of concentration are derived the equations used to describe partitioning.

$$C_s = \frac{M_{cs}}{M_s} \qquad C_w = \frac{M_{cw}}{V_w} \qquad C_a = \frac{M_{ca}}{V_a} \tag{1}$$

and:

$$C_t = \frac{M_{ct}}{V_t} = \frac{M_{cs} + M_{cw} + M_{ca}}{V_a + V_w + V_s} \tag{2}$$

where:

| | | |
|---|---|---|
| $C_s$ | = | concentration of adsorbed pollutant on soil particles (kg/kg) |
| $M_{cs}$ | = | mass of adsorbed pollutant (kg) |
| $M_s$ | = | mass of soil (kg) |
| $C_w$ | = | concentration of dissolved pollutant in soil (kg/m$^3$) |
| $M_{cw}$ | = | mass of dissolved pollutant (kg) |
| $V_w$ | = | volume of water in soil (m$^3$) |
| $C_a$ | = | concentration of gaseous pollutant in soil (kg/m$^3$) |
| $M_{ca}$ | = | mass of gaseous pollutant (kg) |
| $V_a$ | = | volume of air in soil (m$^3$) |
| $C_t$ | = | total concentration of pollutant in soil (kg/m$^3$) |
| $M_{ct}$ | = | total mass of pollutant in soil (kg) |
| $V_t$ | = | total volume of soil (m$^3$) |
| $V_s$ | = | volume of solids in soil (m$^3$) |

The equilibrium distribution coefficient between adsorbed and dissolved phases (KD, $m^3/kg$) can be defined as:

$$KD = \frac{\left(\frac{M_{ca}}{M_s}\right)}{\left(\frac{M_{cw}}{V_w}\right)} = \frac{M_{ca}\ V_w}{M_s\ M_{cw}} \quad (3)$$

where:

| | | |
|---|---|---|
| KD | = | partitioning coefficient between solids and liquids (l/kg) |
| $M_{ca}$ | = | mass of adsorbed pollutant (kg) |
| $M_s$ | = | mass of soil (kg) |
| $M_{cw}$ | = | mass of dissolved pollutant (kg) |
| $V_w$ | = | volume of water in soil ($m^3$) |

The dimensionless Henry's Law constant ($\dot{H}$) describing the partitioning between gaseous and dissolved phases is defined as:

$$\dot{H} = \frac{C_a}{C_w} = \frac{\left(\frac{M_{CA}}{V_A}\right)}{\left(\frac{M_{CW}}{V_W}\right)} = \frac{M_{CA}\ V_W}{V_A\ M_{CW}} \quad (4)$$

where:

| | | |
|---|---|---|
| $M_{ca}$ | = | mass of gaseous pollutant (kg) |
| $V_a$ | = | volume of air in soil ($m^3$) |
| $M_{cw}$ | = | mass of dissolved pollutant (kg) |
| $V_w$ | = | volume of water in soil ($m^3$) |

The bulk density of soil (BD, $kg/m^3$) is defined as:

$$BD = \frac{M_s}{V_t} \quad (5)$$

where:

| | | |
|---|---|---|
| BD | = | bulk density of soil in mixing zone ($kg/m^3$) |
| $M_s$ | = | mass of soil (kg) |
| $V_t$ | = | total volume of soil ($m^3$) |

The air-filled porosity of soil ($\theta_a$) is defined as:

$$\theta_a = \frac{V_a}{V_t} \tag{6}$$

where:

$\theta_a$ = air-filled porosity of soil (unitless)
$V_a$ = volume of air in soil ($m^3$)
$V_t$ = total volume of soil ($m^3$)

as:

$$\theta_w = \frac{V_w}{V_t} \tag{7}$$

where:

$\theta_w$ = water-filled porosity of soil (unitless)
$V_w$ = volume of water in soil ($m^3$)
$V_t$ = total volume of soil ($m^3$)

and, the total porosity of soil ($\theta_t$) is defined as:

$$\theta_t = \frac{(V_t - V_a)}{V_t} \tag{8}$$

$$= \theta_a + \theta_w$$

where:

$\theta_t$ = total porosity of soil (unitless)
$V_t$ = total volume of soil ($m^3$)
$V_a$ = volume of air in soil ($m^3$)
$\theta_a$ = air-filled porosity of soil (unitless)
$\theta_w$ = water-filled porosity of soil (unitless)

The above definitions can be combined to yield:

$$\frac{C_t}{C_a} = \frac{KD\ BD}{\dot{H}} + \frac{\theta_w}{\dot{H}} + \theta_a \tag{9}$$

and:

$$\frac{C_t}{C_w} = BD\ KD + \theta_w + \dot{H}\ \theta_a \tag{10}$$

and:

$$\frac{C_t}{C_s} = BD + \frac{\theta_w}{KD} + \frac{\theta_a \dot{H}}{KD} \qquad (11)$$

where:

| | | |
|---|---|---|
| $C_t$ | = | total concentration of pollutant in soil (kg/m$^3$) |
| $C_s$ | = | concentration of gaseous pollutant in soil (kg/m$^3$) |
| KD | = | soil-water distribution coefficient for pollutant (m$^3$/kg) |
| BD | = | bulk density of soil (kg/m$^3$) |
| $\dot{H}$ | = | nondimensional Henry's Law constant for the pollutant |
| $\theta_w$ | = | water-filled porosity of soil (unitless) |
| $\theta_a$ | = | air-filled porosity of soil (unitless) |
| $C_w$ | = | concentration of dissolved pollutant in soil (kg•pollutant/m$^3$) |
| $C_s$ | = | concentration of adsorbed pollutant in treated soil (kg/kg) |

These relations are used throughout the calculations used to derive reference application rates. Where dry-weight concentrations of pollutant in sewage sludge or sewage sludge-treated soil are involved, the equations are modified slightly, based on the definition:

$$C_{dw} = \frac{M_{ct}}{M_s}$$

$$= \frac{M_{ct}}{V_t\, BD} \qquad (12)$$

$$= \frac{C_t}{BD}$$

where:

| | | |
|---|---|---|
| $C_{dw}$ | = | dry-weight concentration of pollutant in soil (kg pollutant/kg) |
| $M_{ct}$ | = | total mass of pollutant in soil (kg) |
| $M_s$ | = | mass of soil (kg) |
| $V_t$ | = | total volume of soil (m$^3$) |
| BD | = | bulk density of soil (kg/m$^3$) |
| $C_t$ | = | total concentration of pollutant in soil (kg/m$^3$) |

# APPENDIX I

## Derivation of First-Order Coefficient for Losses to Leaching

# APPENDIX I

## DERIVATION OF FIRST-ORDER COEFFICIENT FOR LOSSES TO LEACHING

U.S. EPA (1987e) provides an equation for computing a first-order loss rate to leaching for pollutant in treated soil:

$$K_{lec} = \frac{NR}{BD\ KD\ d_i} \quad (1)$$

where:

| | | |
|---|---|---|
| $K_{lec}$ | = | first-order loss rate coefficient for leaching ($yr^{-1}$) |
| NR | = | annual recharge rate (m/yr) |
| BD | = | bulk density of soil ($kg/m^3$) |
| KD | = | soil-water distribution coefficient for pollutant ($m^3/kg$) |
| $d_i$ | = | depth of incorporation of sewage sludge (M) |

This appendix describes a modified version of that equation.

The basic strategy for deriving a coefficient for first-order loss to leaching is to estimate the mass of pollutant expected to be lost each year and divide by the available mass of pollutant. The mass of pollutant that will be lost to leaching in any interval of time can be described by the volume of water percolating through the treated soil multiplied by the average concentration of pollutant in that water:

$$FA_{GW} = NR\ C_{lec}\ 1{,}000 \quad (2)$$

where:

| | | |
|---|---|---|
| $FA_{GW}$ | = | flux of leached pollutant from treated soil ($kg/ha \cdot yr$) |
| NR | = | recharge to ground water beneath the treated soil ($m^3/m^2 \cdot yr$, or m/yr) |
| $C_{lec}$ | = | concentration of pollutant in water infiltrating through the treated soil ($kg/m^3$) |
| 1,000 | = | constant to convert units from ($kg/m^2 \cdot yr$) to ($kg/ha \cdot yr$) |

From Appendix H, the concentration of pollutant in leachate is related to the total concentration (by volume) of pollutant in soil as:

$$C_w = \frac{C_t}{BD \cdot KD + \theta_w + \dot{H} \cdot \theta_a} \quad (3)$$

where:

| | | |
|---|---|---|
| $C_w$ | = | concentration of dissolved pollutant in soil (kg•pollutant/$m^3$) |
| $C_t$ | = | total concentration of pollutant in treated soil (kg/$m^3$) |
| BD | = | bulk density of soil (kg/$m^3$) |
| KD | = | soil-water distribution coefficient for pollutant ($m^3$/kg) |
| $\theta_w$ | = | water-filled porosity of soil (unitless) |
| $\dot{H}$ | = | Henry's Law Constant for pollutant (unitless) |
| $\theta_a$ | = | air-filled porosity of soil (unitless) |

This flux of pollutant must be translated into a first-order loss coefficient so that:

$$\frac{dC_t}{dt} = -K_{loc} C_t \quad (4)$$

where:

| | | |
|---|---|---|
| $C_t$ | = | total concentration of pollutant in treated soil (kg/$m^3$) |
| t | = | time (yr) |
| $K_{loc}$ | = | first-order loss rate coefficient for leaching ($yr^{-1}$) |

$K_{loc}$ is estimated with the approximation:

$$K_{loc} = \frac{\left(\frac{dC_t}{dt}\right)}{C_t} \approx \frac{\left(\frac{\Delta C_t}{\Delta t}\right)}{C_t} = \frac{\left(\frac{\Delta M_{ct}}{\Delta t}\right)}{M_{ct}} \quad (5)$$

where:

| | | |
|---|---|---|
| $K_{loc}$ | = | first-order loss rate coefficient for leaching ($yr^{-1}$) |
| $C_t$ | = | total concentration of pollutant in treated soil (kg/$m^3$) |
| t | = | time (yr) |
| $\Delta t$ | = | one year |
| $M_{ct}$ | = | mass of pollutant in soil (kg) |

The volume of treated soil beneath one square meter of soil surface ( $m^3/m^2$) is equal to the depth to which sewage sludge has been incorporated into the soil ($d_i$, m). The total mass of pollutant beneath one square meter of surface can therefore be described by:

$$M_{ct} = C_t V_t = C_t d_i \quad (6)$$

Combining these equations with results from Appendix H yields:

$$K_{lec} \approx \frac{FA_{GW}\ 10^{-3}}{M_{ct}} = \frac{NR\ C_{lec}}{C_t V_t} = \frac{NR}{(BD\ KD + \theta_w + H \cdot \theta_a)\ d_i} \quad (7)$$

# APPENDIX J

## Input Parameters Used to Derive Reference Application Rates for Pathways 12 through 14

# APPENDIX J

# INPUT PARAMETERS USED TO DERIVE REFERENCE APPLICATION RATES FOR PATHWAYS 12 THROUGH 14

This appendix discusses input parameters used to derive reference application rates for land application.

## J.1 SITE PARAMETERS

Values for input parameters used to characterize land application sites are listed in Table J-1, and discussed below.

### J.1.1 Area of Land Application Site

The land application site area ($A_{sa}$) of 1,074 ha is based on an analysis of the National Sewage Sludge Survey (NSSS) and represents the 90th percentile of land area estimated to have been treated by those POTWs in the analytic component of the survey reporting the application of sewage sludge to agricultural land.

### J.1.2 Watershed Area

The area of the watershed ($A_{ws}$) is assumed to be 440,300 ha, the mean size hydrologic cataloguing unit as defined by the U.S Geological Survey (U.S. EPA, 1990a). It is assumed that the entire watershed is used for agricultural purposes, so that the topography, cover, and other characteristics of the remainder of the watershed are identical to those of the sludge management area (SMA).

**TABLE J-1**

**SITE AND SLUDGE PARAMETERS FOR LAND APPLICATION**

| | |
|---|---|
| Sludge Management Area (A, ha) | 1,074[a] |
| Watershed Area ($A_{WS}$, ha) | 440,300[b] |
| Depth of Incorporation for Sewage Sludge ($d_i$, m) | 0.15[c] |
| Lateral Distance to Well (m) | 0 |
| Width of Buffer Zone (m) | 10 |
| Wind Velocity (*w*m/sec) | 4.5[d] |
| Average Air Temperature (T, °K) | 288[e] |
| Number of Applications of Sewage Sludge | 20[f] |
| Yearly Loss to Soil Erosion ($d_e$, m/yr) | 0.00060[g] |

[a] 90th percentile of land area estimated to be treated annually by those POTWs in the analytic component of the National Sewage Sludge Survey.
[b] Mean size hydrologic cataloging unit (U.S. EPA, 1990a).
[c] U.S. EPA (1987e).
[d] Typical value for U.S. (U.S. EPA, 1990c).
[e] *Federal Register* (1986c).
[f] Typical site life (U.S. EPA, 1983d).
[g] USDA (1987).

### J.1.3 Depth of Incorporation for Sludge

It is assumed that sewage sludge is incorporated into treated soil to a depth ($d_i$) of 6 inches or 15 cm (U.S EPA, 1987e).

### J.1.4 Distance to Well

As a worst-case exposure scenario, it is assumed that the highly exposed individual lives at the down-gradient edge of the land application site: the distance from the down-gradient edge of the SMA to the potential well is assumed to be 0 meters.

### J.1.5 Width of Buffer Zone

The width of the buffer zone between the SMA and the nearest body of surface water is assumed to be 10 meters. A buffer zone of identical width is also assumed to protect all remaining surface water within the watershed.

### J.1.6 Velocity of Wind at the Ground Surface

Wind velocity (w) affects the transport of volatilized pollutant from the site. A value of 4.5 m/sec (10 mph) has been selected for wind velocity at the ground surface. This value represents a typical annual wind speed in the United States (U.S. EPA, 1990c).

### J.1.7 Air Temperature

The model air temperature (T) of 15°C represents the annual average for the U.S. (*Federal Register*, 1986c).

### J.1.8 Number of Applications of Sludge

For organic pollutants, reference application rates are expressed as an annual loading (kg/ha•yr) at which sewage sludge can be applied indefinitely without exceeding reference water or air concentrations. For metals, reference application rates are expressed as a maximum cumulative loading (kg/ha) independent of the number of times sewage sludge is applied. Nevertheless, deriving reference application rates for metals requires that the number of applications of sewage sludge be specified to determine the length of time required for pollutant to be depleted from the site. It is assumed that the modeled land application site receives annual applications of sewage sludge for 20 consecutive years. This value M is consistent with the "useful life of application sites" described by U.S. EPA (1983d).

### J.1.9 Yearly Loss of Soil to Erosion

The model erosion rate ($d_e$) of 0.00060 m/yr represents a weighted average of annual soil loss rates presented in the Soil Conservation Survey Summary Report (USDA, 1987). The average value has been converted from 3.8 tons/acre•yr based on an assumed bulk density of 1,400 kg/m$^3$ for treated soil.

## J.2 SOIL PARAMETERS

The unsaturated zone is characterized by pore space containing both air and water, whereas the pore space in the saturated zone contains water only. Because of differences in fluid mechanics, these two zones require different equations and input parameters for tracking pollutant transport. A simplifying assumption used for deriving reference application rates is that the basic soil characteristics (including soil type, porosity, and bulk density) of the two zones are identical. Values for parameters describing the mixing, unsaturated, and saturated soil zones are provided in Table J-2.

## TABLE J-2

## SOIL AND HYDROLOGIC PARAMETERS FOR LAND APPLICATION

| | |
|---|---|
| Soil Type | Sand |
| Porosity of Sewage Sludge/Soil | 0.4[a] |
| Bulk Density of Sewage Sludge/Soil ($kg/m^3$) | 1400[b] |
| Bulk Density of Soil in Unsaturated and Saturated Zones ($kg/m^3$) | 1600[c] |
| Saturated Hydraulic Conductivity of Soil (m/hr) | 0.61[d] |
| Water Retention Parameters | |
| $\theta_r$ | 0.045[e] |
| $\alpha$ ($m^{-1}$) | 14.5[e] |
| $\beta$ | 2.68[e] |
| Fraction of Organic Carbon in Soil or Sewage Sludge | |
| Mixing Layer | 0.01 |
| Unsaturated Zone | 0.001[f] |
| Saturated Zone | 0.0001 |
| Depth to Groundwater (m) | 1[g] |
| Net Recharge or Seepage (m/yr) | 0.5[h] |
| Thickness of Aquifer (m) | 1[g] |
| Hydraulic Gradient | 0.005[i] |
| Total Suspended Solids in Surface Water (mg/l) | 16[j] |

[a] Todd (1980), Carsel and Parrish (1988).
[b] Chaney (1992b).
[c] Based on porosity of 0.4. Freeze and Cherry (1979).
[d] 95th percentile value from Carsel and Parrish (1988).
[e] Mean values reported for sand in Carsel and Parrish (1988).
[f] Lower bound of range reported in *Federal Register* (1986c).
[g] Conservative value.
[h] Average of range reported in *Federal Register* (1986c).
[i] Average value for groundwater surveyed in *Federal Register* (1986c).
[j] Geometric mean of values reported in U.S. EPA's STORET data base, U.S. EPA (1992a).

### J.2.1 Soil Type

The type of soil in the mixing zone, unsaturated and saturated zones affects the ability of a pollutant to move vertically to the aquifer and laterally to a nearby well. In general, the pollution potential of a soil is largely affected by the type of clay present, the shrink/swell potential of that clay, and the grain size of the soil; that is, the less the clay shrinks and swells and the smaller the grain size of the soil, the less the pollution potential associated with that soil. Soil types in the unsaturated zone in order of increasing pollution potential are: (1) nonshrinking clay, (2) clay loam, (3) silty loam, (4) loam, (5) sandy loam, (6) shrinking clay, (7) sand, (8) gravel, and (9) thin or absent soil (U.S. EPA, 1985a).

Sand has been selected as a reasonable worst case soil to use in model scenarios for defining numerical reference application rates for sludge. Wherever possible values for parameters describing soil characteristics for model simulations are based on values estimated for sand.

### J.2.2 Porosity of Sewage Sludge/Soil Mixture

Porosity is the ratio of the void volume of a given soil or rock mass to the total volume of that mass. If the total volume is represented by $V_t$ and the volume of the voids by $V_v$, the porosity can be defined as $\theta_t = V_v / V_t$. Porosity is usually reported as a decimal fraction or percentage, and ranges from zero (no pore space) to one (no solids). For soil types with small particle sizes such as clay, porosity increases to a maximum of around 0.5. Porosities of coarser media like gravel decrease to a minimum of around 0.3.

For deriving reference application rates, a total porosity of 0.4 has been taken from Todd (1980). This value is consistent with the average value for sand (0.43) reported in Carsel and Parrish (1988). It is used to represent total porosity within the mixing unsaturated and saturated soil zones.

Effective porosity ($\theta_e$) is calculated as the difference between the average saturated water content and the approximate average residual water content, and refers to the amount of interconnected pore space available for fluid flow. For deriving reference application rates, average residual water content in the unsaturated zone is assumed to be less than 0.05, and effective porosity has been approximated with the same value used for total porosity (0.4) in mass balance and ground-water transport calculations.

### J.2.3 Bulk Density of Sludge/Soil

The bulk density of soil (BD) is defined as the mass of dry soil divided by its total (or bulk) volume. Bulk density directly influences the retardation of solutes and is related to soil structure. In general, as soils become more compact, their bulk density increases. Bulk density can be related to the particle density and porosity of a given soil as:

$$BD = \rho_{so}(1 - \theta_t) \quad (1)$$

where:

| | | |
|---|---|---|
| BD | = | bulk density of soil (kg/m$^3$) |
| $\rho_{so}$ | = | particle density of soil (kg/m$^3$) |
| $\Theta_t$ | = | porosity of soil (unitless) |

Typical mineral soils have particle densities of about 2,650 kg/m$^3$ (Freeze and Cherry, 1979). This value and a soil porosity of 0.4 suggest a bulk density of about 1,600 kg/m$^3$ for pure soil, somewhat higher than the 1,300-1,500 kg/m$^3$ range typically encountered for soil mixed with sewage sludge (Chaney, 1992b). For deriving reference application rates, it is assumed that the bulk density of the mixing zone is 1,400 kg/m$^3$, and the bulk density of soil in the unsaturated and saturated zones is 1,600 kg/m$^3$.

### J.2.4 Saturated Hydraulic Conductivity of Soil

Saturated hydraulic conductivity refers to the ability of soil to transmit water, which is governed by the amount and interconnection of void spaces in the unsaturated or saturated zones. These voids may occur as a consequence of inter-granular porosity, fracturing, or bedding planes. In general, high hydraulic conductivities are associated with high potential for pollution. The value for saturated hydraulic conductivity used for deriving reference application rates (0.61 m/hr) is the 95th percentile of a probability distribution for hydraulic conductivity in sand derived by Carsel and Parrish (1988). It thus represents a conservative or "reasonable worst case" value.

### J.2.5 Unsaturated Hydraulic Conductivity of Soil

The hydraulic conductivity or effective permeability of soil in the unsaturated zone is a function of its moisture content, which is in turn a function of pressure head. These relationships are central to the simulation of water flow through the unsaturated zone. The VADOFT model used to derive reference application rates accepts as inputs sets of data points describing effective permeability-saturation curves and the saturation-pressure head curves. Alternatively, it accepts van Genuchten water retention parameters defining the curves (U.S. EPA, 1989c; Carsel and Parrish, 1988); this latter option is used for deriving reference application rates.

Based on soils data from the USDA Soil Conservation Survey (SCS), Carsel and Parrish (1988) derived distributions for the three parameters required ($\Theta_r$, $\alpha$, and $\beta$) according to twelve SCS textural classifications. Values used for deriving reference application rates (0.045, 14.5 $m^{-1}$, and 2.68 for $\Theta_r$, $\alpha$, and $\beta$, respectively) correspond to mean values reported for sand.

### J.2.6 Fraction of Organic Carbon in Soil or Sludge

The model combines the fraction of organic carbon in the soil with each pollutant's organic carbon partition coefficient to determine the partitioning of pollutant between soil and water. In general, a lower fraction of organic carbon implies greater mobility for organic pollutants. The organic carbon content for sludge varies among sludge types, with mean values for various types showing a relatively narrow range of 27.6-32.6 percent (U.S. EPA, 1983d). It is conservatively assumed that soil within the upper 15 cm of the soil column (or "mixing zone") contains 1 percent organic carbon. A value of $10^{-3}$ has been selected for the fraction of organic carbon in the unsaturated zone because it is a typical value for sand, and falls at the lower end of the range (0.001-0.01) reported for soil beneath hazardous waste disposal facilities (*Federal Register*, 1986c). The fraction of organic carbon ($f_{oc}$) in the saturated zone is expected to be lower than that of the unsaturated zone, and has been assigned a value of $10^{-4}$, or one-tenth the fraction assumed for the unsaturated zone.

### J.2.7 Depth to Ground Water

The depth to ground water is defined as the distance from the bottom of the mixing zone to the water table. The water table is itself defined as the subsurface boundary between the unsaturated zone (where the pore spaces contain both water and air) and the saturated zone (where the pore spaces contain water only). It may be present in any type of medium and may be either permanent or seasonal. The depth to ground water determines the distance a pollutant must travel before reaching the aquifer, and affects the attenuation of pollutant concentration during vertical transport. As this depth increases, attenuation also tends to increase, thus reducing potential pollution of the ground water. A conservative value of 1 m is assumed for the distance between treated soil and ground water.

## J.3 HYDROLOGIC PARAMETERS

Key hydrologic parameters include net recharge or seepage, the thickness of the aquifer, and the hydraulic gradient. Values used to derive reference application rates are included in Table J-2 and discussed below.

### J.3.1 Net Recharge

The primary source of most ground water is precipitation, which passes through the ground surface and percolates to the water table. Net recharge is the volume of water reaching the water table per unit of land, and determines the quantity of water available for transporting pollutants vertically to the water table and laterally within the aquifer. The greater the recharge rate, the greater the potential for pollution, up to the point at which the amount of recharge is large enough to dilute the pollutant. Beyond that point, the pollution potential ceases to increase and may actually decrease (U.S. EPA, 1985b).

For land application sites, the selected net recharge rate (NR), (0.5 m/yr) represents the average of a range of values presented in (*Federal Register*, 1986c).

### J.3.2 Thickness of Aquifer

Saturated zones are considered aquifers unless they lack the permeability to yield sufficient water. Only true aquifers are considered when selecting input parameters for calculating reference application rates. For deriving reference application rates, the thickness of the aquifer is assumed to be 1 m. This thickness is assumed to represent reasonable worst-case conditions and has been selected as a matter of policy to ensure that reference application rates for sewage sludge are sufficiently protective.

### J.3.3 Hydraulic Gradient

The hydraulic gradient is a function of the local topography, ground-water recharge volumes and locations, and the influence of withdrawals (e.g., well fields). It is also very likely to be indirectly related to properties of porous media. Although steep gradients are rarely associated with very high conductivities, no functional relationship exists to express this relationship.

The hydraulic gradient value selected for deriving reference application rates is 0.005 m/m or 0.5 percent, and is based on an average value for ground waters surveyed for the Hazardous Waste Management System Land Disposal Restrictions Regulation (*Federal Register*, 1986c).

### J.3.4 Total Suspended Solids

Calculating the amounts of pollutant partitioning to liquid and solid phases in surface water requires a value for suspended solids content. Raw data for total suspended solids in streams and rivers in the U.S. were obtained from the EPA's STORET data base, under the field "Total Residue" (U.S. EPA, 1992a). The data consist of annual mean total residues for the U.S. for the years 1903 through 1991. The geometric mean of these annual values is calculated as 16.2 mg/l and the median as 16.41 mg/l. A rounded value of 16 mg/l is chosen for the total suspended solids (TSS) content of the surface water modeled for this analysis.

## J.4 CHEMICAL-SPECIFIC PARAMETERS

### J.4.1 Distribution Coefficients

Pollutant transport in soil systems is influenced by interactions between the pollutant and soil. The affinity of pollutants for soil particles may result from ion exchange on charged sites or adsorption due to surface forces. When the soil's capacity to attract pollutant is exceeded,

soluble pollutants will move through the soil at the same velocity as the bulk leachate. The affinity between a soil and a pollutant is characterized by the distribution coefficient (KD). Representative KD values (l/kg or $m^3/kg$) are defined as the equilibrium ratio of the pollutant concentration in soil (mg/kg) to that in associated water (mg/l or $mg/m^3$). Values used for this analysis are listed in Table J-3.

For organic pollutants KD is calculated from a pollutant's partition coefficient between organic carbon and water:

$$KD = KOC\ f_{oc} \quad (2)$$

where:

| | | |
|---|---|---|
| KD | = | equilibrium partition coefficient for pollutant ($m^3/kg$) |
| KOC | = | organic carbon partition coefficient ($m^3/kg$) |
| $f_{oc}$ | = | fraction of soil consisting of organic carbon |

As discussed in Section J.2.6, $f_{oc}$ values of 0.01, 0.001 and 0.0001 are assumed for the mixing, unsaturated, and saturated zones, respectively.

The organic carbon partition coefficient for a pollutant is estimated from its octanol-water partition coefficient, as measured in laboratory experiments. Values of KOC used to determine reference application rates are shown in Table J-4, and are calculated from the following regression equation by Hassett et al. (1983):

$$\log(KOC) = 0.0884 + 0.909\log(KOW) \quad (3)$$

where:

| | | |
|---|---|---|
| KOW | = | octanol-water partition coefficient for pollutant |

With the exception of PCBs, the KOW values used for this analysis have been obtained from the CHEMEST procedures in the Graphical Exposure Modeling Systems (GEMS and PCGEMS), U.S. EPA (1988d, 1989c).

## TABLE J-3

## DISTRIBUTION COEFFICIENTS FOR ORGANIC AND INORGANIC POLLUTANTS

| | Within Sludge Management Area (l/kg) | Unsaturated Zone (l/kg) | Saturated Zone (l/kg) |
|---|---|---|---|
| Arsenic | 20 | 20 | 20 |
| Cadmium | 431 | 431 | 431 |
| Chromium | 59 | 59 | 59 |
| Copper | 98 | 98 | 98 |
| Lead | 621 | 621 | 621 |
| Mercury | 330 | 330 | 330 |
| Nickel | 63 | 63 | 63 |
| Benzene | 1.06 | 0.106 | 0.0106 |
| Benzo(a)pyrene | 4,480 | 448 | 44.8 |
| Bis(2-ethylhexyl)phthalate | 541 | 54.1 | 5.41 |
| Chlordane | 1,330 | 133 | 13.3 |
| DDT | 7,720 | 772 | 77.2 |
| Lindane | 23.4 | 2.34 | 0.234 |
| n-Nitrosodimethylamine | 0.00371 | 0.000371 | 0.0000371 |
| Polychlorinated biphenyls | 15,100 | 1,510 | 151 |
| Toxaphene | 295 | 29.5 | 2.95 |
| Trichloroethylene | 1.94 | 0.194 | 0.0194 |

Note: The distribution coefficient for organic pollutants (KD) is the product of the organic carbon partition coefficient (KOC) and the fraction of organic carbon in the medium ($f_{oc}$). Assumes foc of 1 percent for mixing layer, and 0.1 percent and 0.01 percent in the unsaturated and saturated soil zones, respectively. Distribution coefficients for metals are geometric means of values reported for "sandy loam" soil in Gerritse et al. (1982).

## TABLE J-4

## OCTANOL-WATER AND ORGANIC CARBON PARTITION COEFFICIENTS FOR ORGANIC POLLUTANTS

| | Log of Octanol-Water Partition Coefficient[a] | Organic Carbon Partition Coefficient[b] |
|---|---|---|
| Benzene | 2.13 | 106 |
| Benzo(a)pyrene | 6.12 | 448,000 |
| Bis(2-ethylhexyl)phthalate | 5.11 | 54,100 |
| Chlordane | 5.54 | 133,000 |
| DDT | 6.38 | 772,000 |
| Lindane | 3.61 | 2,340 |
| n-Nitrosodimethylamine | -0.57 | 0.371 |
| Polychlorinated biphenyls[c] | 6.70 | 1,510,000 |
| Toxaphene | 4.82 | 29,500 |
| Trichloroethylene | 2.42 | 194 |

[a] All values except for PCBs taken from the CHEMEST procedure of the Graphical Exposure Modeling System (GEMS), U.S. EPA (1989c).
[b] KOC for organic pollutants derived from KOW with Equation 6 from Chapter 15 of Hassett et al. (1983): log(KOC)= 0.0884 + 0.909 log(KOW).
[c] Based on aroclor 1254, the most common PCB in sewage sludge. Derived from O'Connor (1992) and representative values from Anderson and Parker (1990).

Polychlorinated biphenyls (PCBs) are a class of chemicals containing 209 possible congeners. The most common constituent of PCB mixtures is Aroclor 1254, which is dominated by penta-congeners, with about equal amounts of tetra- and hexa-congeners. In a well-aged soil contaminated with PCBs, however, Aroclor 1260, which contains more penta- and hexa-congeners than tetra-congeners, is more representative (O'Connor, 1992). To determine a representative organic carbon partition coefficient for PCBs, an average has been calculated from log KOW coefficients listed in Table J-5 (from Anderson and Parker, 1990). The log KOW for the penta-congener has been estimated to be approximately 6.5 by noting that the log KOW values are approximately linearly related to the number of chlorines in the congener. Averaging that value with the hexa-congener value gives 6.7 for the log KOW. As with other organic pollutants, the regression equation from Hassett et al. (1983) is used to convert this KOW value to an estimate of KOC.

For metals, separate KD values are used to describe the partitioning between water and soil within the mixing, unsaturated, and saturated zones, and the partitioning between water and sediment in the surface water. Values for KD in the mixing zone and the soil zones are taken from a study by Gerritse et al. (1982) and represent the results of laboratory tests with a sludge-amended sandy loam topsoil. These values are listed in Table J-3, and represent geometric means of the ranges provided by Gerritse et al. (1982). Partition coefficients for metals in surface water are calculated according to the following regression equation provided in (U.S. EPA, 1982c):

$$KD_{sw} = \alpha TSS^{\beta} \qquad (4)$$

where:

| | | |
|---|---|---|
| $KD_{sw}$ | = | partition coefficient for pollutant in stream ($m^3/kg$) |
| TSS | = | total suspended solids content of the stream (mg/l) |
| $\alpha, \beta$ | = | pollutant-specific empirical constants |

Values for the regression constants for each pollutant are based on data for streams (U.S. EPA, 1982c), and are presented in Table J-6. Estimates are based on an assumed Total Suspended Solids (TSS) of 16 mg/l, as discussed in Section J.3.4.

**TABLE J-5**

**OCTANOL-WATER PARTITION COEFFICIENTS FOR PCBs[a]**

| Congener | Number of Chlorines | Log KOW |
|---|---|---|
| 2,4' | 2 | 5.1 |
| 2,2',5,5' | 4 | 6.1 |
| All Penta | 5 | 6.5[b] |
| 2,2',4,4',5,5' | 6 | 6.9 |
| Average[c] | 5.5 | 6.7 |

[a] Source: Anderson and Parker (1990).
[b] Estimated based on apparent linear relationship between number of chlorines on congener and log KOW.
[c] log KOW values for penta- and hexa-congeners averaged for representative log KOW.

**TABLE J-6**

**STATISTICAL PARAMETERS FOR PREDICTING THE EQUILIBRIUM PARTITIONING OF METALS IN SURFACE WATER[a]**

| | $\alpha$ | $\beta$ | $KD_{sw}$ (l/kg)[b] |
|---|---|---|---|
| Arsenic | $0.48 \times 10^6$ | -0.7286 | 63,700 |
| Cadmium | $4.00 \times 10^6$ | -1.1307 | 174,000 |
| Chromium | $3.36 \times 10^6$ | -0.9304 | 255,000 |
| Copper | $1.04 \times 10^6$ | -0.7436 | 132,000 |
| Lead | $0.31 \times 10^6$ | -0.1856 | 185,000 |
| Mercury | $2.91 \times 10^6$ | -1.1356 | 125,000 |
| Nickel | $0.49 \times 10^6$ | -0.5719 | 100,000 |

[a] Source: U.S. EPA (1982c).
[b] $KD_{sw}$ as $KD_{sw}=\alpha TSS^{\beta}$. Assumes TSS=16 mg/l.

### J.4.2 Degradation Rates

Pollutant concentrations in the subsurface regime may be decreased by various degradation processes, including abiotic hydrolysis and aerobic or anaerobic microbial degradation. Although rates of hydrolysis are dependent only on pH and temperature (and can be estimated with reasonable accuracy), estimates of rates for microbial degradation are fraught with uncertainty. This uncertainty is due to many confounding influences in the field, such as substrate availability (fraction of organic carbon present), temperature, the microbial consortium, and microbial acclimation to a given pollutant. Nevertheless, the range of microbial degradation rates obtained in the laboratory by measuring the rate of disappearance of a pollutant in various soil and water grab samples, soil column studies, etc., provides a rough estimate of the rate at which microbial activity is likely to degrade a particular pollutant in the field.

As shown in Table J-7, this work utilizes several sources for representative microbial degradation rates. Where a range of values is reported by these sources, values from the lower end of the range have been selected to derive estimates most protective of public health. Studies of biodegradation in soil have been favored over studies of biodegradation in aquatic environments. If estimates of only aerobic biodegradation rates are available for a given pollutant, a half-life for anaerobic biodegradation has been conservatively estimated to be four times longer (Howard et al., 1991a.) However, if available data fail to show any indication that a pollutant degraded in a particular regime, a value of zero has been assumed for the degradation rate.

For the zone of incorporation for land treated with sewage sludge, estimated rates of degradation are based on studies of microbial degradation under anaerobic conditions.

For the unsaturated soil zone, aerobic microbial degradation and hydrolysis are assumed to be the two dominant degradation processes. Lindane and trichloroethylene are the only two compounds that undergo hydrolysis: since hydrolysis rates are far more accurately quantifiable than microbial degradation rates, hydrolysis rates are used for these two chemicals. For the other eight organic pollutants, 10 percent of the aerobic biodegradation decay rate is assumed to

TABLE J-7

DEGRADATION RATES ($K_{deg}$)

| | Aerobic Degradation Rate ($yr^{-1}$)[a] | Anaerobic Degradation Rate ($yr^{-1}$)[b] | Unsaturated Zone Degradation Rate ($yr^{-1}$)[c] | Saturated Zone Degradation Rate ($yr^{-1}$)[d] |
|---|---|---|---|---|
| Benzene | 16[e] | 0[f] | 1.6 | 0.8 |
| Benzo(a)pyrene | 0.48[g] | 0.12[h] | 0.048 | 0.084 |
| Bis(2-ethylhexyl) phthalate | 11[i] | 0[k,l] | 1.1 | 0.55 |
| Chlordane | 0[m] | 36[i] | 0 | 18 |
| DDT | 0.04[l] | 2.5[k] | 0.004 | 1.3 |
| Lindane | 1.2[m] | 8.3[n] | 1.2 | 4.8 |
| n-Nitrosodimethylamine | 5.1[o] | 1.3[h] | 0.51 | 0.9 |
| PCBs | 0.063[p] | 0.00063[q] | 0.0063 | 0.0035 |
| Toxaphene | 1.2[q] | 6[r] | 0.12 | 3.1 |
| Trichloroethene | 0.78[s] | 3.3[t] | 0.78 | 2.0 |

[a] Based on microbial degradation rates, except for lindane and trichloroethene, where hydrolysis rates are used.
[b] Based on microbial degradation rates.
[c] Estimated as 10 percent of aerobic biodegradation rates. Hydrolysis rates for lindane and trichloroethene assumed same as aerobic rates.
[d] Estimated as arithmetic average of the unsaturated zone degradation rates and the anaerobic degradation rate.
[e] Vaishnav and Babeu (1987).
[f] Horowitz et al. (1982).
[g] Coover and Sims (1987).
[h] Anaerobic rate assumed to equal 25 percent of aerobic rate; see text for discussion.
[i] Howard et al. (1991a).
[j] Shelton et al. (1984b).
[k] Castro and Yoshida (1971).
[l] Stewart and Chisholm (1971).
[m] Ellington et al. (1988).
[n] Zhang et al. (1982).
[o] Tate and Alexander (1975).
[p] Fries (1982).
[q] Consensus value agreed upon by the PRC at their March 8, 1991 meeting.
[r] Howard (1991a).
[s] Dilling et al. (1975).
[t] Bouwer and McCarthy (1983).

be appropriate for the unsaturated zone. This decision is based on the observation that $f_{oc}$ tends to decrease with depth in the soil, thereby reducing the amount of suitable substrate for microbial populations which might degrade these chemicals (O'Connor, 1992).

In the saturated zone, all three degradation processes can occur because some ground water is anaerobic and some aerobic. To capture this mix of processes, an arithmetic mean has been calculated from the aerobic and anaerobic biodegradation decay rates discussed above. For lindane and trichloroethylene, the only two chemicals where hydrolysis is a significant degradation process, estimated anaerobic decay rates are significantly higher than hydrolysis rates.

For PCBs, it is difficult to assign an anaerobic degradation rate. Highly chlorinated congeners may be partially degraded very slowly in reducing conditions, but then oxidative conditions must be established for further degradation to occur. Inadequate information on anaerobic degradation rates exists in the scientific literature. For deriving reference application rates, it is conservatively assumed that anaerobic degradation of PCBs occurs at 1 percent of the aerobic biodegradation rate.

### J.4.3 Molecular Weight

The values presented in Table J-8 are standard molecular weights for the pollutants of concern. These weights are used in the vapor loss component of the mass-balance calculations.

### J.4.4 Henry's Law Constants

Henry's Law constants are used to calculate the rate at which organic pollutants volatilize from sludge. Determining appropriate values for these constants is complicated by the wide variation in estimates provided by various sources. Table J-9 shows values taken from four different sources, along with the value selected for this analysis. Whenever possible, values are taken from Lyman et al. (1990); Otherwise values are taken from: the GEMS data base (U.S.

## TABLE J-8

## MOLECULAR WEIGHTS FOR ORGANIC POLLUTANTS

| | Molecular Weight |
|---|---|
| Benzene | 78.1 |
| Benzo(a)pyrene | 252.3 |
| Bis(2-ethylhexyl)phthalate | 390.6 |
| Chlordane | 409.8 |
| DDT | 354.5 |
| Lindane | 290.8 |
| n-Nitrosodimethylamine | 74.1 |
| Polychlorinated biphenyls (Aroclor 1254) | 325.1 |
| Toxaphene | 431.8 |
| Trichloroethylene | 131.4 |

[a] Calculated according to Wilke and Lee's method, as described in Lyman et al. (1990).

TABLE J-9

HENRY'S LAW CONSTANTS

| | GEMS[a,b] (atm·m³/mol) | PCGEMS[c,b] (atm·m³/mol) | Lyman et al.[d] (atm·m³/mol) | Aquatic Fate[e,b] (atm·m³/mol) | Selected Values[f] (unitless) | Reference |
|---|---|---|---|---|---|---|
| Benzene | $3.5\times10^{-3}$ | $5.6\times10^{-3}$ (M) | $5.5\times10^{-3}$ | $5.5\times10^{-3}$ | $2.3\times10^{-1}$ | (d) |
| Benzo(a)pyrene | $1.9\times10^{-10}$ | -- | -- | -- | $8.0\times10^{-9}$ | (a) |
| Bis(2-ethylhexyl)phthalate | $4.4\times10^{-8}$ | $1.5\times10^{-5}$ | -- | $3.0\times10^{-7}$ | $1.9\times10^{-6}$ | (a) |
| Chlordane | -- | $4.9\times10^{-5}$ (M) | -- | $9.4\times10^{-5}$ | $3.0\times10^{-3}$ | (c,e) |
| DDT | $2.8\times10^{-8}$ | -- | $3.8\times10^{-5}$ | $1.6\times10^{-5}$ | $1.6\times10^{-3}$ | (d) |
| n-Nitrosodimethylamine | $6.5\times10^{-4}$ | $2.6\times10^{-7}$ | -- | $3.3\times10^{-5}$ | $1.1\times10^{-5}$ | (c) |
| Lindane | $4.3\times10^{-6}$ | $1.4\times10^{-5}$ | $4.8\times10^{-7}$ | -- | $2.0\times10^{-5}$ | (d) |
| Polychlorinated biphenyls | -- | -- | -- | -- | $1.4\times10^{-2}$ | (g) |
| Toxaphene | -- | $6.0\times10^{-6}$ (M) | -- | $2.1\times10^{-1}$ | $2.5\times10^{-4}$ | (c) |
| Trichloroethylene | $2.9\times10^{-3}$ | $1.0\times10^{-2}$ (M) | $1.0\times10^{-2}$ | $9.1\times10^{-3}$ | $4.2\times10^{-1}$ | (d) |

[a] CHEMEST procedure in U.S. EPA (1988d).
[b] Values estimated using $\dot{H}$ = VP/WSOL where VP is the vapor pressure and WSOL is the water solubility, unless designated as a measurement (M).
[c] CHEMEST procedure in U.S. EPA (1989c).
[d] Lyman, Reehl and Rosenblatt, Handbook of Chemical Property Estimation Methods, McGraw-Hill, 1990.
[e] U.S. EPA (1982b).
[f] Converted to non-dimensional value using $\dot{H}$ = H/(RT) where T = 288°K, R is the Universal Gas Constant and H is the dimensional Henry's Law constant.
[g] Average values from Anderson and Parker (1990) adjusted to 15°C.

EPA, 1988d), the PCGEMS data base (U.S. EPA, 1989c), or the Aquatic Fate Process Data for Organic Priority Pollutants (U.S. EPA, 1982b). The decision process is as follows: if a value is published in Lyman et al. (1990) it is used. If not, but if two values are similar, the mean of those two values is used. If there is no value in Lyman et al. (1990) and no two values agree, a measured value is chosen in preference to an estimated one. If only estimated, dissimilar values are available, the value most conservative for ground water (i.e., the lowest Henry's Law constant) is chosen. This last circumstance occurs only for n-nitrosodimethylamine and bis(2-ethylhexyl)phthalate.

The only exception to the decision process described above is for polychlorinated biphenyls (PCBs), which include a variety of possible congeners with different chemical characteristics. Anderson and Parker (1990) provides a compilation of nondimensional Henry's Law constants for one penta-congener and three hexa-congeners. To derive a representative Henry's Law Constant for PCBs, the three values for hexa-congeners were averaged to a single value which was then averaged with the penta-congener value to obtain the single constant reported in Table J-9.

For all organic pollutants except PCBs, the dimensioned estimate of Henry's Law Constant reported in Table J-9 has been converted to an equivalent nondimensional constant based on an assumed temperature of 15°C (288°K) and the following equation:

$$\dot{H} = \frac{H}{RT} \qquad (5)$$

where:

| | | |
|---|---|---|
| T | = | Temperature (assumed to be 288°K) |
| R | = | Universal Gas Constant ($m^3$•atm/mol•K) |
| H | = | dimensional Henry's law constant (m•atm/mol) |
| $\dot{H}$ | = | nondimensional Henry's Law constant (unitless) |

Because Anderson and Parker (1990) report nondimensional values for PCBs at 25°C, the average value derived from this source has been adjusted to an equivalent nondimensional value at 15°C.

### J.4.5 Diffusion Coefficients

As discussed elsewhere in this report, the volatilization of pollutant from a land application site is modeled with equations provided by Hwang and Falco (1986). These equations require estimates for the diffusivity of each pollutant in air. Wilke and Lee's method provides estimates for the diffusivity of each pollutant in air and Hayduk and Laudie's method provides estimates for each pollutant's diffusivity in water (Lyman et al., 1990). The resulting estimates, which are based on a temperature of 15°C, are listed in Table J-10.

### J.4.6 Reference Water Concentrations for Ground Water

For the ground-water pathway of human exposure, reference application rates are calculated based on the reference water concentration or adjusted reference water concentration ($RC_{gw}$ mg/l). Reference application rates for land application of sludge are calculated to result in ground-water concentrations equal to or less than the $RC_{gw}$ at the receptor well. Values for $RC_{gw}$ are listed in Table J-11.

For all pollutants except n-nitrosodimethylamine, the reference water concentration for ground water has been calculated by adjusting the maximum pollutant level for background concentrations of pollutant expected in ground water. For n-nitrosodimethylamine, the $RC_{gw}$ has been derived from the human cancer potency. It is assumed that the highly exposed individual ingests 2 l of water per day and weighs 70 kg. The $RC_{gw}$ for n-nitrosodimethylamine is calculated based on a risk level of $10^{-4}$.

To ensure that well water does not exceed the MCL, any pre-existing ground-water concentrations must be considered in addition to pollutant contributions from the surface disposal of sewage sludge. Metals are ubiquitous in the environment, and can be expected to occur naturally in ground water; values for background concentrations of inorganic pollutants in ground water are taken from the National Inorganic and Radionuclides Survey, and presented in Table J-11. Where concentrations of a given metal in a particular sample fall beneath the limit of detection, a value of 1/2 the detection limit has been assigned to the sample to derive these

**TABLE J-10**

**DIFFUSION COEFFICIENTS FOR CONTAMINANT IN AIR**

| | Diffusivity in Air ($cm^2/sec$)[a] |
|---|---|
| Benzene | $9.06 \times 10^{-2}$ |
| Benzo(a)pyrene | $4.58 \times 10^{-2}$ |
| Bis(2-ethylhexyl)phthalate | $3.27 \times 10^{-2}$ |
| Chlordane | $4.51 \times 10^{-2}$ |
| DDT | $4.13 \times 10^{-2}$ |
| Lindane | $4.98 \times 10^{-2}$ |
| n-Nitrosodimethylamine | $9.29 \times 10^{-2}$ |
| Polychlorinated biphenyls | $5.69 \times 10^{-2}$ |
| Toxaphene | $5.25 \times 10^{-2}$ |
| Trichloroethylene | $8.18 \times 10^{-2}$ |

[a] Calculated according to Wilke and Lee's method, as described in Lyman et al. (1990).

## TABLE J-11

## ADJUSTED REFERENCE WATER CONCENTRATION FOR GROUND WATER

| | Reference Water Concentration[a] (mg/l) | Background Concentration in Ground Water[b] (mg/l) | Adjusted Reference Water Concentration[c] (mg/l) |
|---|---|---|---|
| Arsenic | 0.05 | 0.0032 | 0.0468 |
| Cadmium | 0.005 | 0.0011 | 0.0039 |
| Chromium | 0.1 | 0.0014 | 0.0986 |
| Copper | 1.3 | 0.0499 | 1.2501 |
| Lead | 0.015 | 0.0035 | 0.0115 |
| Mercury | 0.002 | 0.0001 | 0.0019 |
| Nickel | 0.1 | 0.0030 | 0.097 |
| Benzene | 0.005 | 0 | 0.005 |
| Benzo(a)pyrene | 0.0002 | 0 | 0.0002 |
| Bis(2-ethylhexyl)phthalate | 0.004 | 0 | 0.004 |
| Chlordane | 0.002 | 0 | 0.002 |
| DDT | 0.0102 | 0 | 0.0102 |
| Lindane | 0.0002 | 0 | 0.0002 |
| n-Nitrosodimethylamine[d] | 0.00007 | 0 | 0.00007 |
| Polychlorinated biphenyls | 0.000454 | 0 | 0.000454 |
| Toxaphene | 0.003 | 0 | 0.003 |
| Trichloroethylene | 0.005 | 0 | 0.005 |

[a] All values except those for DDT and n-nitrosodimethylamine are based on the maximum contaminant level (MCL) under the Safe Drinking Water Act (SDWA).
[b] National Inorganic and Radionuclides Survey
[c] Values represent the RWC less background concentrations (see Section A.5.4)
[d] Calculated from human cancer potency at the $10^{-4}$ risk level.

averages. Organic pollutants are less likely to be found in uncontaminated sources, so background concentrations are assumed to equal zero.

### J.4.7 Reference Water Concentration for Surface Water

The reference water concentration for the surface water pathway is based on either human health criteria, adjusted for total background intake, or chronic fresh water criteria, whichever is more limiting. The calculation of human health criteria for surface water is similar to the calculation for ground water, with the additional exposure through fish consumption. Concentration of pollutants in ingested fish are calculated from the expected concentration in surface water, the bioconcentration factor (BCF) and a food chain multiplier (FM) for each pollutant. The ratio between concentrations in the edible and total fish ($P_f$) is also considered.

Estimated values for BCF and FM are listed in Table J-12. With the exception of PCBs, the pollutant concentration in fillet is assumed equal to the pollutant concentration in the whole fish ($P_f$=1). This is a worst-case assumption, because many pollutants are known to bioconcentrate in nonedible tissues and organs. Based on data for dioxin (Branson et al., 1985), the concentration in the fillet for PCBs is assumed to be 50 percent of the concentration of the whole fish ($P_f$ = 0.5).

Table J-13 lists calculated human health criteria, chronic fresh water criteria, and the limiting reference water concentration for each pollutant in surface water. The fresh water criteria are based on chronic freshwater criteria from the latest Ambient Water Quality Criteria, where available. Where chronic values are not available, acute values are substituted. If no criteria are available, the Lowest Observable Adverse Effect Level (LOAEL) is used. For chemicals with hardness-dependent chronic or acute freshwater criteria, a hardness of 100 mg/l is assumed. The human body weight (BW) is set to 70 kg; the water ingestion rate (Iw) at 2 l/day; and the daily consumption of fish (Ic) at 40 g/day (Javitz, 1980).

TABLE J-12

DATA FOR REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER

| | Bioconcentration Factor[a] (l/kg) | Food Chain Multiplier[b] (unitless) |
|---|---|---|
| Arsenic | 350 | 1 |
| Cadmium | 330 | 1 |
| Chromium | 130 | 1 |
| Copper | 120 | 1 |
| Lead | 180 | 1 |
| Mercury | 100 | 1 |
| Nickel | 50 | 1 |
| Benzene | 7.6 | 1 |
| Benzo(a)pyrene | 11,000 | 10 |
| Bis(2-ethylhexyl)phthalate | 1,700 | 10 |
| Chlordane | 3,700 | 10 |
| DDT | 17,000 | 10 |
| Lindane | 110 | 1 |
| n-Nitrosodimethylamine | 0.056 | 1 |
| Polychlorinated biphenyls | 31,000 | 10 |
| Toxaphene | 1,000 | 1 |
| Trichloroethylene | 13 | 1 |

[a] BCF values for inorganic contaminants are taken from U.S. EPA (1989b). BCF values for organic contaminants are derived from the following regression equation, taken from U.S. EPA (1990b): $\log(BCF) = 0.79 \log(K_{ow}) - 0.40 - \log(7.6/3.0)$. The $\log(K_{ow})$ values are presented in Table J-4.

[b] Food chain multipliers are determined from the procedure in U.S. EPA (1990b), assuming a Trophic Level of 3 for fish.

## TABLE J-13

## DATA FOR REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER
## REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER

| | Chronic Freshwater Reference Application Rates[a] (mg/l) | Human Health Criteria[b] (mg/l) | Limiting Reference Water Concentration (mg/l) |
|---|---|---|---|
| Arsenic | $1.90 \times 10^{-1}$ [c] | $3.40 \times 10^{-2}$ | $1.90 \times 10^{-1}$ |
| Cadmium | $1.10 \times 10^{-3}$ | $2.52 \times 10^{-3}$ | $1.10 \times 10^{-4}$ |
| Chromium | $2.10 \times 10^{-1}$ | $1.07 \times 10^{-1}$ | $1.07 \times 10^{-1}$ |
| Copper | $1.20 \times 10^{-2}$ [d] | $2.45 \times 10^{0}$ | $1.20 \times 10^{-2}$ |
| Lead | $3.20 \times 10^{-3}$ [d] | $1.00 \times 10^{-2}$ | $3.20 \times 10^{-3}$ |
| Mercury | $1.20 \times 10^{-5}$ | $1.29 \times 10^{-4}$ | $1.20 \times 10^{-5}$ |
| Nickel | $1.60 \times 10^{-1}$ [d] | $4.17 \times 10^{-1}$ | $1.60 \times 10^{-1}$ |
| Benzene | $5.30 \times 10^{0}$ [e] | $1.15 \times 10^{-1}$ | $1.15 \times 10^{-1}$ |
| Benzo(a)pyrene | - [f] | $9.82 \times 10^{-6}$ | $9.82 \times 10^{-6}$ |
| Bis(2-ethylhexyl)phthalate | - [f] | $1.77 \times 10^{-2}$ | $1.77 \times 10^{-2}$ |
| Chlordane | $4.30 \times 10^{-6}$ | $1.91 \times 10^{-7}$ | $1.91 \times 10^{-7}$ |
| DDT | $1.00 \times 10^{-6}$ | $1.92 \times 10^{-7}$ | $1.92 \times 10^{-7}$ |
| Lindane | $8.00 \times 10^{-5}$ | $2.63 \times 10^{-3}$ | $8.00 \times 10^{-5}$ |
| n-Nitrosodimethylamine | $5.85 \times 10^{0}$ [e] | $6.86 \times 10^{-5}$ | $6.86 \times 10^{-5}$ |
| Polychlorinated biphenyls | $1.40 \times 10^{-5}$ | $1.46 \times 10^{-8}$ | $1.46 \times 10^{-8}$ |
| Toxaphene | $2.00 \times 10^{-7}$ | $2.41 \times 10^{-5}$ | $2.00 \times 10^{-7}$ |
| Trichloroethylene | $4.50 \times 10^{1}$ [e] | $2.88 \times 10^{-1}$ | $2.88 \times 10^{-1}$ |

[a] Chronic fresh water criteria based upon latest Ambient Water Quality Criteria. Because chronic values were not available for benzene, n-nitrosodimethylamine, and trichloroethylene, acute values were used instead. No values were found for benzo(a)pyrene and bis(2-ethylhexyl)phthalate.
[b] Human health criteria calculated using assumed rates of water and fish consumption, bioconcentration factors and food chain multipliers for fish.
[c] based on arsenic (V)
[d] Hardness dependent (assumed 100 mg/l)
[e] No criteria available; value given is a LOAEL
[f] No criteria available.

### J.4.7 Bioconcentration Factors and Food Chain Multipliers

Bioaccumulation in surface water is the process by which aquatic organisms accumulate pollutants, from both water and food, at concentrations higher than the ambient concentration. The process by which a compound is absorbed from water through gill membranes or other external body surfaces is termed bioconcentration, and the measure of a chemical's tendency to bioconcentrate is described by the bioconcentration factor. Biomagnification, in contrast, denotes the process by which the concentration of a compound increases in different organisms occupying successive trophic levels. The combined accumulation from these two sources is represented by the bioaccumulation factor, which is calculated as the product of the bioconcentration factor and a food chain multiplier (U.S. EPA, 1990b):

$$BAF = FM\ BCF \tag{6}$$

where:

| | | |
|---|---|---|
| BAF | = | bioaccumulation factor (l/kg) |
| FM | = | food chain multiplier (kg/kg) |
| BCF | = | bioconcentration factor (l/kg) |

The food chain multiplier and the bioconcentration factor are both derived from the pollutant's octanol-water partition coefficient (KOW). In addition, the food-chain multiplier is a function of the trophic level of the species under consideration. Based on a trophic level of 3 for fish, U.S. EPA (1990b) recommends the following values:

| Range of Log(KOW) | Food Chain Multiplier |
|---|---|
| $\leq 5$ | 1 |
| 5 - 5.5 | 10 |
| $\geq 5.5$ | 10 |

According to U.S. EPA (1990b), BCF values can be calculated from the log of KOW values (based on a 3 percent lipid content) according to the following regression equation:

$$\log(BCF) = 0.79 \log(KOW) - 0.40 - \log\left(\frac{7.6}{3.0}\right) \tag{7}$$

The BCF and the FM values used to derive criteria are listed in Table J-12. BCFs for organic pollutants are calculated from the regression equation above using the KOW values presented in Table J-4. For metals, BCF values are taken from U.S. EPA (1989b).

### J.4.8 Reference Air Concentration

Reference application rates for the air pathway are derived based on calculations of reference air concentrations ($RC_{air}$ $\mu g/m^3$) for each pollutant. Reference application rates are calculated such that the concentration of each pollutant in ambient air at the point of compliance is not expected to exceed the reference concentration.

Values for the reference air concentration of all organic pollutants are calculated from the pollutants' estimated human cancer potencies, as summarized in Table J-14. Estimates are based on a risk level of $10^{-4}$ and a body weight of 70 kg. The highly exposed individual is assumed to inhale 20 $m^3$ of contaminated air daily for his or her entire lifetime.

## TABLE J-14

## REFERENCE AIR CONCENTRATIONS

| | Human Cancer Potency $(mg/kg \cdot day)^{-1}$ | Reference Air Concentrations[a] $(\mu g/m^3)$ |
|---|---|---|
| Benzene | 0.029 | 12.0 |
| Benzo(a)pyrene | 11.5 | 0.032 |
| Bis(2-ethylhexyl)phthalate | 0.0141 | 25.0 |
| Chlordane | 1.3 | 0.27 |
| DDT | 0.34 | 1.0 |
| Lindane | 1.33 | 0.26 |
| n-Nitrosodimethylamine | 51 | 0.0071 |
| Polychlorinated biphenyls | 7.7 | 0.045 |
| Toxaphene | 1.1 | 0.32 |
| Trichloroethylene | 0.011 | 32.0 |

[a] Calculated from Human Cancer Potency based on a risk level of $10^{-4}$, body weight of 70 kg, and inhalation volume of 20 $m^3$/day.

# APPENDIX K

## Justification for the Annual Application for Domestic Septage in the Standards for the Use or Disposal of Sewage Sludge

# JUSTIFICATION FOR THE ANNUAL APPLICATION RATE FOR DOMESTIC SEPTAGE IN THE STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Office of Science and Technology
U.S. Environmental Protection Agency
401 M Street, S.W.
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November 23, 1992

# JUSTIFICATION FOR THE ANNUAL APPLICATION RATE FOR DOMESTIC SEPTAGE IN THE STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

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## SECTION ONE

## INTRODUCTION

On February 6, 1989, the U.S. Environmental Protection Agency (EPA) proposed Standards for the Use or Disposal of Sewage Sludge **(40 CFR Part 503)** in the Federal Register (54 FR 5746). Included in those standards were pollutant limits for different sewage sludge use or disposal practices.

In the Part 503 proposal, septage was included in the definition of sewage sludge. For this reason, the requirements for the use or disposal of sewage sludge also applied to the use or disposal of septage. Several commenters on the proposal indicated that it is not feasible for the use or disposal of septage to be subject to the same requirements as the use or disposal of sewage sludge. Those commenters indicated that the proposed Part 503 requirements were too costly for the use or disposal of septage. Also, the requirements may have a negative affect on the environment because they could lead to illegal use or disposal of septage or result in a lower frequency of pumping for septic tanks.

After reviewing the comments on the Part 503 proposal, the Agency decided to re-examine the pollutant limits for land application of domestic septage. A new approach to the pollutant limits was published in the Federal Register on November 9, 1990, (55 FR 47240) and comments were requested on that approach.

Under the new approach, the volume (i.e., gallons) of domestic septage that can be applied to an acre of land in a year would be calculated using an equation in the final Part 503 regulation. This volume would be based on the amount of nitrogen needed by the crop or vegetation grown on the land where the domestic septage is applied and on the concentration of available nitrogen.

There are two important aspects about the annual application rate approach for land application of domestic septage. First, the approach only applies to domestic septage. Domestic septage is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage.

The annual application rate approach does not apply to land application of commercial or industrial septage or to land application of a combination of domestic septage and either commercial or industrial septage. The reason for this is that the final Part 503 regulation does not apply to the use or disposal of commercial or industrial septage. Commercial and industrial septage have characteristics that are different than the characteristics of domestic septage. Because those characteristics

are different, the pathway exposure analyses used to develop the Part 503 land application pollutant limits, which were used to justify the annual application rate for domestic septage, are not applicable to the use or disposal of commercial and industrial septage.

The second aspect is that the annual application rate approach only is applicable to domestic septage applied to agricultural land, forest, or a reclamation site. This approach does not apply to domestic septage applied to a public contact site or placed on a surface disposal site. In these two cases, the requirements in the final Part 503 regulation for application of sewage sludge to a public contact site and placement of sewage sludge on a surface disposal site, respectively, have to be met.

Most of the commenters on the annual application approach for domestic septage agreed with the approach. Several of the commenters indicated that, in addition to limiting the volume of domestic septage that can be applied to the land per year, the domestic septage also must meet pathogen and vector attraction reduction requirements. The Agency agrees and included pathogen and vector attraction reduction requirements in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site. These requirements are discussed in the technical support document for the Part 503 land application requirements and in the technical support document for the Part 503 pathogen and vector attraction reduction requirements.

EPA decided to use the approach in the November 9, 1990, notice for domestic septage applied to agricultural land, forest, or a reclamation site in the final Part 503 regulation. This paper discusses the equation in the final Part 503 regulation used to calculate the annual application rate for land application of domestic septage; presents an example that illustrates how to use the equation; and presents results of an evaluation to determine whether the annual application rate protects public health and the environment from reasonably anticipated adverse effects of pollutants in domestic septage that is applied to agricultural land, forest, or a reclamation site.

## SECTION TWO

## ANNUAL APPLICATION RATE

### 2.1 Equation

The following equation is used to calculate the annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site.

$$AAR = \frac{N}{ANC \times 8.34} \qquad (1)$$

Where:

AAR = Annual application rate in millions gallons per acre per year.

N = Amount of nitrogen needed by the crop or vegetation grown on the agricultural land, forest, or reclamation site in pounds per acre per year.

ANC = Available nitrogen concentration in milligrams per liter.

8.34 = A conversion factor.

### 2.2 Amount of Nitrogen

The amount of nitrogen needed depends on the crop or vegetation grown on the land where the domestic septage is applied. This amount is published for the crop yield desired by various government agencies (e.g., the Agriculture Extension Service).

### 2.3 Concentration of Available Nitrogen

Various assumptions were made to determine the available nitrogen concentration (ANC) in equation (1). These assumptions are discussed below.

The available nitrogen concentration consists of the concentration of ammonia-nitrogen in the domestic septage and the concentration of organic nitrogen that becomes available over time. Together, ammonia-nitrogen and organic nitrogen are Total Kjeldahl Nitrogen (TKN). To determine the TKN concentration in domestic septage, a sampling and analyses program was conducted. Nine samples of domestic septage were collected and analyzed for TKN. The Agency chose to use only data from these nine samples to estimate the TKN concentration in domestic septage because EPA has knowledge of how those samples were collected and how the samples were analyzed.

Summary statistics were developed for the analytical results from the nine samples of domestic septage. This information is presented in Appendix A.

As shown in Appendix A, the 95th percentile concentration for TKN is 352 milligrams per liter. EPA believes that this value is a conservative estimate of the TKN concentration in domestic septage because 95 percent of the domestic septage is expected to have a TKN concentration of 352 milligrams per liter or less. That value is used, therefore, as the value for the TKN concentration in domestic septage for this analysis.

The relationship between ammonia-nitrogen and TKN is represented by equation (2), which was derived during the development of the summary statistics for the analytical results of the nine domestic septage samples.

$$\text{Ammonia-N} = \text{TKN} \times 0.427247 \qquad (2)$$

Using equation (2), the estimated ammonia-nitrogen concentration in domestic septage is 150 milligrams per liter (i.e., 352 x 0.427247).

Subtracting the ammonia-nitrogen concentration for the TKN concentration leaves 202 milligrams per liter for organic nitrogen in domestic septage. Fifty percent of the organic nitrogen is assumed to become available to the crop or vegetation in the first year after application of domestic septage; 20 percent in the second year; 10 percent in the third year; and the remainder at three percent per year until no more of the organic nitrogen from a particular application of domestic septage remains. For the purpose of this analysis, the concentration of organic nitrogen available to the crop or vegetation in the fourth year and subsequent years after application the domestic septage was assumed to be zero because of the low concentration of organic nitrogen remaining in those years.

Another assumption for the calculation of the available nitrogen concentration is that the domestic septage is injected below the land surface. In that case, none of the ammonia-nitrogen is lost through volatilization. In addition, the Agency assumed that none of the ammonia-nitrogen is lost through volatilization if the pH of the domestic septage is raised to 12, which is one of the alternative pathogen and vector attraction reduction requirements in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site. These two assumptions lead to a conservative estimate of the ammonia-nitrogen available to the crop or vegetation grown on the land where the domestic septage is applied.

The available nitrogen concentration used in equation (1) was calculated as shown below.

GIVEN: Domestic septage is injected below the land surface.
TKN = 352 mg/l
NH3 = 150 mg/l
Organic-N = 202 mg/l

| | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Ammonia-N | 150 | 150 | 150 |
| Organic-N | 101 | 101 | 101 |
| | | 41 | 41 |
| | | | 21 |
| Total | 251 | 292 | 313 |

Beginning with the third year, the Agency assumes "steady state conditions" are achieved with respect to the available nitrogen concentration. After three years, the available nitrogen concentration is equal to 313 milligrams per liter each year. This is the value used in equation (1).

## 2.4 Calculation of Annual Application Rate

Substituting 313 milligrams per liter for ANC in equation (1) results in the following equation:

$$AAR = \frac{N}{0.0026} \qquad (3)$$

Where:

AAR = annual application rate in gallons per acre per year.

N = amount of nitrogen needed by the crop or vegetation grown on the land in pounds per acre per year.

0.0026 = a factor obtained by multiplying 313 mg/l times 8.34/1,000,000.

Note that the annual application rate in equation (3) is in gallons per acre per year not million gallons per acre per year. Equation (3) is included in the land application subpart (Subpart B) of the final Part 503 regulation.

## 2.5 Example Calculation

The following example illustrates how to calculate the annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site using equation (3).

GIVEN:

Number of acres in application site = 3
Amount of nitrogen needed by the crop = 100 pounds per acre

RATE:

$$\text{Annual application rate} = \frac{100}{0.0026} \times 3$$

$$\text{Annual application rate} = 38{,}462 \frac{\text{gallons}}{\text{acre}} \times 3 \text{ acres}$$

Annual application rate for the site = 115,386 gallons

For this example, 115,386 gallons of domestic septage can be applied to a three acre site on which a crop that requires 100 pounds of nitrogen per acre is grown. This is the application rate for a single year. In subsequent years, the annual application rate has to be re-calculated using the amount of nitrogen needed by the crop or vegetation grown on the site that year.

## SECTION THREE

## JUSTIFICATION FOR ANNUAL APPLICATION RATE

As discussed above, EPA decided to use the annual application rate approach for the pollutant limit in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site after receiving favorable comment on this approach in the November 1990 Notice of Availability of Data from the National Sewage Sludge Survey (55 FR 47210). To use that approach, the Agency has to justify that applying domestic septage at an annual application rate protects public health and the environment from reasonably anticipated adverse effects of pollutants in domestic septage. This justification is presented below.

Step 1

The first step in the justification is to determine the concentration of each pollutant listed in Table 2 of the final Part 503 regulation in domestic septage. EPA used the 95th percentile estimate for the nine domestic septage samples discussed above for those pollutant concentrations (see Attachment A). The maximum likelihood estimation (MLE) procedure was used to develop the 95th percentile values. These values are presented below in Table 1.

**TABLE 1 - POLLUTANT CONCENTRATIONS IN DOMESTIC SEPTAGE**

| Pollutant | Concentration (mg/l)* |
|---|---|
| Arsenic** | 0.02 |
| Cadmium | 0.02 |
| Chromium | 0.16 |
| Copper | 2.0 |
| Lead | 0.14 |
| Mercury | 0.004 |
| Molybdenum*** | 0.02 |
| Nickel | 0.11 |
| Selenium | 0.07 |
| Zinc | 27 |

* Values are reported to two significant figures and may not be the same as the values reported in Attachment A because of rounding.

** Value is the detection limit because the pollutant was not detected in any of the samples.

*** Value is the maximum observed value for the nine samples of domestic septage collected.

Step 2

The second step is to calculate an annual application rate for a high crop nitrogen requirement. For this justification, 300 pounds of nitrogen per acre for orchard grass was used. This is considered a conservative value for the amount of nitrogen because most crops require less than this amount of nitrogen. The annual application rate for a 300 pound nitrogen requirement is:

$$\text{Annual application rate} = \frac{300}{0.0026} \qquad (3)$$

Annual application rate = 116,000 gallons per acre

Step 3

The third step of the justification is to calculate the annual load for each of the pollutants listed in Table 1 above in the domestic septage applied to the land. This was done using the following equation:

$$AL = PC \times AAR \times 8.34 \qquad (4)$$

Where:

AL = annual loading rate for each pollutant in pounds per acre per year.

PC = 95th percentile concentration for each pollutant in milligrams per liter (see Table 1 above).

AAR = annual application rate in million gallons per acre per year.

8.34 = a conversion factor.

The annual loading rates for the pollutants listed in Table 1 above calculated using an application rate of 116,000 gallons (i.e., 0.116 million gallons) in equation (4) are presented in Table 2.

**TABLE 2 - CALCULATED ANNUAL POLLUTANT LOADING RATES**

| Pollutant | Concentration (mg/l)* | Loading Rate** |
|---|---|---|
| Arsenic | 0.02 | 0.02 |
| Cadmium | 0.02 | 0.02 |
| Chromium | 0.16 | 0.15 |
| Copper | 2.0 | 1.9 |
| Lead | 0.14 | 0.14 |
| Mercury | 0.004 | 0.004 |
| Molybdenum | 0.02 | 0.02 |
| Nickel | 0.11 | 0.11 |
| Selenium | 0.07 | 0.07 |
| Zinc | 27 | 26 |

* From Table 1 above.
** Pounds per acre per year - calculated using equation (4).

Step 4

The fourth and final step is to divide the annual pollutant loading rate in Table 2 above into the cumulative pollutant loading rate for the pollutant from Table 2 in the final Part 503 regulation. This provides the number of years that domestic septage with the pollutant concentrations in Table 1 above can be applied to the land at a rate of 116,000 gallons per year without causing the cumulative pollutant loading rate for the pollutants in Table 2 from the final Part 503 regulation to be exceeded. Results of this calculation are presented below in Table 3.

**TABLE 3 - YEARS DOMESTIC SEPTAGE CAN BE APPLIED TO THE LAND**

| Pollutant | Part 503 Loading Rate* | Years** |
|---|---|---|
| Arsenic | 36 | 1800 |
| Cadmium | 32 | 1600 |
| Chromium | 2670 | 17800 |
| Copper | 1335 | 702 |
| Lead | 267 | 1907 |
| Mercury | 15 | 3750 |
| Molybdenum | 16 | 800 |
| Nickel | 373 | 3390 |
| Selenium | 89 | 1271 |
| Zinc | 2492 | 96 |

* pounds per acre

** Part 503 cumulative pollutant loading rate in pounds per acre divided by calculated annual loading rate (i.e., pounds per acre per year) in Table 1 above.

As shown in Table 3, domestic septage with the pollutant concentrations in Table 1 can be applied to agricultural land, forest, or a reclamation site for 96 years at a rate of 116,000 gallons per year without causing any of the cumulative pollutant loading rates in Table 2 of the final Part 503 regulation to be exceeded. After 96 years, the cumulative pollutant loading rate for zinc is exceeded.

The Agency concluded that domestic septage most likely will not be applied to the same site for 96 years at a rate of 116,000 gallons per year. EPA also concluded that domestic septage will be not applied to most sites at rate of 116,000 gallons per year because the nitrogen requirement of the crop grown on the land most likely will be less than 300 pounds, which is the amount of nitrogen used to calculate the 116,000 rate.

For the above reasons and because a conservative value for available nitrogen was used to calculate the constant in equation (3), the Agency concluded that public health and the environment are protected from reasonably anticipated adverse effects of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc in domestic septage applied to agricultural land, forest, or a reclamation site when the domestic septage is applied at a rate that is equal to or less than the rate calculated using equation (3). Part 503 requires, therefore, that the annual volume of domestic septage applied to agricultural land, forest, or a reclamation site be equal to or less than the volume determined using equation (3) above.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 6 1992

OFFICE OF WATER

**MEMORANDUM**

**Subject:** Summary Statistics for EPA's Study on the Quality of Domestic Septage

**From:** Charles E. White, Statistician
Statistical Analysis Section

**To:** Alan Rubin, Chief
Sludge Risk Assessment Branch

**Through:** Henry D. Kahn, Chief
Statistical Analysis Section

At your request, I will present and document summary statistics based on EPA's Study on the Quality of Domestic Septage. These summary statistics will include basic statistics on pollutants of concern, other requested pollutants, and the estimated relationship between Total Kjeldahl Nitrogen and Ammonia. EPA's Study on the Quality of Domestic Septage (1991) was conducted in order to support the development of hydraulic loading rates for the land application of domestic septage under the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal. This loading rate is intended to be a protective and affordable method for regulating the beneficial reuse of septage. Development of the loading rate itself will not be discussed in this memo.

**Results**

There are two basic results from these analyses. First, truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. Second, Total Kjeldahl Nitrogen is found to be approximately 43% Ammonia in wet domestic septage.

**Data**

Nine trucks delivering domestic septage to the Madison Metropolitan Sewerage District (MMSD) in Madison, Wisconsin were each sampled once. As septage was being discharged, a grab sample was collected and delivered to the MMSD lab for splitting, labeling, icing, and shipping to appropriate labs under contract to the EPA. Each



ATTACHMENT A

independent sample was physically analyzed for 324 pollutants. Only data regarding pollutants of concern and some data for pollutants that are also micro-nutrients will be considered in this report.

**Physical Analytical Procedures**

Physical analytical methods used here are the same as those used for the National Sewage Sludge Survey (NSSS), though some pollutants are reported differently. Individual PCB aroclors were reported in the NSSS; total PCB aroclors are reported here. Aldrin and Dieldrin were reported separately in the NSSS; the totals for Aldrin and Dieldrin are reported here. Total Chlordane is reported in the NSSS; the alpha and gamma portions of chlordane are reported here. DDT, DDS, and DDD are reported separately in the NSSS; totals for DDT, DDS, and DDD are reported here. Lindane is reported in the NSSS; Lindane (Gamma-BHC) is reported here.

Some pollutant concentrations were not measured above the Minimum Level for the particular pollutant. Minimum Levels are a form of "detection limit" used in physical analytical methods developed for the Office of Science and Technology. Under contract, each contractor lab must demonstrate that it is able to achieve the Minimum Levels stated for the particular EPA method to be used. In general, a Minimum Level is defined as the lowest concentration at which the physical analytical process can be reliably calibrated. Pollutant concentrations not measured above the Minimum Level for a particular pollutant are not reported; the Minimum Level is reported instead.

**Statistical Methods for Basic Summary Statistics**

Statistical analysis methods were primarily selected to estimate a concentration level for each pollutant such that, under certain assumptions, "most" septage concentrations for a particular pollutant will be below it's respective level, i.e., we are primarily estimating percentiles. These methods will also be used to characterize both wet and dry weight pollutant concentration measurements, mixed with "detection limits." Substitution and Maximum Likelihood Methods will be used to estimate summary statistics. One overall assumption of this study is that residential septage samples across the country follow approximately the same probability distributions for pollutant concentrations as those distributions found in the area around Madison, Wisconsin. Additional statistical assumptions are discussed in the section on the Substitution Method, in the section on the Maximum Likelihood Method for estimating summary statistics in the presence of censored, or "non-detect," data and in the section on estimating the relationship between Ammonia and Total Kjeldahl Nitrogen.

Dry Weight Conversion

Physical analyses were conducted on liquid septage samples. However, both because pollutants are assumed to be concentrated in the solid phase of the septage sample and

because pollutants were reported this way in the NSSS, a dry weight conversion is also used in presentation of these data. More detailed discussion of the reasons for dry weight conversion and analyses in support of this practice are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.* Conversion of a concentration reported in ug/l is illustrated below:

Let: Pollutant Concentration for Sample $i = x_i$ µg/l
Solids Concentration for Sample $i = y_i$ mg/l

$$\text{Dry Weight Pollutant Concentration in µg/kg} = \frac{x_i \mu g/l}{y_i mg/l}\left(\frac{1{,}000{,}000\ mg}{kg}\right)$$
$$= \left(\frac{1{,}000{,}000 x_i}{y_i}\right) \mu g/kg$$

Substitution Methods

The substitution methods used here make no assumptions about the probability distributions of the pollutant concentration data, but they do make assumptions about the concentration of pollutants in samples where pollutants could not be measured above their "detection limit." The first of two substitution methods used assumes that pollutant concentrations, in samples where pollutants could not be measured, are at the "detection limit." The second substitution method assumes that pollutant concentrations, in samples where pollutants could not be measured, are zero. Together, these two substitution methods give a kind of upper and lower bound on non-parametric summary statistics for pollutant concentrations in septage. More detailed discussion of these methods and the reasons for their selection are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.*

Tables of wet weight summary statistics developed using these substitution methods are presented on pages 13 through 23 and tables of dry weight summary statistics developed using these substitution methods are presented on pages 27 through 36.

Maximum Likelihood Estimation

The maximum likelihood estimation (MLE) procedure used here assumes pollutant concentrations are approximately lognormal in probability distribution. When this assumption is true, estimates produced using this procedure will be more efficient than those produced without assumptions about probability distributions. The procedure uses sample

size, measured pollutant concentrations, and the range of possible values for "detection limit" data in order to pick optimum estimates for the log mean and log variance of a two parameter lognormal distribution. If the assumption of a lognormal distribution is not closely approximated, this procedure is expected to produce good estimates for upper percentiles while the mean and variance estimates may not be optimal.

The two parameter lognormal distribution is fully described by the log mean and log variance, or the mean and standard deviation. Any desired summary statistic can be calculated using an appropriate pair of sufficient statistics. More detailed discussion of this method and the reasons why it was selected are presented in *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal* (1992).

In order to assess the quality of the MLEs, cumulative probability distributions were plotted for both the wet and dry weight distributions. Each plot shows the estimated cumulative distribution for all three estimation methods. The substitution methods are illustrated with points for each observation. The probability plotting position for each point is determined by a ranking procedure developed by Blom. The line indicating the estimated lognormal distribution is a plot of the 10th through 90th percentiles. These plots do not indicate any obvious deviations from the assumption that the pollutant concentration data are approximately lognormal in distribution. These plots are presented in the appendix.

Tables for wet weight summary statistics are presented on pages 10 through 12 and tables for dry weight summary statistics are presented on pages 24 through 26. Pollutants measured above their sample specific Minimum Level, or "detection limit," one time or less are not included in these tables as it is not possible to obtain MLEs under those conditions.

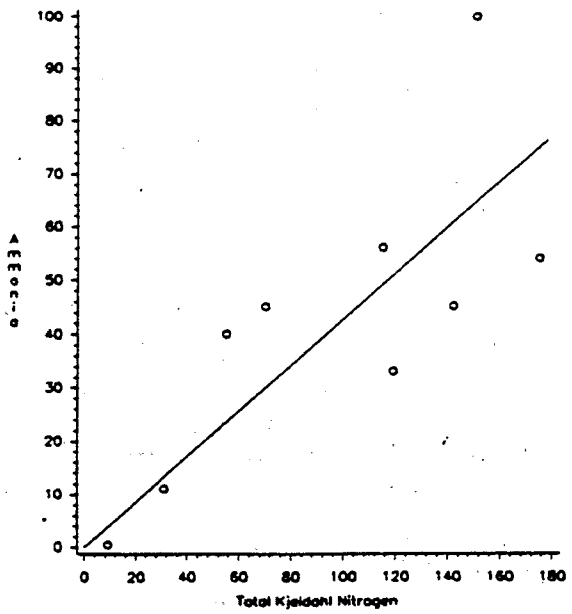
Note that truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. This statement is based on the previously mentioned distributional assumptions of the MLE estimation procedure and the additional assumption that domestic septage trucks across the country have approximately the same probability distribution for pollutant concentrations as domestic septage in trucks found in the area around Madison, Wisconsin. This result is found by comparing the 98th percentile estimates from the National Sewage Sludge Survey, presented in *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge* (1992), to 98th percentile estimates developed here for dry weight concentrations of septage.

**Statistical Methods for Estimating the Relationship Between Ammonia & TKN**

Ammonia is the constituent of Total Kjeldahl Nitrogen (TKN) that is immediately available for plant uptake. Over time, Total Kjeldahl Nitrogen is expected to completely break down into Ammonia. The purpose of this analysis is to assist in determining an

appropriate hydraulic loading rate for domestic septage that allows sufficient nitrogen for crop growth while not allowing for so much nitrogen that crop growth would be adversely affected. The loading rate itself will be estimated in another document.

Relation of Total Kjeldahl Nitrogen to Ammonia:




Units are mg/l

The observed relationship between the Ammonia and the Total Kjeldahl Nitrogen data indicates, as expected, that both pollutants increase together. A statistical model was fit to these data that assumes the concentration of Ammonia is zero when the concentration of TKN is zero, that the Ammonia concentration will increase in a linear fashion as TKN increases, that the Ammonia concentrations about that line are approximately normal in distribution, and that the deviations from that line are independent and identically distributed. Under these assumptions, Total Kjeldahl Nitrogen is approximately 43% Ammonia in wet domestic septage.

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Prob>F |
|---|---|---|---|---|---|
| Model | 1 | 3785.12042 | 3785.12042 | 9.806 | 0.0166 |
| Error | 7 | 2702.12438 | 386.01777 | | |
| C Total | 8 | 6487.26480 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 19.64733 | R-square | 0.5835 |
| Dep Mean | 42.72000 | Adj R-sq | 0.5240 |
| C.V. | 45.99095 | | |

**Parameter Estimates**

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > \|T\| |
|---|---|---|---|---|---|
| INTERCEP | 1 | 6.292426 | 13.34986889 | 0.471 | 0.6517 |
| TKN | 1 | 0.377705 | 0.12061931 | 3.131 | 0.0166 |

| Variable | DF | Variable Label |
|---|---|---|
| INTERCEP | 1 | Intercept |
| TKN | 1 | Total Kjeldahl Nitrogen |

## Evaluation of Assumptions

For the assumption that the concentration of Ammonia is zero when the concentration of TKN is zero, a model was fit that estimated a non-zero constant when TKN is zero and a hypothesis test was conducted that failed to reject the hypothesis that the constant was statistically different than zero. The

Analysis of Variance table for this model indicates that the intercept term is not statistically significant at the 0.05 level. The significance test used is robust to many departures from assumptions.

Analysis of Variance

| Source | DF | Sum of Squares | Mean Square | F Value | Prob>F |
|---|---|---|---|---|---|
| Model | 1 | 20124.34510 | 20124.34510 | 57.748 | 0.0001 |
| Error | 8 | 2787.88530 | 348.48566 | | |
| U Total | 9 | 22912.23040 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 18.66777 | R-square | 0.8783 |
| Dep Mean | 42.72000 | Adj R-sq | 0.8631 |
| C.V. | 43.69797 | | |

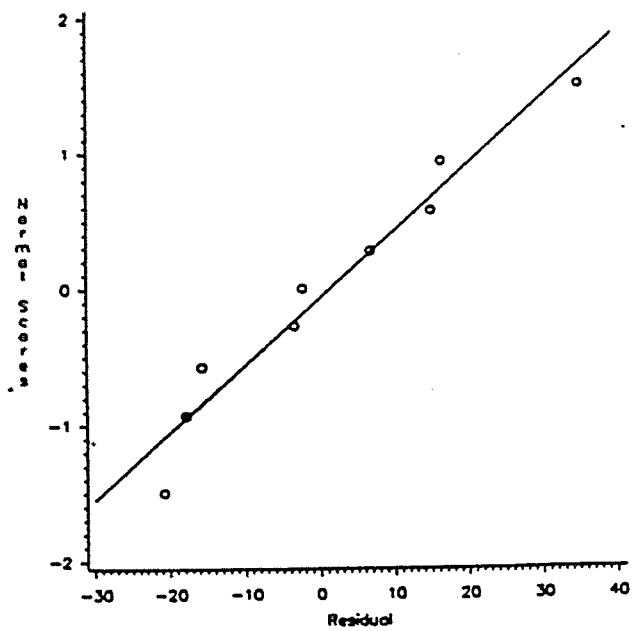
Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > \|T\| |
|---|---|---|---|---|---|
| TKN | 1 | 0.427247 | 0.05622261 | 7.599 | 0.0001 |

| Variable | DF | Variable Label |
|---|---|---|
| TKN | 1 | Total Kjeldahl Nitrogen |

For the assumption of linearity, both the Analysis of Variance table for the model with an intercept term and for the model without an intercept term indicate that a statistically significant linear relationship exists between Ammonia and TKN. Again, the significance test used is robust to many departures from assumptions.

Relation of Total Kjeldahl Nitrogen to Ammonia:
Normal Scores Plot of Residuals from Regression




Units are mg/l

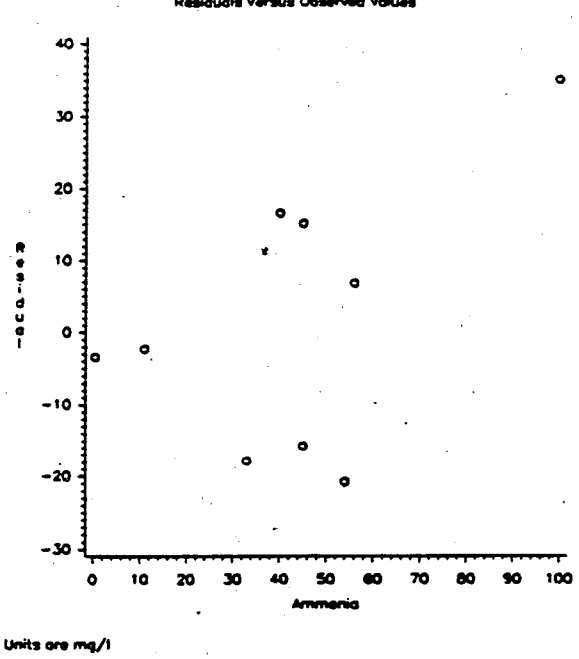
For the assumption that Ammonia concentrations about that line are approximately normal in distribution, the Shapiro-Wilk test for the normal distribution fails to reject the hypothesis that the residuals from the fitted line come from a normal distribution. Residuals are the arithmetic difference between the observed concentration of Ammonia at a particular TKN concentration and the Ammonia concentration predicted by the statistical model. Further evidence is that the plot of the residuals versus their expected position in a normal distribution, a normal scores plot, is approximately linear.

For the assumption that deviations from the line are

independent, the physical process of sampling from different truck loads of septage would tend to make the sample results independent.

For the assumption that deviations from the line are identically distributed, the plot of residuals versus observed Ammonia values does not appear to indicate strong deviation from this assumption.

Relation of Total Kjeldahl Nitrogen to Ammonia:



# References

Blom, G. (1958), *Statistical Estimates and Transformed Beta Variables*, New York: John Wiley & Sons, Inc.

USEPA (1992), *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge*

# Appendix A

## Summary Statistics

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Sample Size | Non-Detect | Log Mean | Log Variance |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 9 | 7 | -4.872 | 15.2471 |
| AMMONIA (AS N) | MG/L | 9 | 0 | 3.231 | 2.5560 |
| CADMIUM | UG/L | 9 | 6 | 1.207 | 1.1385 |
| CHROMIUM | UG/L | 9 | 1 | 3.494 | 0.8888 |
| COPPER | UG/L | 9 | 0 | 5.373 | 1.8551 |
| DDT,DDE,DDD(TOTAL) | UG/L | 9 | 7 | -2.783 | 6.1436 |
| LEAD | UG/L | 9 | 6 | 3.642 | 0.5873 |
| LINDANE(GAMMA-BHC) | UG/L | 9 | 7 | -2.360 | 0.2981 |
| MERCURY | UG/L | 9 | 4 | -1.348 | 2.7855 |
| NICKEL | UG/L | 9 | 4 | 3.747 | 0.3319 |
| NITRATE+NITRITE (AS N) | MG/L | 9 | 2 | -1.345 | 1.0699 |
| PERCENT SOLIDS | % | 9 | 0 | -0.488 | 2.8024 |
| SELENIUM | UG/L | 9 | 7 | 0.442 | 5.4810 |
| TOTAL KJELDAHL NITROGEN | MG/L | 9 | 0 | 4.284 | 0.9236 |
| TOTAL PHOSPHORCUS | MG/L | 9 | 0 | 2.960 | 1.2521 |
| ZINC | UG/L | 9 | 0 | 7.806 | 2.1128 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 15.7000 | 10700.000 | 32100.000 | 2050.0000 |
| AMMONIA (AS N) | MG/L | 90.8000 | 104.0000 | 313.0000 | 3.4500 |
| CADMIUM | UG/L | 5.9100 | 2.8700 | 8.6100 | 1.4600 |
| CHROMIUM | UG/L | 51.3000 | 20.5000 | 61.4000 | 1.2000 |
| COPPER | UG/L | 545.0000 | 422.0000 | 1270.0000 | 2.3200 |
| DDT,DDE,DDD(TOTAL) | UG/L | 1.3300 | 9.5900 | 28.8000 | 21.6000 |
| LEAD | UG/L | 51.2000 | 15.3000 | 45.8000 | 0.8940 |
| LINDANE(GAMMA-BHC) | UG/L | 0.1100 | 0.0215 | 0.0646 | 0.5890 |
| MERCURY | UG/L | 1.0500 | 1.3600 | 4.0800 | 3.9000 |
| NICKEL | UG/L | 50.0000 | 10.5000 | 31.4000 | 0.6270 |
| NITRATE+NITRITE (AS N) | MG/L | 0.4450 | 0.2050 | 0.6160 | 1.3800 |
| PERCENT SOLIDS | % | 2.4900 | 3.2700 | 9.8100 | 3.9300 |
| SELENIUM | UG/L | 24.1000 | 124.0000 | 373.0000 | 15.5000 |
| TOTAL KJELDAHL NITROGEN | MG/L | 115.0000 | 47.3000 | 142.0000 | 1.2300 |
| TOTAL PHOSPHOROUS | MG/L | 36.1000 | 19.0000 | 57.0000 | 1.5800 |
| ZINC | UG/L | 7060.0000 | 6350.0000 | 19000.000 | 2.7000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Median | 90th Percentile | 95th Percentile | 98th Percentile |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/L | 0.0077 | 1.1600 | 4.7200 | 23.4000 |
| AMMONIA (AS N) | MG/L | 25.3000 | 197.0000 | 351.0000 | 676.0000 |
| CADMIUM | UG/L | 3.3400 | 13.2000 | 19.3000 | 30.0000 |
| CHROMIUM | UG/L | 32.9000 | 111.0000 | 155.0000 | 228.0000 |
| COPPER | UG/L | 216.0000 | 1240.0000 | 2030.0000 | 3540.0000 |
| DDT,DDE,DDD(TOTAL) | UG/L | 0.0619 | 1.4900 | 3.6500 | 10.1000 |
| LEAD | UG/L | 38.2000 | 102.0000 | 135.0000 | 184.0000 |
| LINDANE(GAMMA-BHC) | UG/L | 0.0944 | 0.1900 | 0.2320 | 0.2900 |
| MERCURY | UG/L | 0.2600 | 2.2200 | 4.0400 | 8.0200 |
| NICKEL | UG/L | 42.4000 | 88.9000 | 109.0000 | 138.0000 |
| NITRATE+NITRITE (AS N) | MG/L | 0.2610 | 0.9840 | 1.4300 | 2.1800 |
| PERCENT SOLIDS | % | 0.6140 | 5.2800 | 9.6400 | 19.1000 |
| SELENIUM | UG/L | 1.5600 | 31.5000 | 73.2000 | 191.0000 |
| TOTAL KJELDAHL NITROGEN | MG/L | 72.5000 | 249.0000 | 352.0000 | 523.0000 |
| TOTAL PHOSPHOROUS | MG/L | 19.3000 | 81.3000 | 122.0000 | 192.0000 |
| ZINC | UG/L | 2460.0000 | 15900.000 | 26800.000 | 48700.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.4480 | 0.2660 | 0.7980 | 178.0 | 0.1000 | 0.1000 | 2.500 |
| SM-0 | 0.3610 | 0.2800 | 0.8400 | 232.0 | 0.0000 | 0.0000 | 2.500 |

---------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1090 | 0.0093 | 0.0280 | 25.6 | 0.1000 | 0.1000 | 0.184 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 42.7000 | 9.4900 | 28.5000 | 66.7 | 0.4800 | 45.0000 | 100.000 |
| SM-0 | 42.7000 | 9.4900 | 28.5000 | 66.7 | 0.4800 | 45.0000 | 100.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

### Pollutant=ARSENIC -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 20.0000 | 0.0000 | 0.0000 | 0.0 | 20.0000 | 20.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=BENZENE -- Sample Size=7 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.4000 | 1.4300 | 3.7800 | 33.1 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

### Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/L

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=BERYLLIUM -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 5.0000 | 0.0000 | 0.0000 | 0.0 | 5.0000 | 5.0000 | 5.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

**Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

**Pollutant=CADMIUM -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 7.1300 | 1.4900 | 4.4700 | 62.7 | 5.0000 | 5.0000 | 18.400 |
| SM-0 | 3.8000 | 2.1700 | 6.5000 | 171.0 | 0.0000 | 0.0000 | 18.400 |

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 46.7000 | 12.7000 | 38.1000 | 81.6 | 10.0000 | 33.5000 | 128.000 |
| SM-0 | 45.6000 | 13.1000 | 39.4000 | 86.5 | 0.0000 | 33.5000 | 128.000 |

---------- Pollutant=COPPER -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 503.0000 | 223.0000 | 669.0000 | 133.0 | 62.0000 | 115.0000 | 1850.000 |
| SM-0 | 503.0000 | 223.0000 | 669.0000 | 133.0 | 62.0000 | 115.0000 | 1850.000 |

---------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.6850 | 0.2810 | 0.8440 | 123.0 | 0.3380 | 0.3380 | 2.880 |
| SM-0 | 0.4220 | 0.3230 | 0.9690 | 230.0 | 0.0000 | 0.0000 | 2.880 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1230 | 0.0104 | 0.0313 | 25.4 | 0.1130 | 0.1130 | 0.207 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.0896 | 0.0209 | 0.0626 | 69.9 | 0.0630 | 0.0630 | 0.250 |
| SM-0 | 0.0278 | 0.0278 | 0.0833 | 300.0 | 0.0000 | 0.0000 | 0.250 |

---------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.1000 | 1.1100 | 3.3300 | 30.0 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=LEAD -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 63.4000 | 8.0800 | 24.2000 | 38.2 | 50.0000 | 50.0000 | 121.000 |
| SM-0 | 30.1000 | 15.7000 | 47.1000 | 157.0 | 0.0000 | 0.0000 | 121.000 |

---------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.1620 | 0.0170 | 0.0511 | 31.6 | 0.1250 | 0.1380 | 0.253 |
| SM-0 | 0.0417 | 0.0295 | 0.0884 | 212.0 | 0.0000 | 0.0000 | 0.250 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=MERCURY -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.8220 | 0.4200 | 1.2600 | 153.0 | 0.2000 | 0.3000 | 4.050 |
| SM-0 | 0.7330 | 0.4380 | 1.3100 | 179.0 | 0.0000 | 0.3000 | 4.050 |

---------- Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 10.5000 | 0.4890 | 1.4700 | 14.0 | 10.0000 | 10.0000 | 14.400 |
| SM-0 | 1.6000 | 1.6000 | 4.8000 | 300.0 | 0.0000 | 0.0000 | 14.400 |

---------- Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 55.6000 | 5.5600 | 16.7000 | 30.0 | 50.0000 | 50.0000 | 100.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=NICKEL -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 54.5000 | 7.8300 | 23.5000 | 43.1 | 40.0000 | 41.6000 | 105.000 |
| SM-0 | 36.7000 | 13.2000 | 39.7000 | 108.0 | 0.0000 | 41.6000 | 105.000 |

**Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.3890 | 0.0964 | 0.2890 | 74.4 | 0.1000 | 0.2000 | 0.900 |
| SM-0 | 0.3670 | 0.1050 | 0.3160 | 86.2 | 0.0000 | 0.2000 | 0.900 |

**Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/L**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1.9100 | 0.1630 | 0.4890 | 25.6 | 1.7500 | 1.7500 | 3.220 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=PERCENT SOLIDS -- Sample Size=9 -- Units=' %' ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.2100 | 1.5100 | 4.5400 | 205.0 | 0.0653 | 0.6580 | 14.200 |
| SM-0 | 2.2100 | 1.5100 | 4.5400 | 205.0 | 0.0653 | 0.6580 | 14.200 |

---------- Pollutant=SELENIUM -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 20.8000 | 6.6400 | 19.9000 | 95.6 | 5.0000 | 5.0000 | 50.000 |
| SM-0 | 6.9400 | 4.6000 | 13.8000 | 199.0 | 0.0000 | 0.0000 | 32.000 |

---------- Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 96.4000 | 19.2000 | 57.6000 | 59.7 | 9.0000 | 115.0000 | 175.000 |
| SM-0 | 96.4000 | 19.2000 | 57.6000 | 59.7 | 9.0000 | 115.0000 | 175.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 27.6000 | 5.7400 | 17.2000 | 62.3 | 1.7000 | 32.0000 | 48.000 |
| SM-0 | 27.6000 | 5.7400 | 17.2000 | 62.3 | 1.7000 | 32.0000 | 48.000 |

---------- Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.3000 | 1.6700 | 5.0100 | 44.3 | 0.9100 | 11.4000 | 20.900 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

---------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 11.4000 | 1.4300 | 3.7800 | 33.1 | 10.0000 | 10.0000 | 20.000 |
| SM-0 | 0.0000 | 0.0000 | 0.0000 | . | 0.0000 | 0.0000 | 0.000 |

## Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------- Pollutant=ZINC -- Sample Size=9 -- Units=UG/L ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 5300.0000 | 2420.0000 | 7270.0000 | 137.0 | 182.0000 | 3190.0000 | 23800.000 |
| SM-0 | 5300.0000 | 2420.0000 | 7270.0000 | 137.0 | 182.0000 | 3190.0000 | 23800.000 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Sample Size | Non-Detect | Log Mean | Log Variance |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 9 | 7 | 0.741 | 8.92238 |
| AMMONIA (AS N) | MG/KG | 9 | 0 | 8.325 | 3.90825 |
| CADMIUM | MG/KG | 9 | 6 | -1.766 | 5.86238 |
| CHROMIUM | MG/KG | 9 | 1 | 1.542 | 2.39400 |
| COPPER | MG/KG | 9 | 0 | 3.559 | 4.39988 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 9 | 7 | 1.665 | 7.27425 |
| LEAD | MG/KG | 9 | 6 | 0.561 | 3.87225 |
| LINDANE(GAMMA-BHC) | UG/KG | 9 | 7 | 0.967 | 2.14650 |
| MERCURY | MG/KG | 9 | 4 | -3.571 | 2.86875 |
| NICKEL | MG/KG | 9 | 4 | 1.330 | 1.57612 |
| NITRATE+NITRITE (AS N) | MG/KG | 9 | 2 | 3.522 | 0.82463 |
| PERCENT SOLIDS | % | 9 | 0 | -0.488 | 2.80237 |
| SELENIUM | MG/KG | 9 | 7 | -2.098 | 6.97725 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 9 | 0 | 9.378 | 2.81813 |
| TOTAL PHOSPHOROUS | MG/KG | 9 | 0 | 8.054 | 1.42312 |
| ZINC | MG/KG | 9 | 0 | 5.992 | 1.05525 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 182.0000 | 5240.0000 | 15700.000 | 86.6000 |
| AMMONIA (AS N) | MG/KG | 29100.000 | 67800.000 | 203000.00 | 6.9900 |
| CADMIUM | MG/KG | 3.2100 | 20.0000 | 60.0000 | 18.7000 |
| CHROMIUM | MG/KG | 15.5000 | 16.3000 | 48.8000 | 3.1600 |
| COPPER | MG/KG | 317.0000 | 948.0000 | 2840.0000 | 8.9700 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 201.0000 | 2540.0000 | 7620.0000 | 38.0000 |
| LEAD | MG/KG | 12.1000 | 27.8000 | 83.3000 | 6.8600 |
| LINDANE(GAMMA-BHC) | UG/KG | 7.6900 | 7.0500 | 21.1000 | 2.7500 |
| MERCURY | MG/KG | 0.1180 | 0.1600 | 0.4810 | 4.0800 |
| NICKEL | MG/KG | 8.3200 | 5.4300 | 16.3000 | 1.9600 |
| NITRATE+NITRITE (AS N) | MG/KG | 51.1000 | 19.3000 | 57.9000 | 1.1300 |
| PERCENT SOLIDS | % | 2.4900 | 3.2700 | 9.8100 | 3.9300 |
| SELENIUM | MG/KG | 4.0200 | 43.8000 | 131.0000 | 32.7000 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 48400.000 | 64000.000 | 192000.00 | 3.9700 |
| TOTAL PHOSPHOROUS | MG/KG | 6410.0000 | 3790.0000 | 11400.000 | 1.7700 |
| ZINC | MG/KG | 678.0000 | 309.0000 | 928.0000 | 1.3700 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

| Pollutant | Units | Median | 90th Percentile | 95th Percentile | 98th Percentile |
|---|---|---|---|---|---|
| ALDRIN/DIELDRIN(TOTAL) | UG/KG | 2.1000 | 97.4000 | 286.0000 | 972.0000 |
| AMMONIA (AS N) | MG/KG | 4130.0000 | 52300.000 | 107000.00 | 240000.00 |
| CADMIUM | MG/KG | 0.1710 | 3.8400 | 9.1800 | 24.8000 |
| CHROMIUM | MG/KG | 4.6700 | 34.1000 | 59.6000 | 112.0000 |
| COPPER | MG/KG | 35.1000 | 520.0000 | 1110.0000 | 2620.0000 |
| DDT,DDE,DDD(TOTAL) | UG/KG | 5.2900 | 169.0000 | 447.0000 | 1350.0000 |
| LEAD | MG/KG | 1.7500 | 22.0000 | 44.6000 | 100.0000 |
| LINDANE(GAMMA-BHC) | UG/KG | 2.6300 | 17.3000 | 29.3000 | 53.4000 |
| MERCURY | MG/KG | 0.0281 | 0.2480 | 0.4560 | 0.9140 |
| NICKEL | MG/KG | 3.7800 | 19.0000 | 29.8000 | 49.9000 |
| NITRATE+NITRITE (AS N) | MG/KG | 33.9000 | 109.0000 | 151.0000 | 219.0000 |
| PERCENT SOLIDS | % | 0.6140 | 5.2800 | 9.6400 | 19.1000 |
| SELENIUM | MG/KG | 0.1230 | 3.6600 | 9.4600 | 27.9000 |
| TOTAL KJELDAHL NITROGEN | MG/KG | 11800.000 | 102000.00 | 187000.00 | 372000.00 |
| TOTAL PHOSPHOROUS | MG/KG | 3150.0000 | 14600.000 | 22400.000 | 36500.000 |
| ZINC | MG/KG | 400.0000 | 1500.0000 | 2170.0000 | 3300.0000 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 77.200 | 36.300 | 109.000 | 141.0 | 8.55000 | 17.6000 | 325.00 |
| SM-0 | 38.000 | 35.900 | 108.000 | 283.0 | 0.00000 | 0.0000 | 325.00 |

**Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 44.100 | 19.500 | 58.500 | 133.0 | 0.70400 | 15.2000 | 153.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

**Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 12700.000 | 6390.000 | 19200.000 | 151.0 | 77.50000 | 8210.0000 | 61300.00 |
| SM-0 | 12700.000 | 6390.000 | 19200.000 | 151.0 | 77.50000 | 8210.0000 | 61300.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=ARSENIC -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 8.710 | 3.920 | 11.800 | 135.0 | 0.14100 | 3.0400 | 30.60 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=BENZENE -- Sample Size=7 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1540.000 | 519.000 | 1370.000 | 89.1 | 70.40000 | 1080.0000 | 4330.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=BERYLLIUM -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.180 | 0.981 | 2.940 | 135.0 | 0.03520 | 0.7600 | 7.66 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

**Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

**Pollutant=CADMIUM -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 2.430 | 0.954 | 2.860 | 118.0 | 0.03520 | 0.9950 | 7.66 |
| SM-0 | 0.632 | 0.349 | 1.050 | 166.0 | 0.00000 | 0.0000 | 2.77 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

Pollutant=CHROMIUM -- Sample Size=9 -- Units=MG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 10.900 | 3.640 | 10.900 | 100.0 | 0.22600 | 7.6300 | 35.30 |
| SM-0 | 9.360 | 3.800 | 11.400 | 122.0 | 0.00000 | 6.9200 | 35.30 |

Pollutant=COPPER -- Sample Size=9 -- Units=MG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 113.000 | 40.900 | 123.000 | 108.0 | 0.81000 | 105.0000 | 328.00 |
| SM-0 | 113.000 | 40.900 | 123.000 | 108.0 | 0.81000 | 105.0000 | 328.00 |

Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 176.000 | 64.500 | 194.000 | 110.0 | 2.38000 | 69.3000 | 518.00 |
| SM-0 | 33.800 | 28.100 | 84.400 | 250.0 | 0.00000 | 0.0000 | 254.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 49.800 | 22.000 | 66.100 | 133.0 | 0.79600 | 17.2000 | 173.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 32.000 | 12.400 | 37.100 | 116.0 | 0.44400 | 9.5700 | 96.50 |
| SM-0 | 5.690 | 5.690 | 17.100 | 300.0 | 0.00000 | 0.0000 | 51.20 |

---------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4420.000 | 1950.000 | 5840.000 | 132.0 | 70.40000 | 1520.0000 | 15300.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

---------- Pollutant=LEAD -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 23.800 | 9.600 | 28.800 | 121.0 | 0.35200 | 7.6000 | 76.60 |
| SM-0 | 3.960 | 2.730 | 8.200 | 207.0 | 0.00000 | 0.0000 | 24.80 |

---------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 61.900 | 26.700 | 80.000 | 129.0 | 0.88000 | 22.1000 | 211.00 |
| SM-0 | 2.560 | 2.450 | 7.340 | 287.0 | 0.00000 | 0.0000 | 22.10 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=MERCURY -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 0.138 | 0.044 | 0.132 | 95.4 | 0.00211 | 0.0760 | 0.35 |
| SM-0 | 0.059 | 0.037 | 0.112 | 189.0 | 0.00000 | 0.0021 | 0.35 |

**Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4.460 | 1.950 | 5.850 | 131.0 | 0.07040 | 1.5200 | 15.30 |
| SM-0 | 0.328 | 0.328 | 0.984 | 300.0 | 0.00000 | 0.0000 | 2.95 |

**Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 22100.000 | 9740.000 | 29200.000 | 132.0 | 352.00000 | 7600.0000 | 76600.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------- Pollutant=NICKEL -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 18.900 | 7.800 | 23.400 | 124.0 | 0.56200 | 6.0800 | 61.30 |
| SM-0 | 4.470 | 2.870 | 8.620 | 193.0 | 0.00000 | 0.5620 | 26.80 |

---------- Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 68.600 | 17.200 | 51.700 | 75.4 | 6.34000 | 53.1000 | 153.00 |
| SM-0 | 36.400 | 11.600 | 34.900 | 95.9 | 0.00000 | 32.4000 | 91.20 |

---------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/KG ----------

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 771.000 | 341.000 | 1020.000 | 133.0 | 12.30000 | 266.0000 | 2680.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

## Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

**Pollutant=SELENIUM -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4.370 | 1.240 | 3.720 | 85.2 | 0.03520 | 2.7400 | 10.20 |
| SM-0 | 0.487 | 0.335 | 1.000 | 206.0 | 0.00000 | 0.0000 | 2.74 |

**Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 23600.000 | 8350.000 | 25100.000 | 106.0 | 218.00000 | 13000.0000 | 84200.00 |
| SM-0 | 23600.000 | 8350.000 | 25100.000 | 106.0 | 218.00000 | 13000.0000 | 84200.00 |

**Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/KG**

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 4580.000 | 1050.000 | 3150.000 | 68.7 | 176.00000 | 3500.0000 | 10700.00 |
| SM-0 | 4580.000 | 1050.000 | 3150.000 | 68.7 | 176.00000 | 3500.0000 | 10700.00 |

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 3240.000 | 1600.000 | 4800.000 | 148.0 | 80.10000 | 1390.0000 | 15500.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 1540.000 | 519.000 | 1370.000 | 89.1 | 70.40000 | 1080.0000 | 4330.00 |
| SM-0 | 0.000 | 0.000 | 0.000 | . | 0.00000 | 0.0000 | 0.00 |

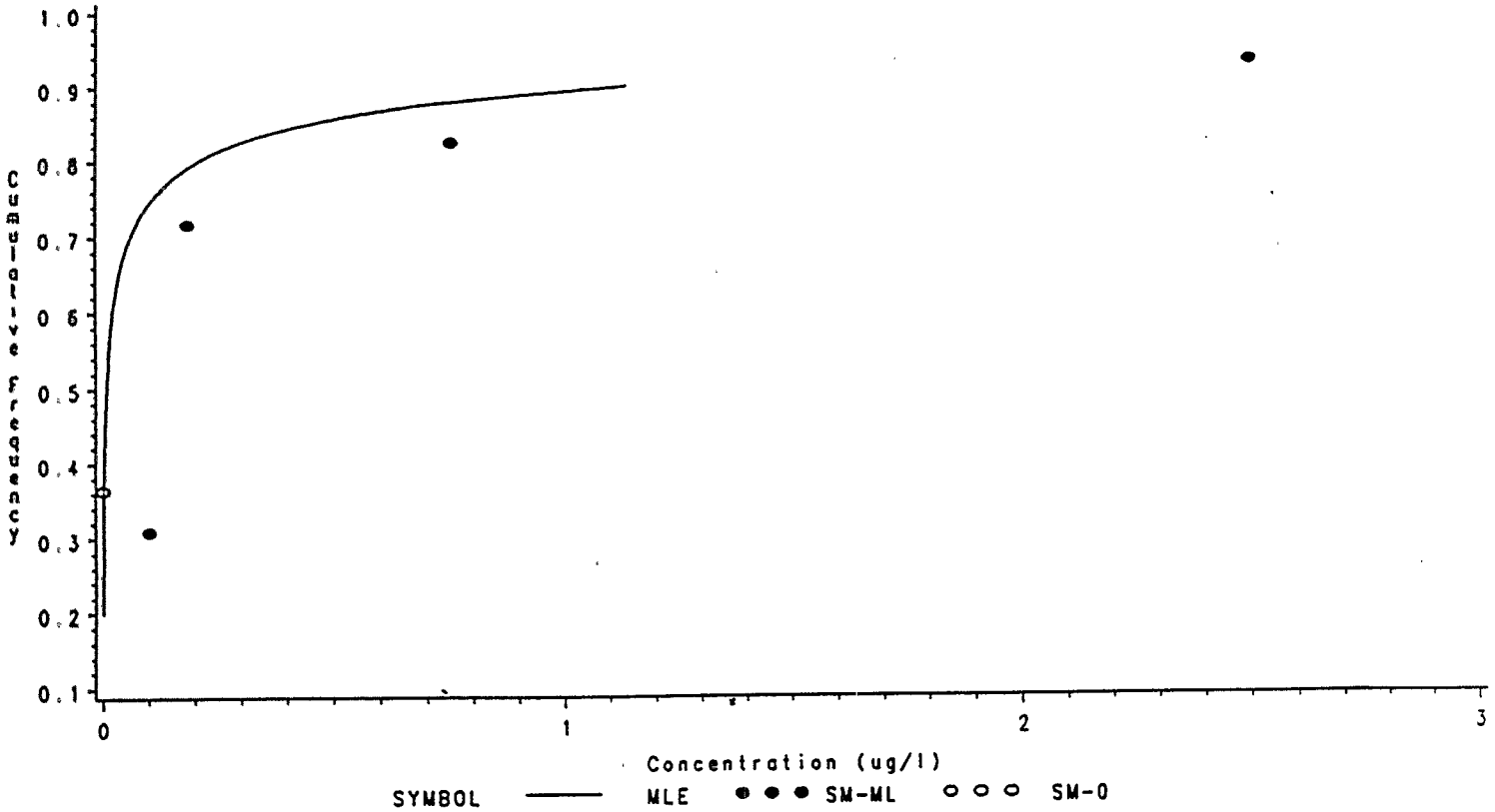
Pollutant=ZINC -- Sample Size=9 -- Units=MG/KG

| Substitution Method | Mean | Standard Deviation of the Mean | Standard Deviation | Coefficient of Variation | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|---|
| SM-ML | 570.000 | 146.000 | 439.000 | 77.1 | 43.70000 | 433.0000 | 1290.00 |
| SM-0 | 570.000 | 146.000 | 439.000 | 77.1 | 43.70000 | 433.0000 | 1290.00 |

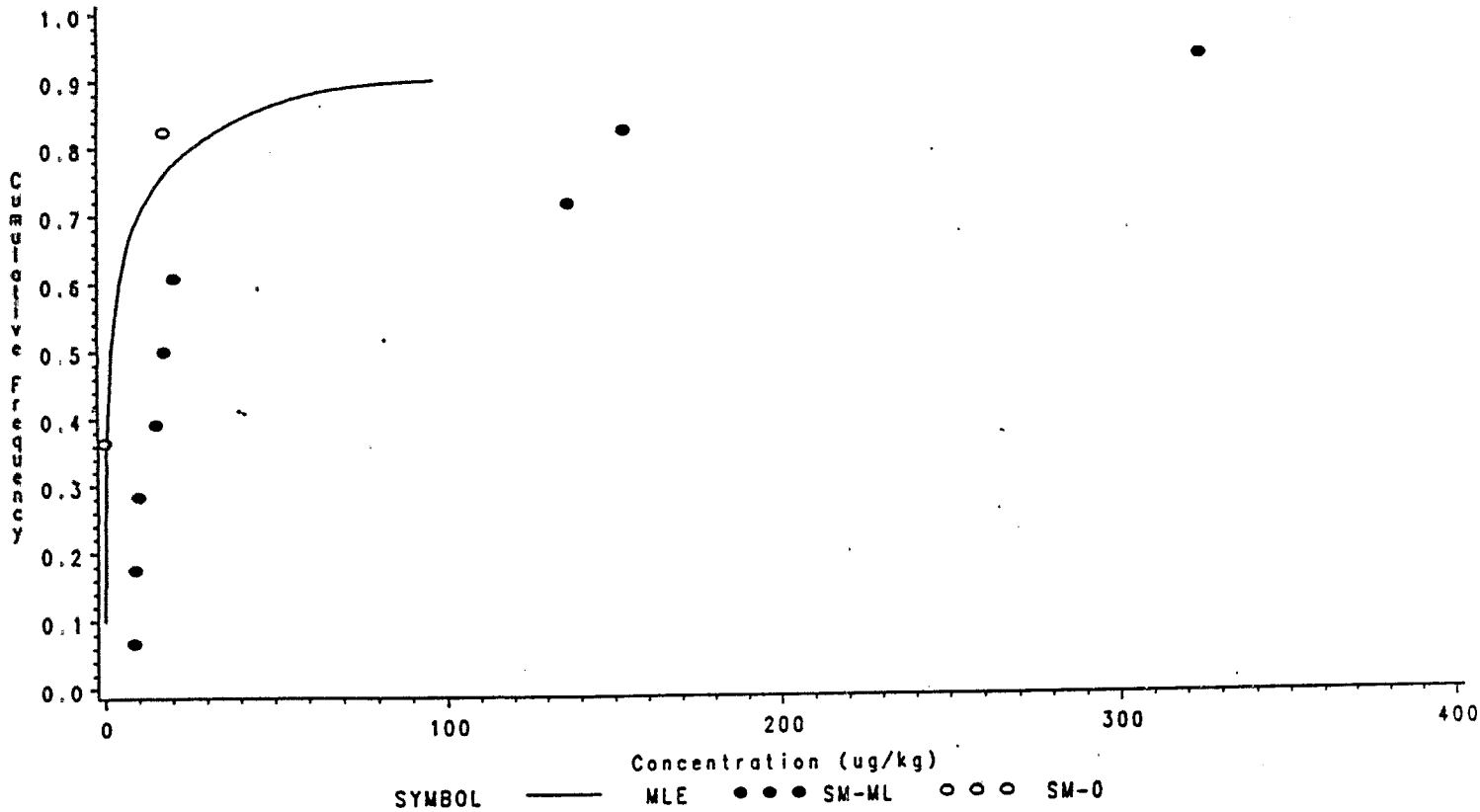
# Appendix B

## Graphics

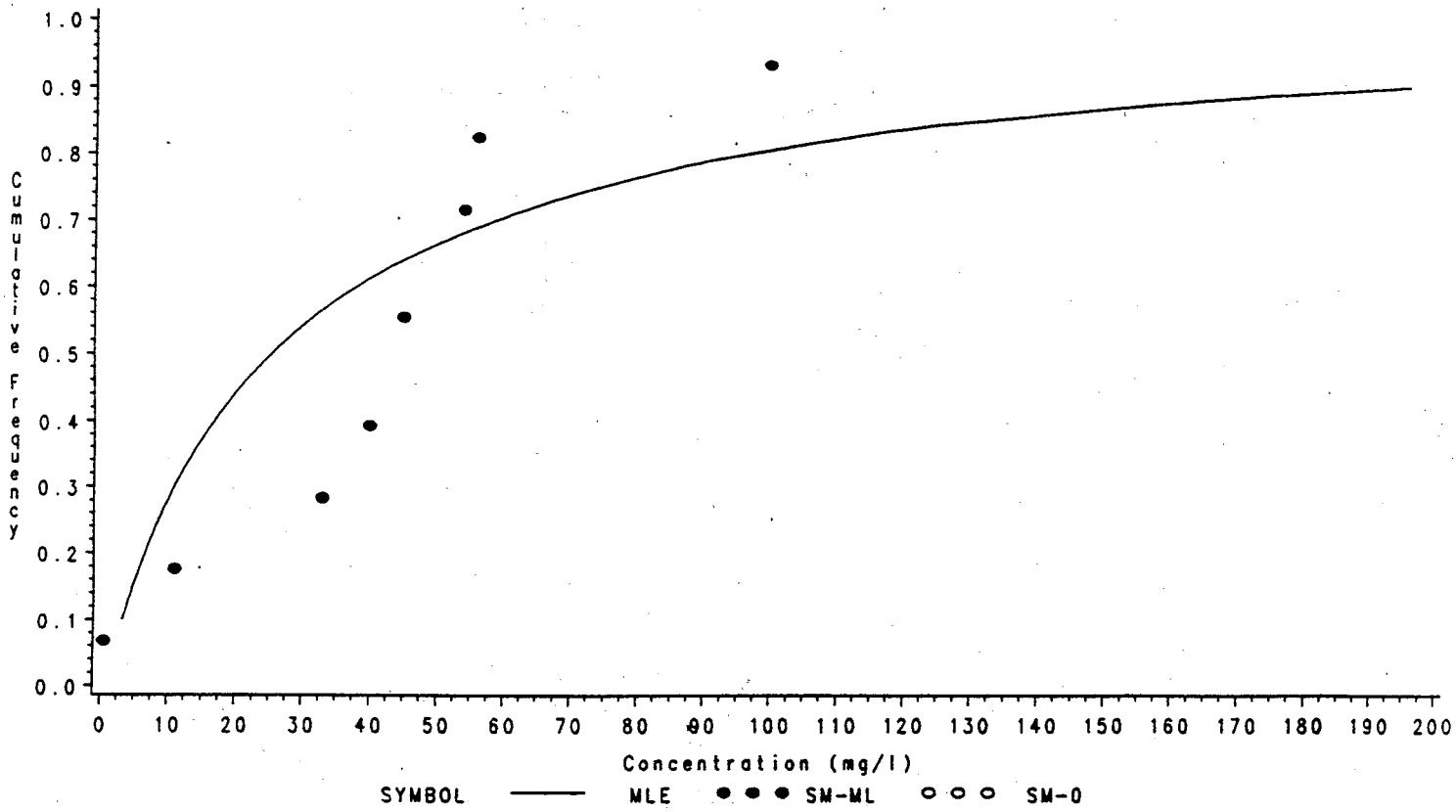
## Cumulative Frequency for Total Aldrin/Dieldrin (ug/l)



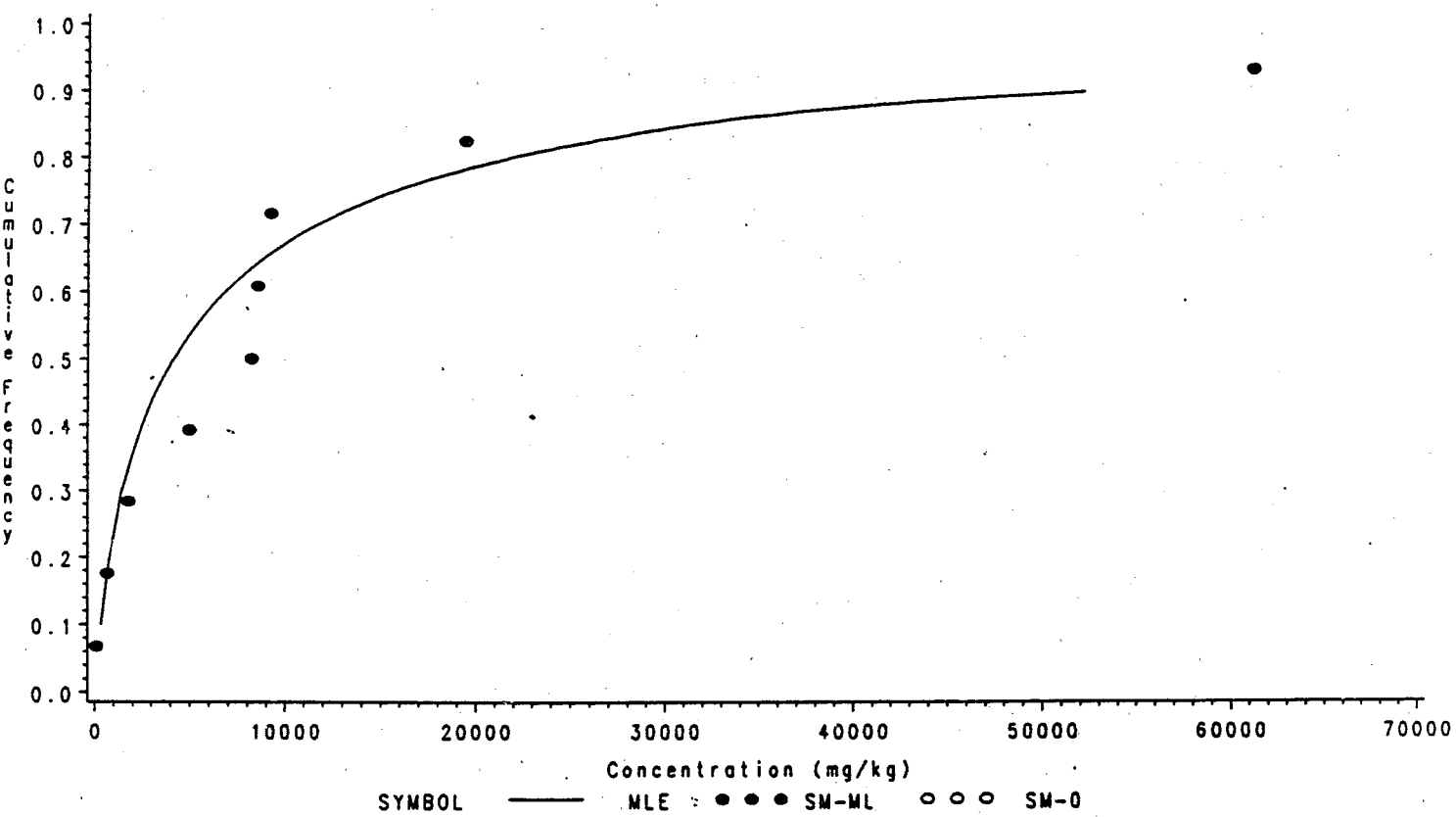

## Cumulative Frequency for Total Aldrin/Dieldrin (ug/kg)



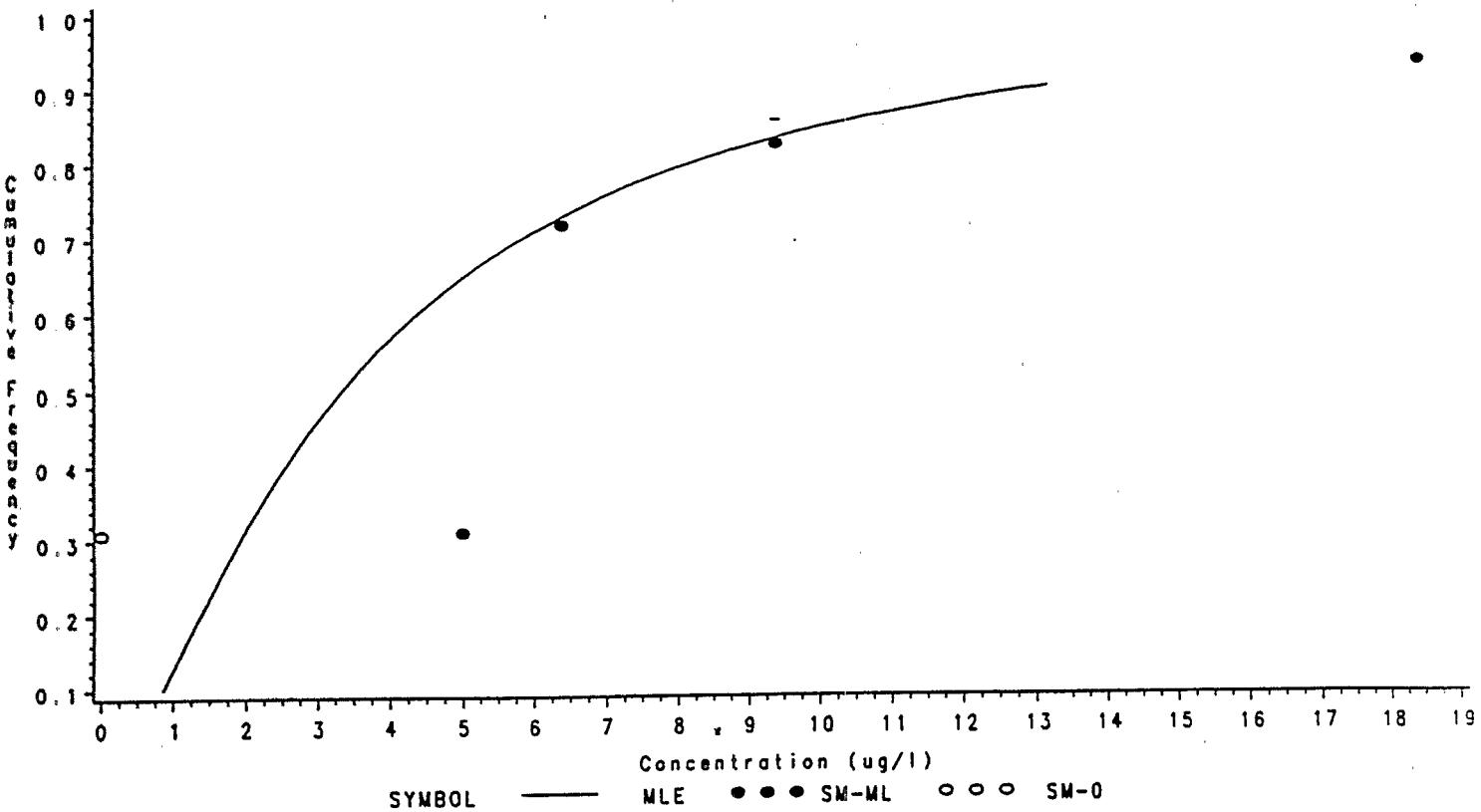
## Cumulative Frequency for Ammonia (AS N) (mg/l)



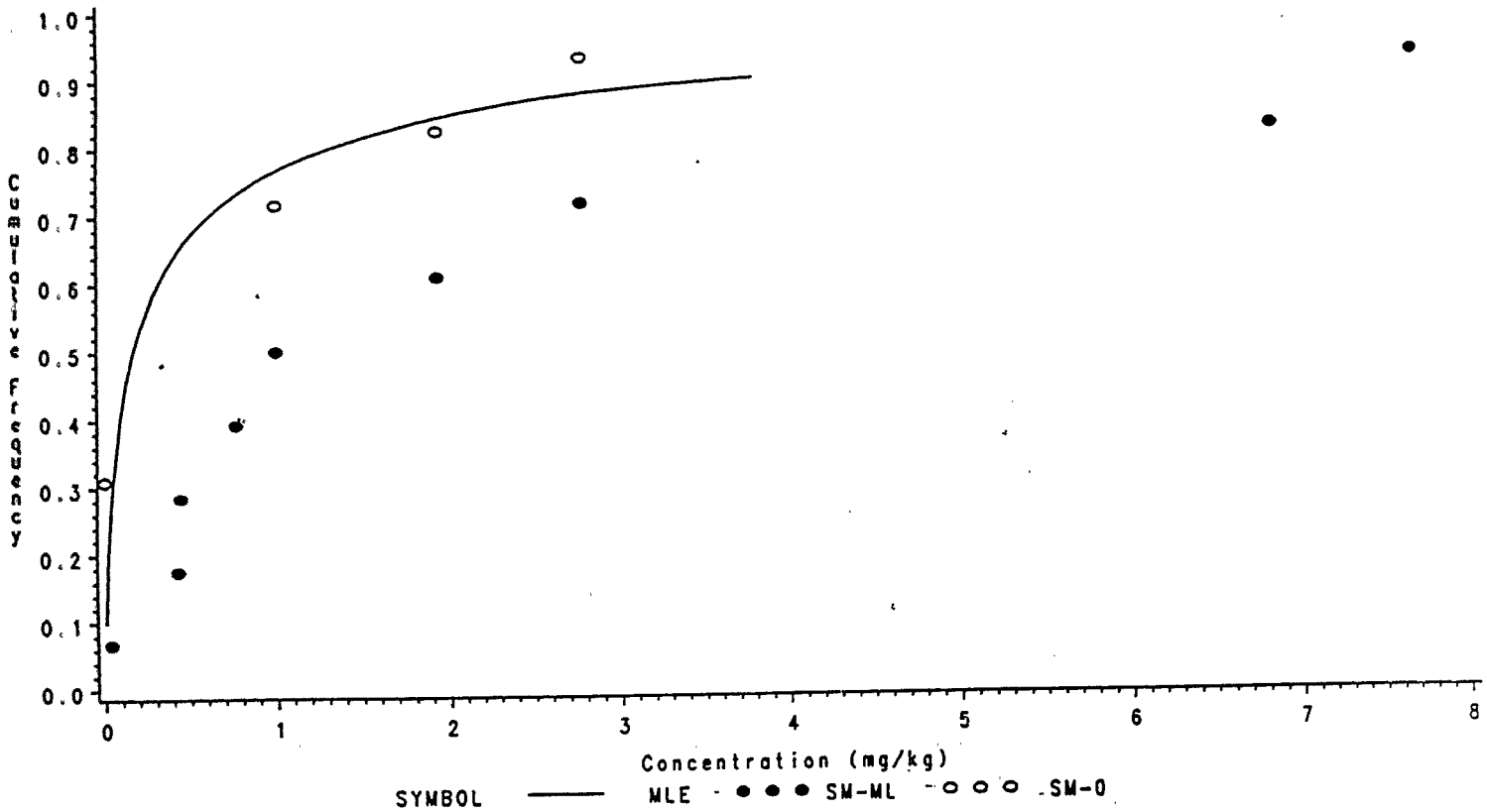

## Cumulative Frequency for Ammonia (AS N) (mg/kg)



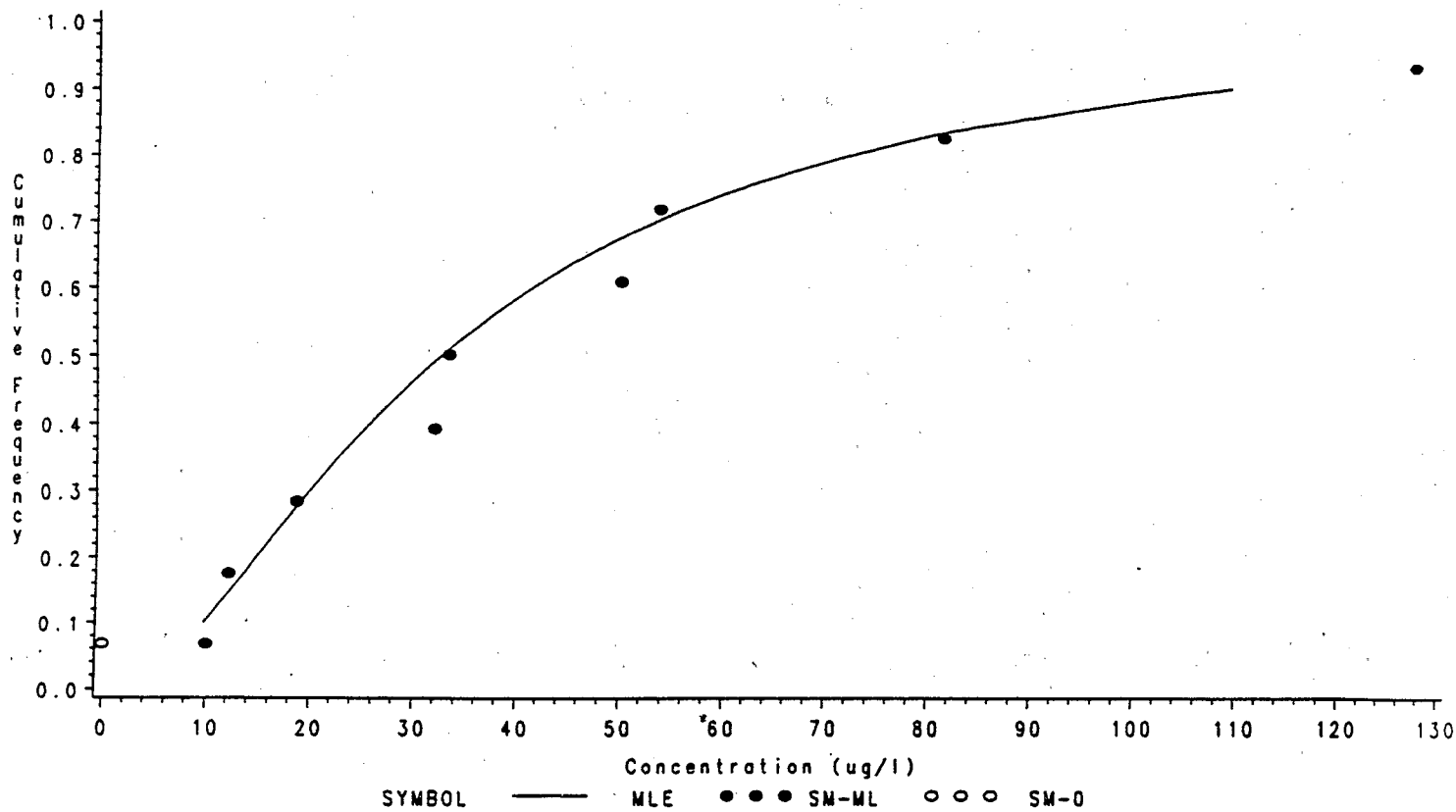
## Cumulative Frequency for Cadmium (ug/l)



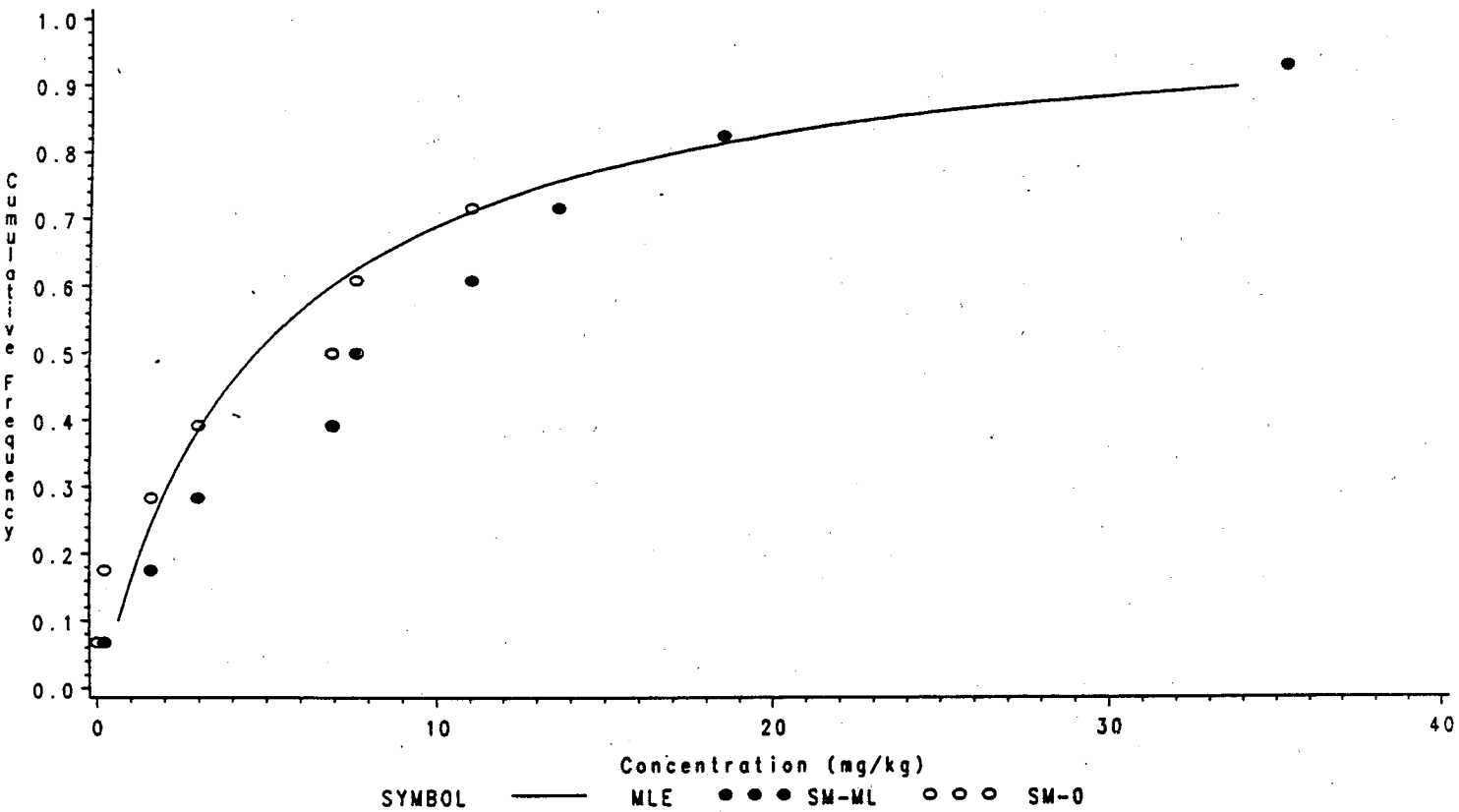

## Cumulative Frequency for Cadmium (mg/kg)



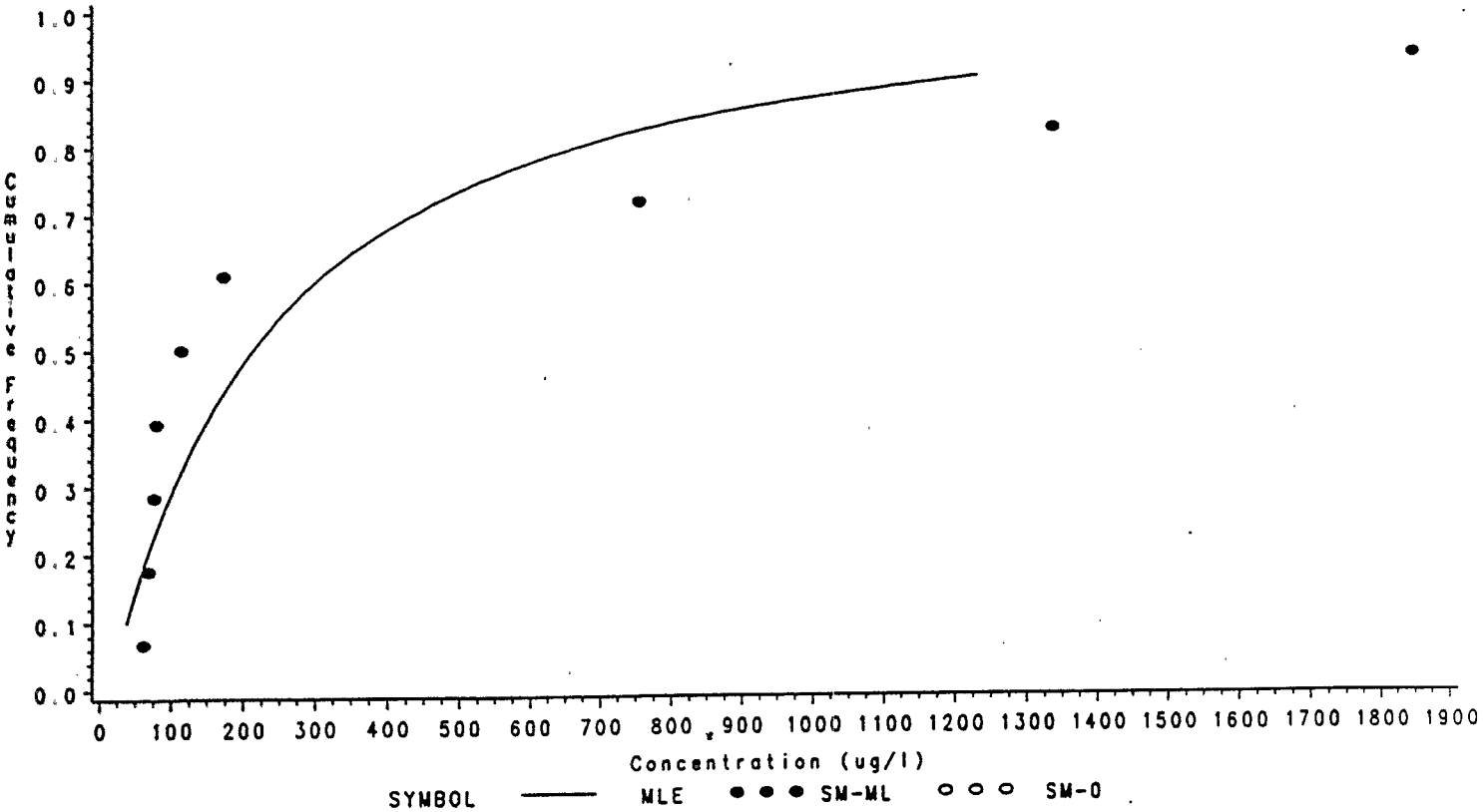
## Cumulative Frequency for Chromium (ug/l)



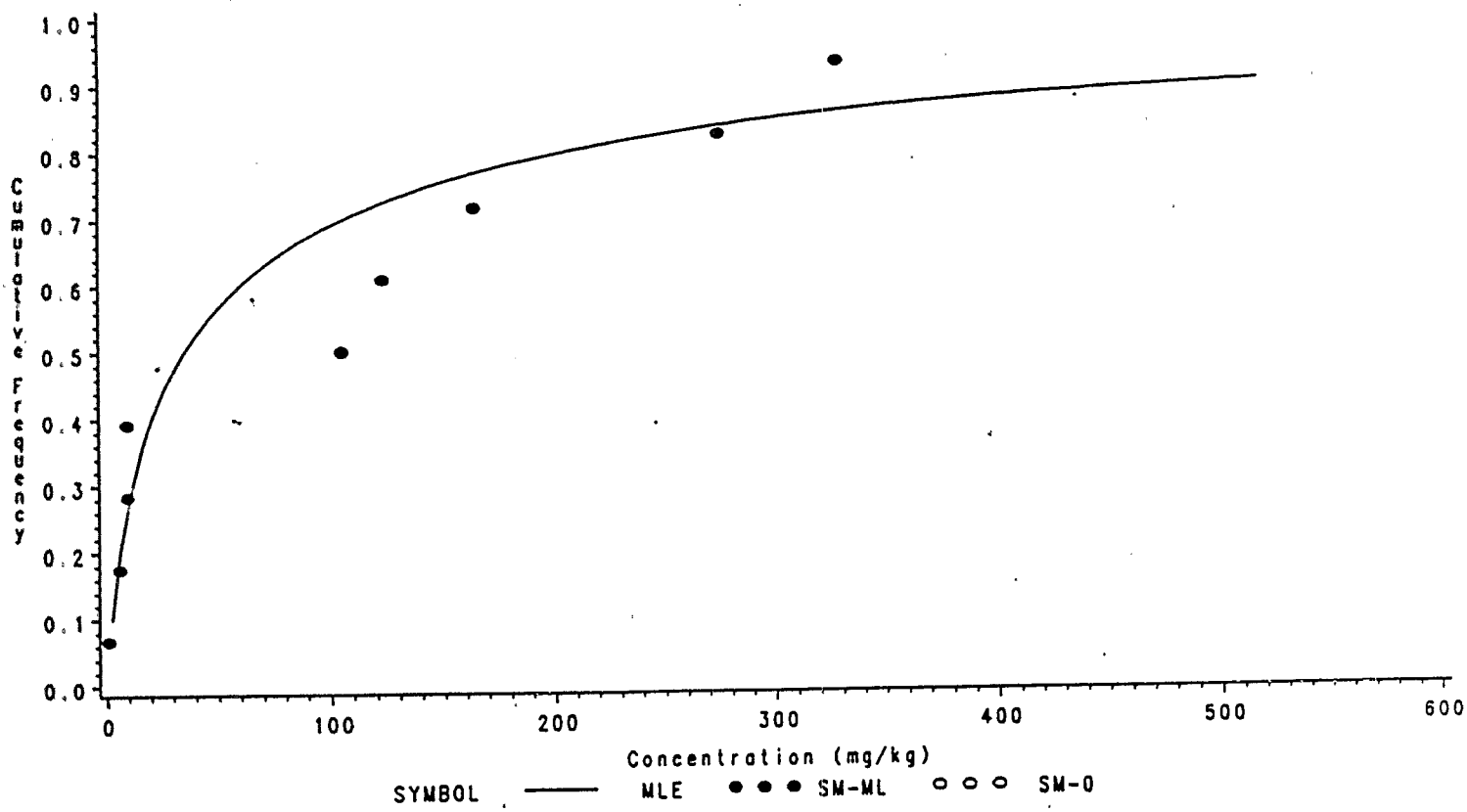

## Cumulative Frequency for Chromium (mg/kg)



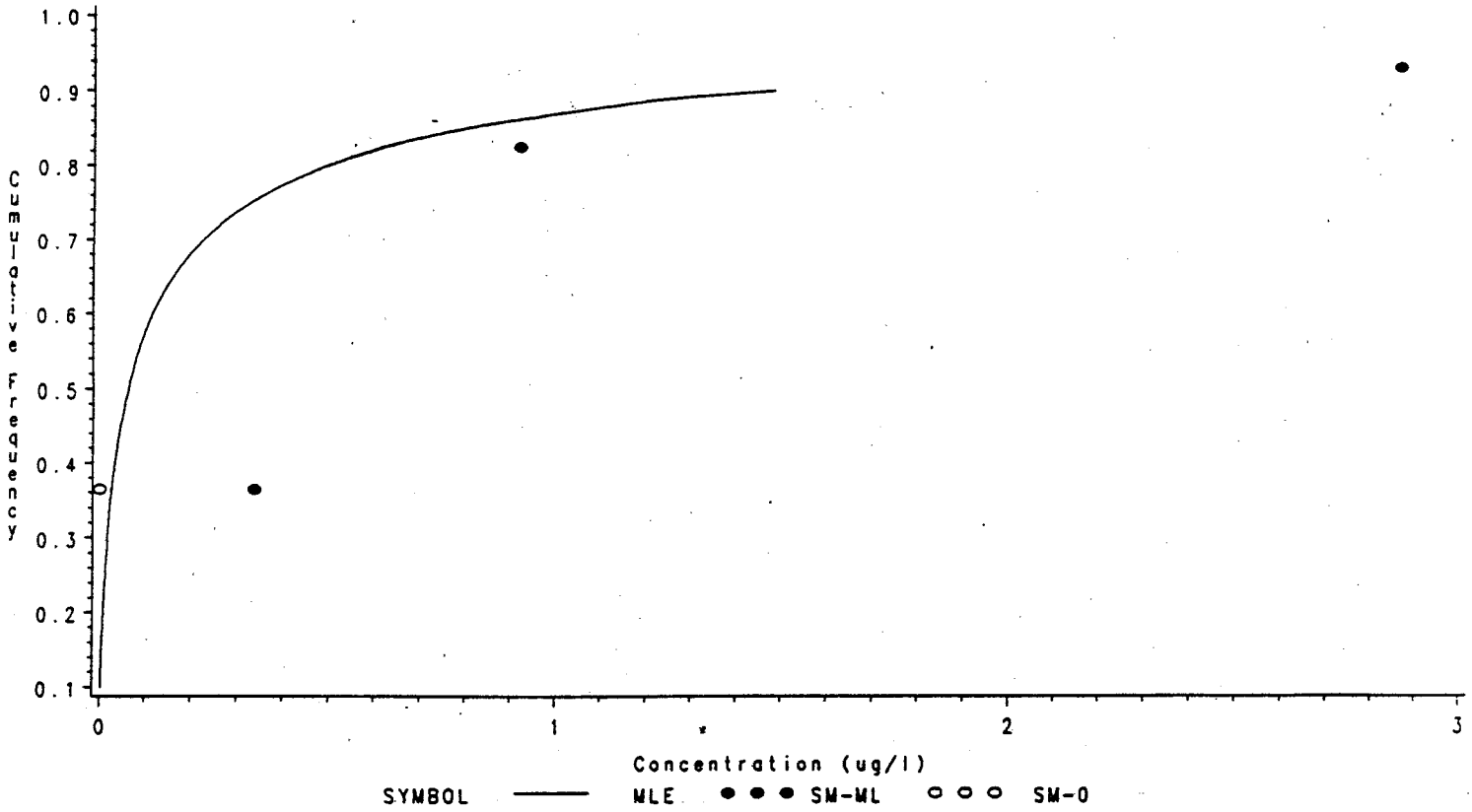
## Cumulative Frequency for Copper (ug/l)



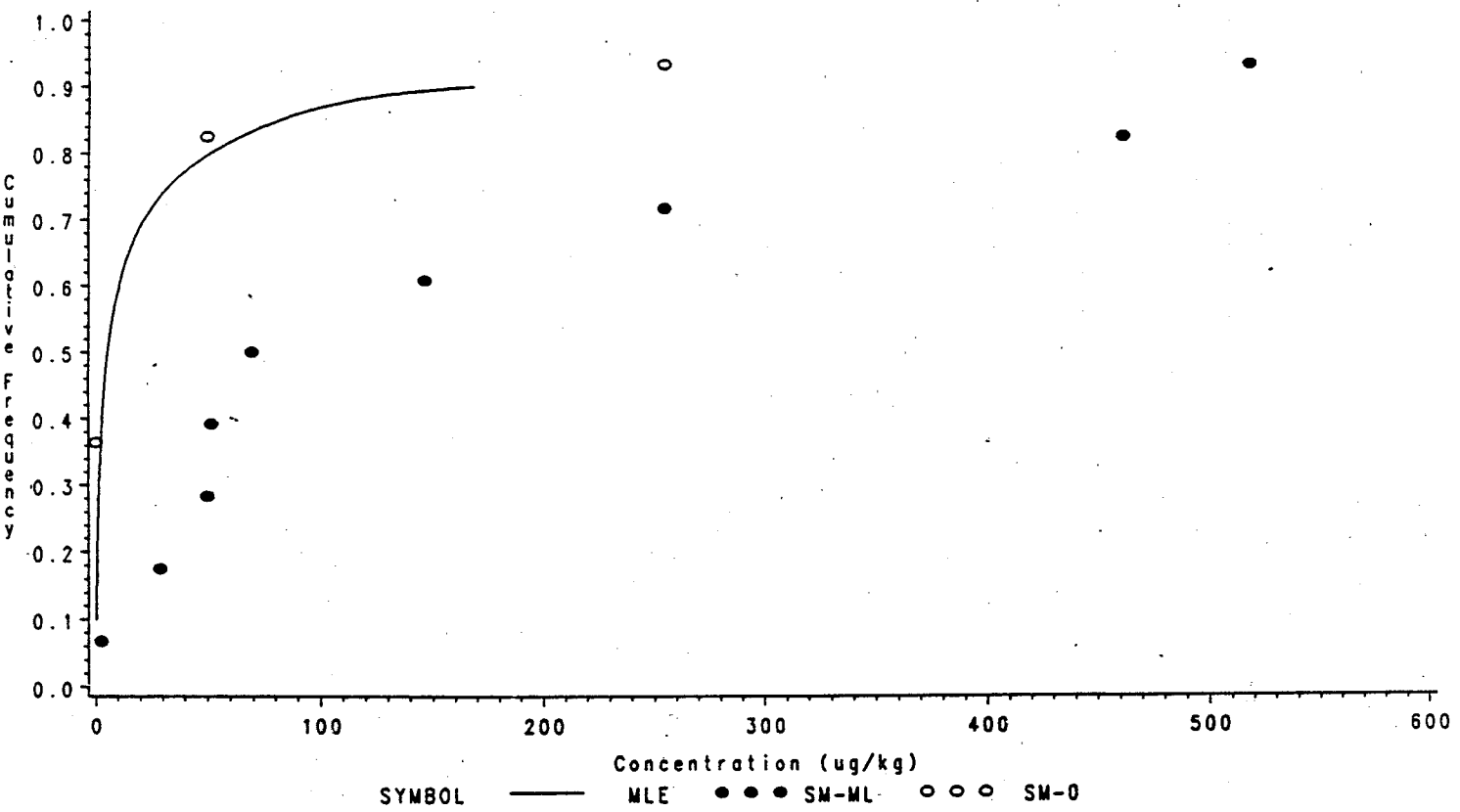

## Cumulative Frequency for Copper (mg/kg)



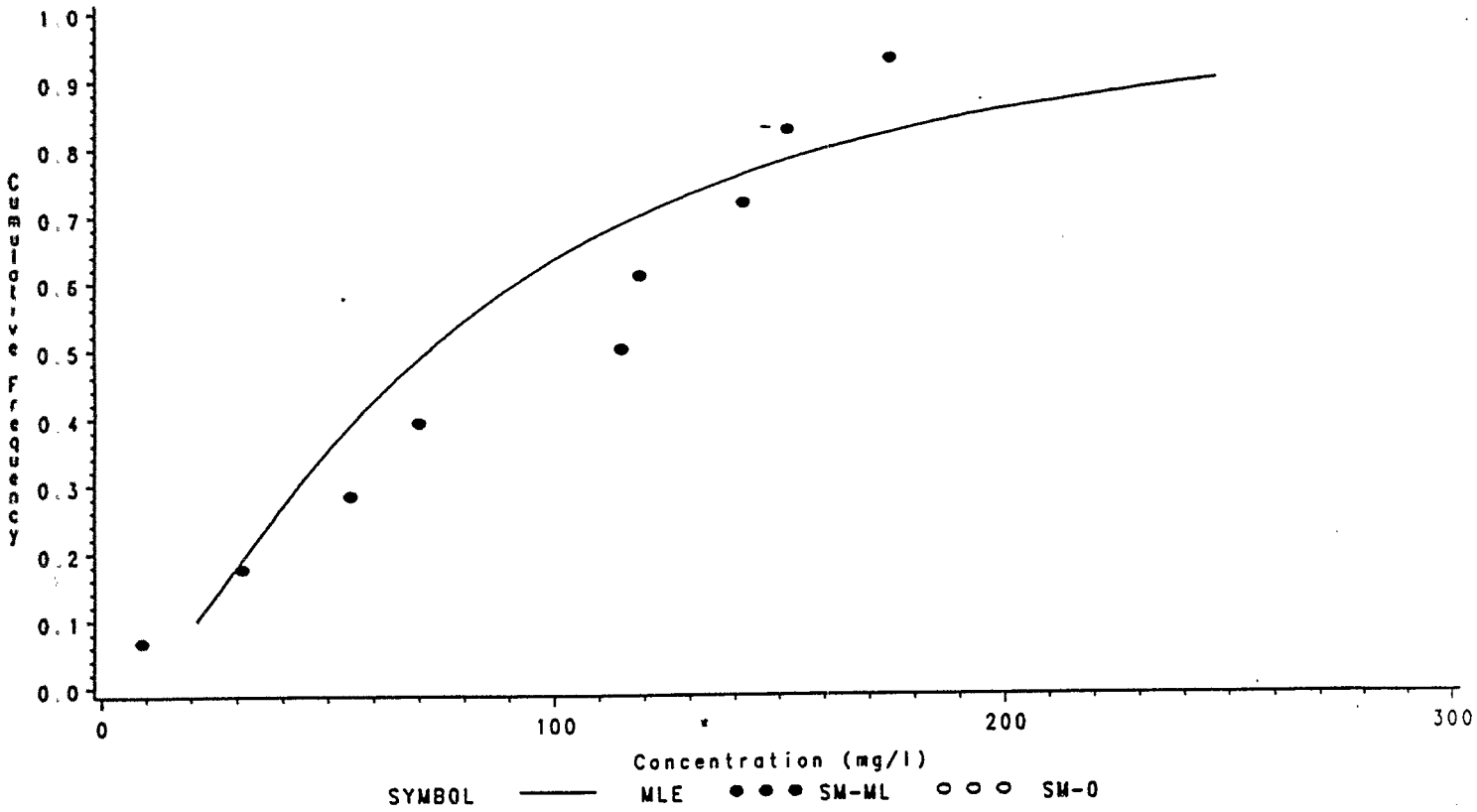
## Cumulative Frequency for Total DDT, DDE, and DDD (ug/l)



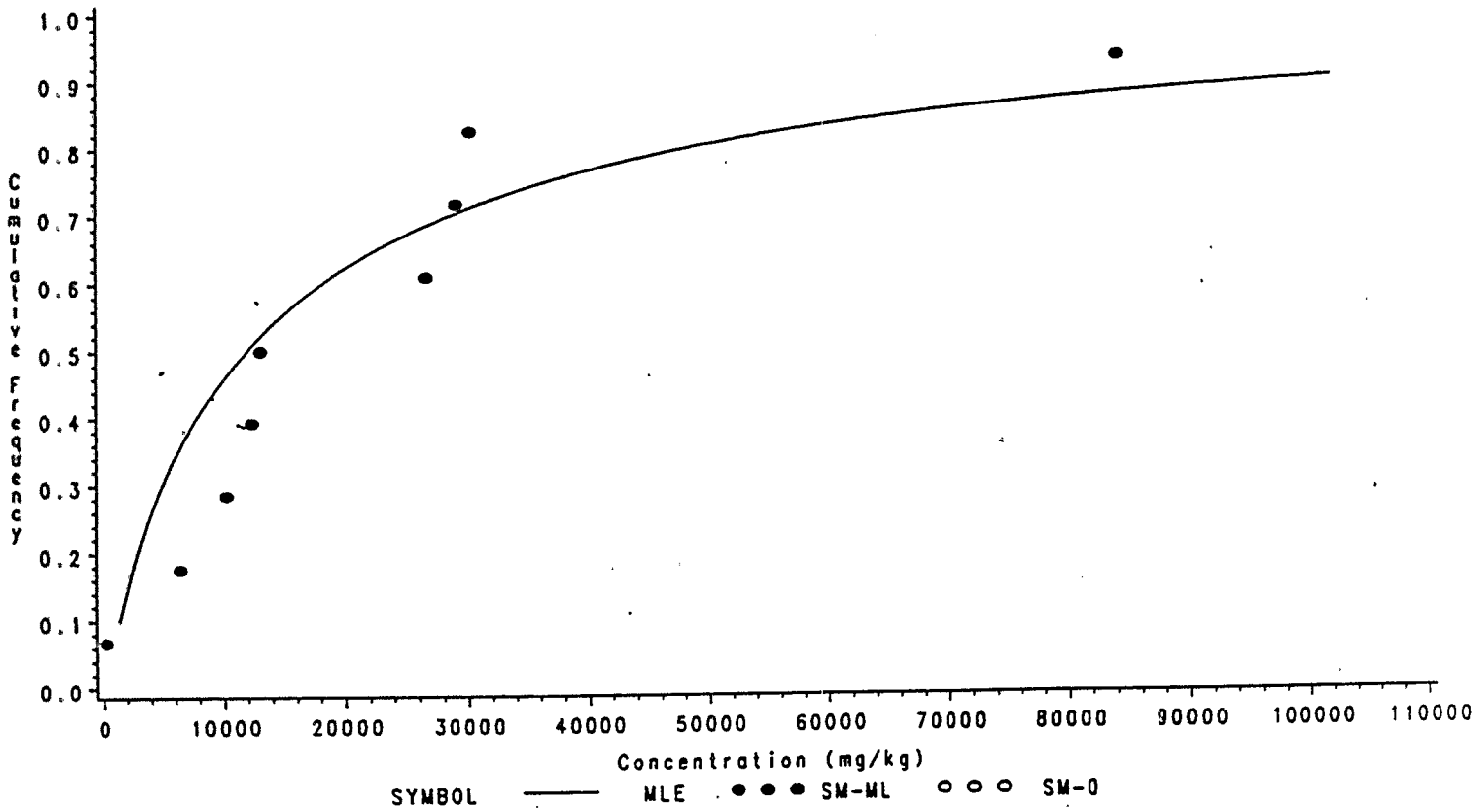

## Cumulative Frequency for Total DDT, DDE, and DDD (ug/kg)



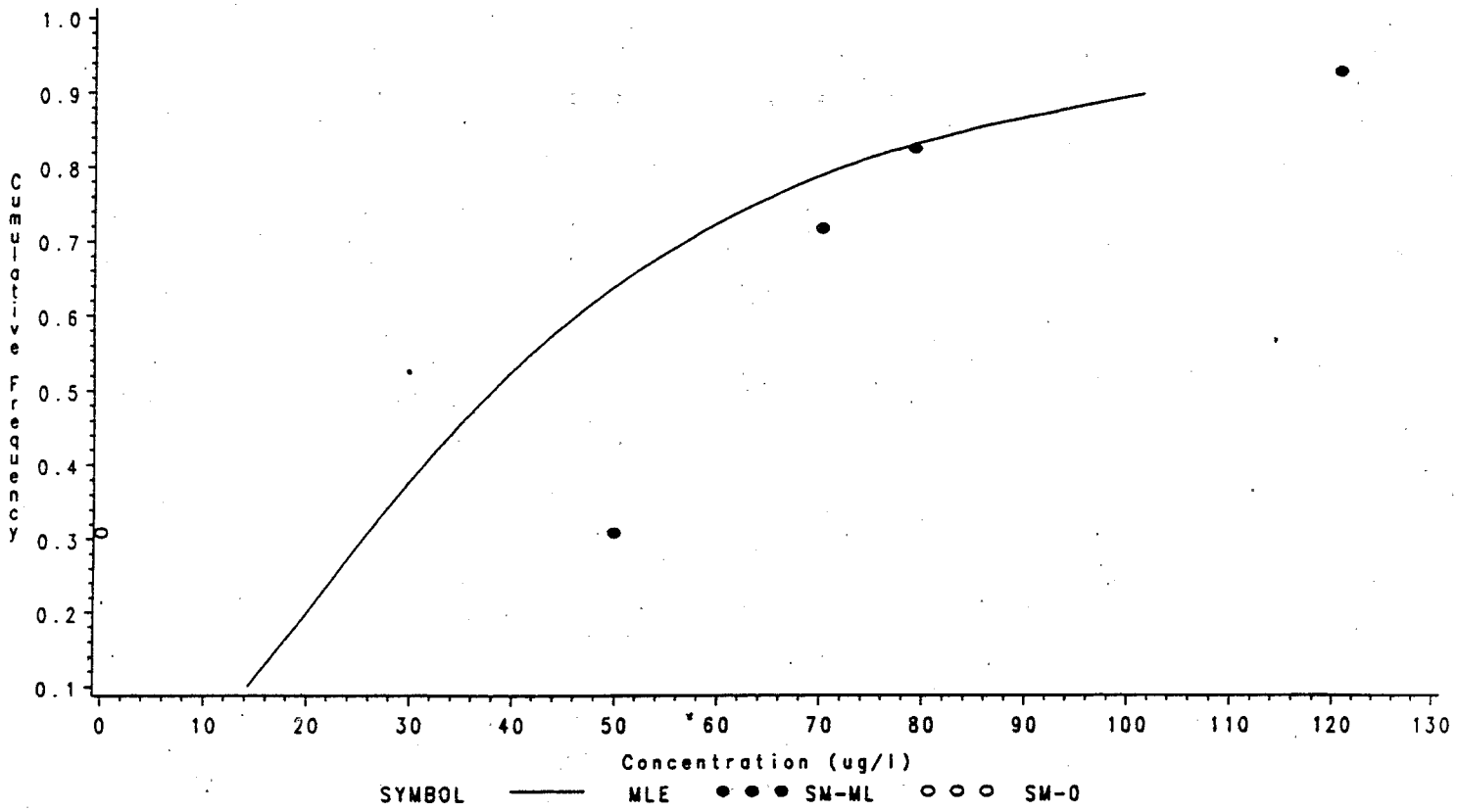
## Cumulative Frequency for Total Kjeldahl Nitrogen (mg/l)



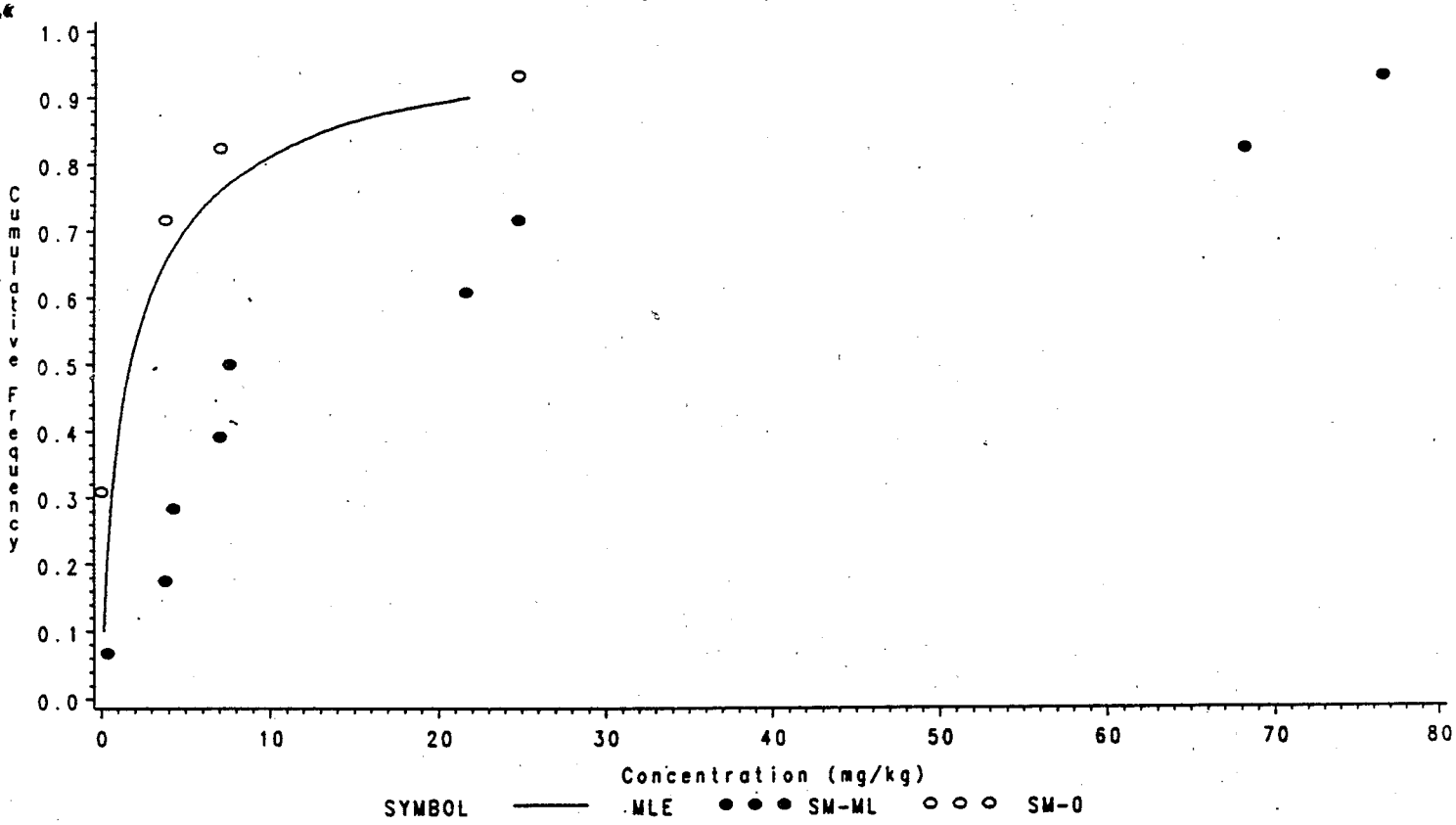

## Cumulative Frequency for Total Kjeldahl Nitrogen (mg/kg)



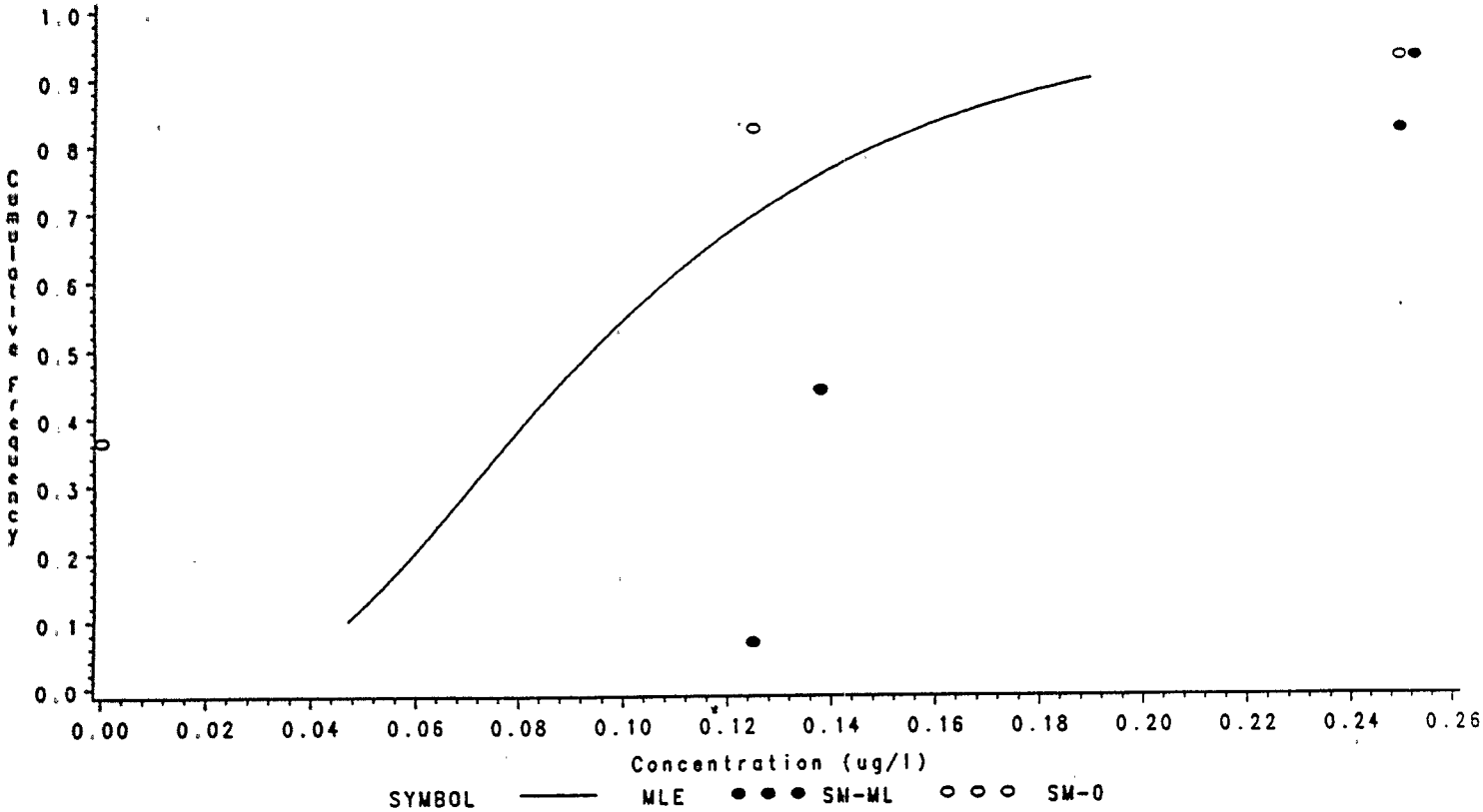
## Cumulative Frequency for Lead (ug/l)



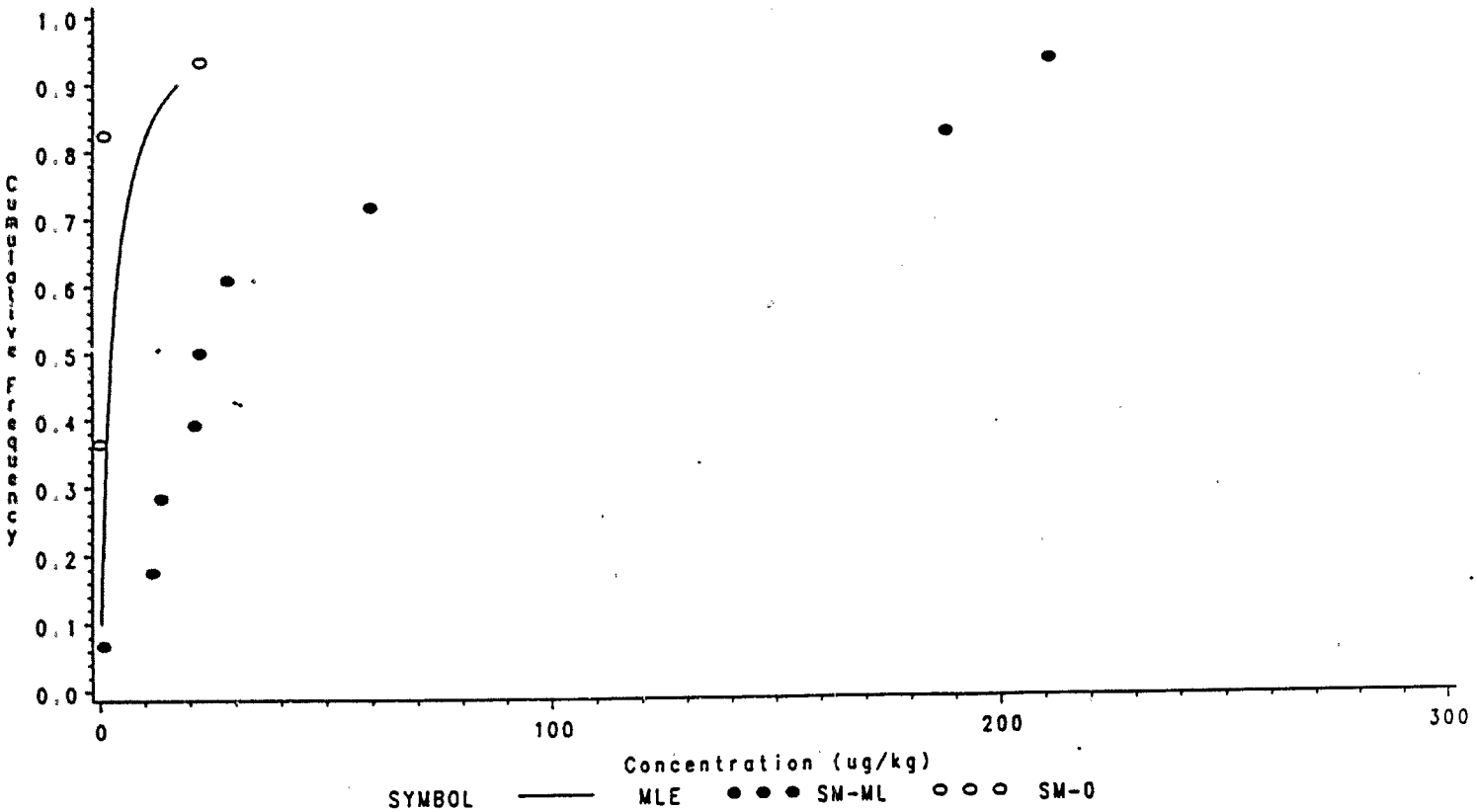

## Cumulative Frequency for Lead (mg/kg)



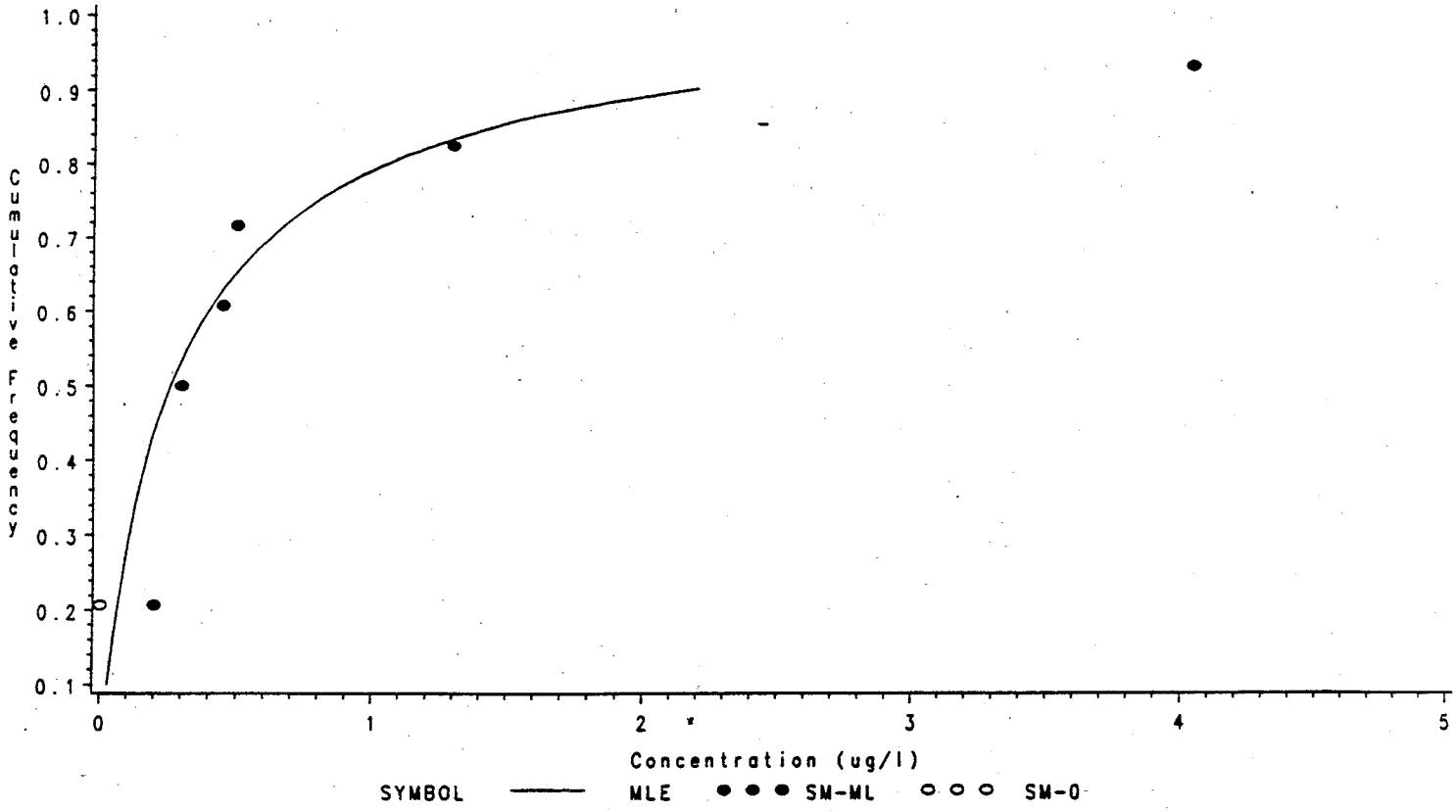
## Cumulative Frequency for Lindane (Gamma – BHC) (ug/l)



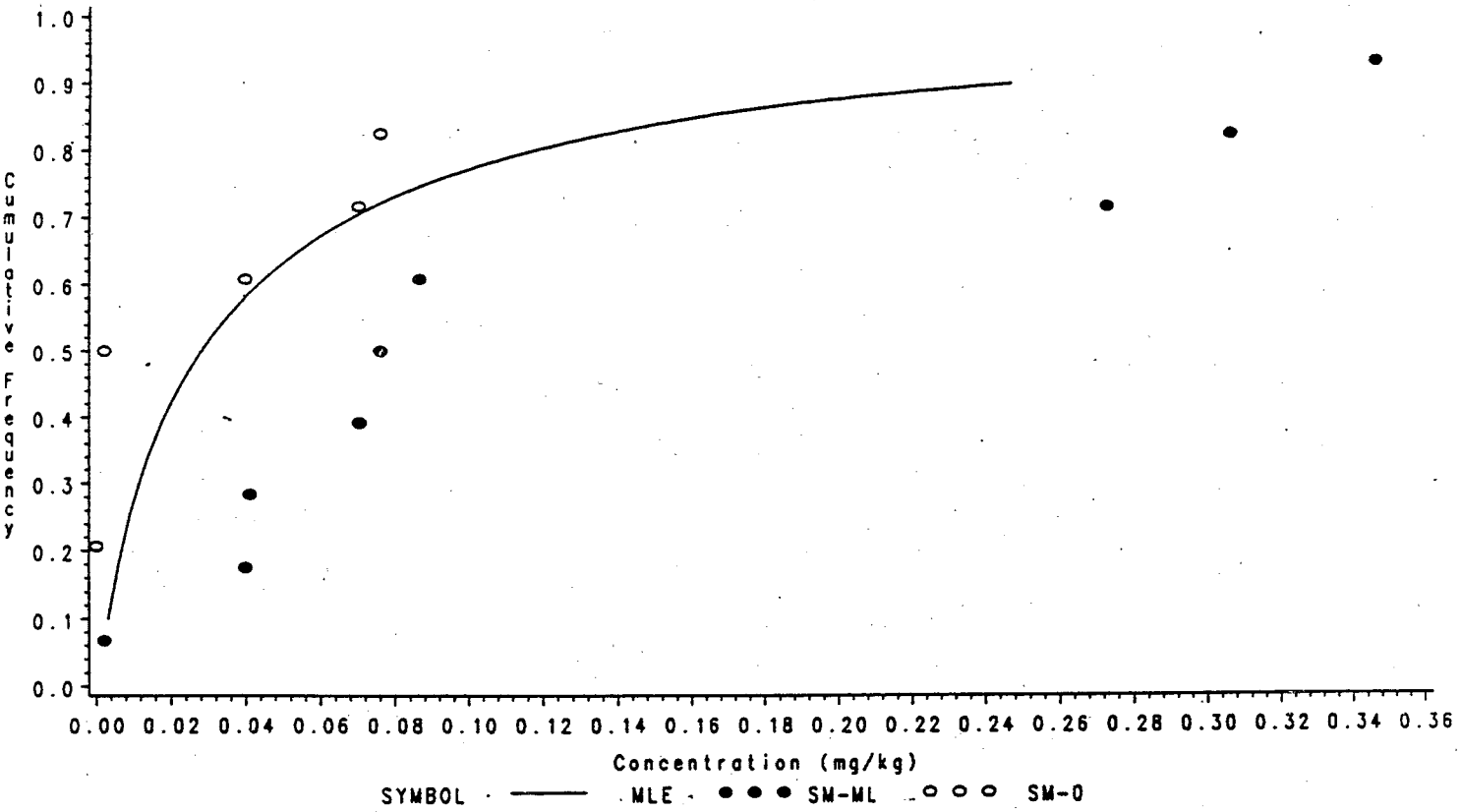

## Cumulative Frequency for Lindane (Gamma – BHC) (ug/kg)



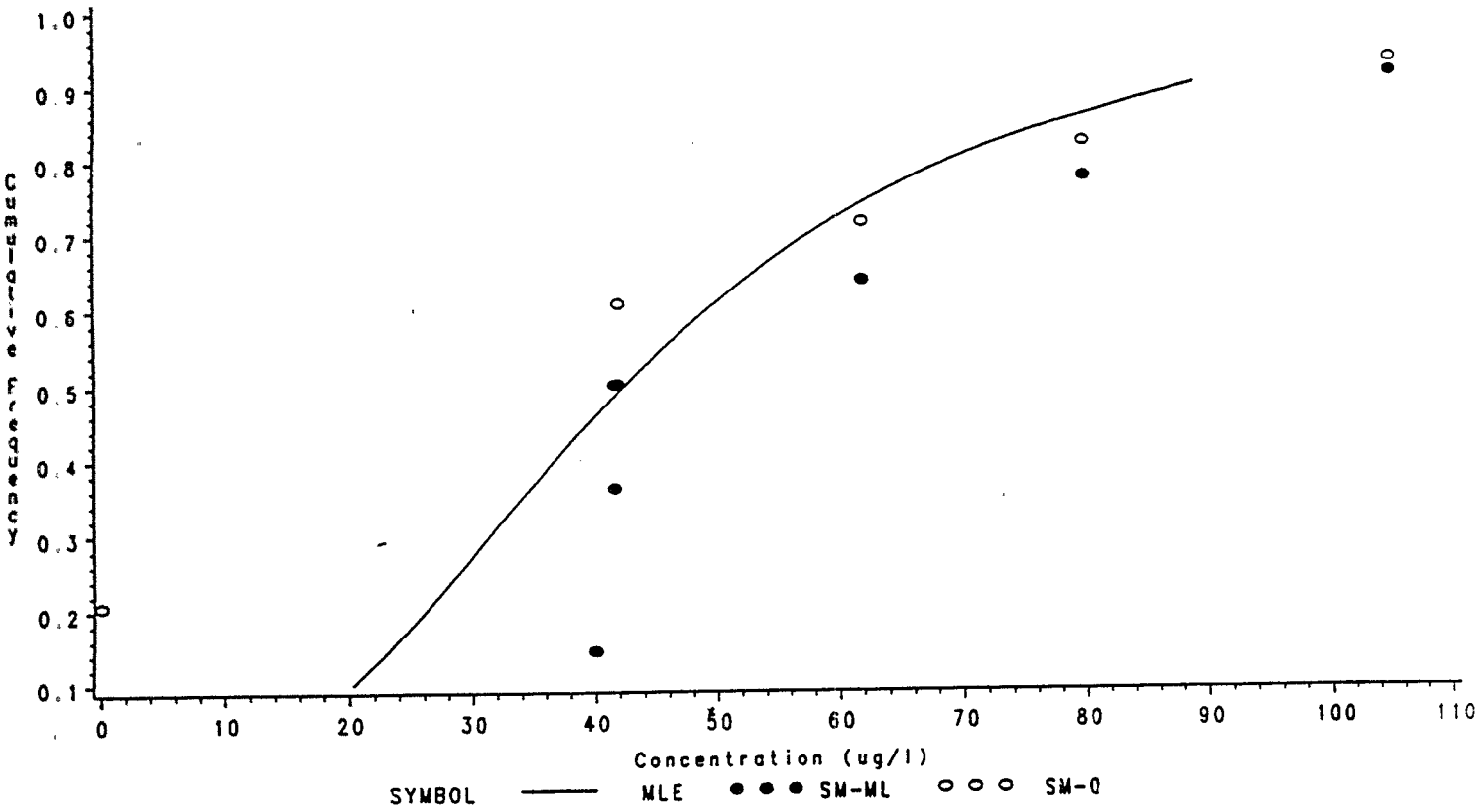
## Cumulative Frequency for Mercury (ug/l)



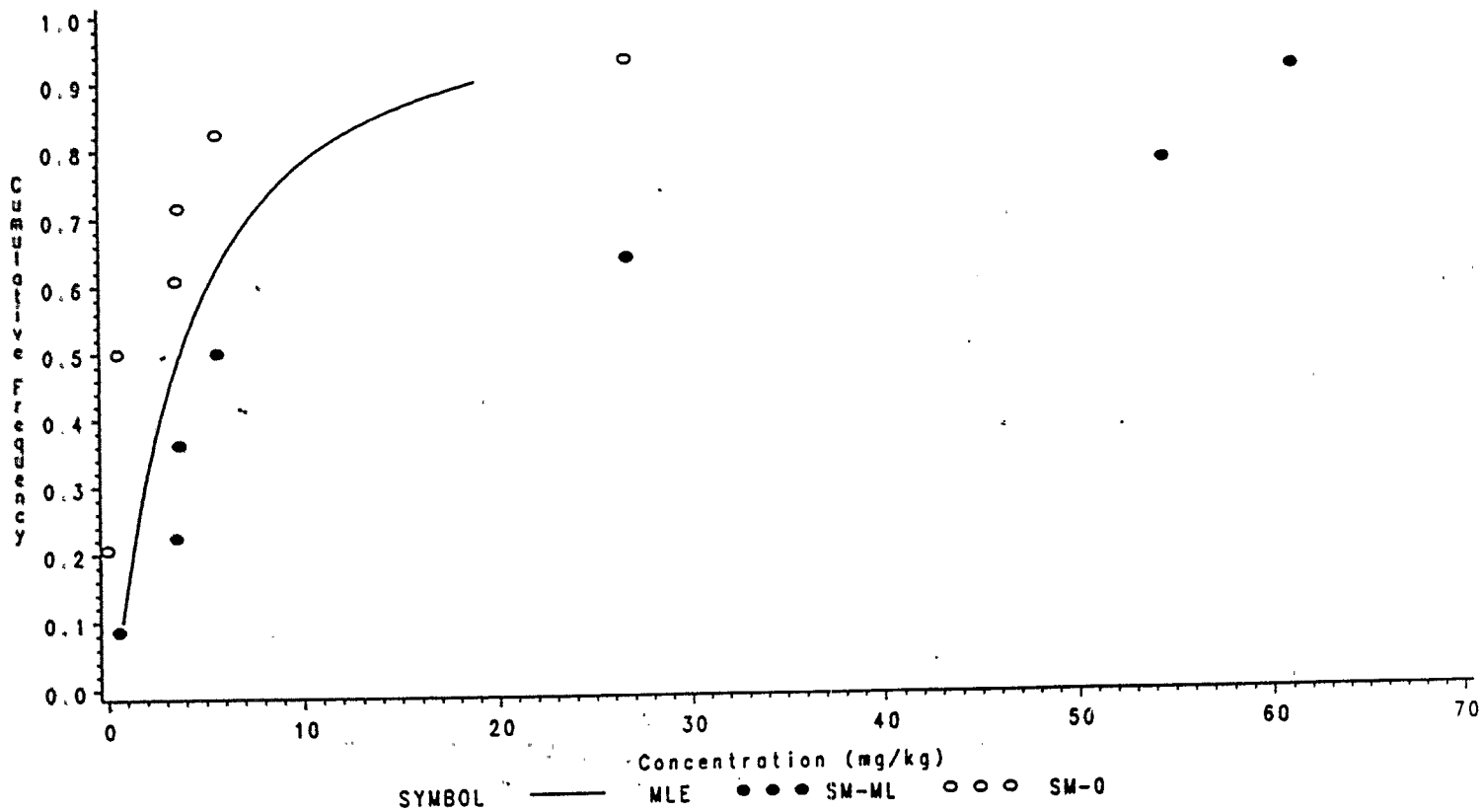

## Cumulative Frequency for Mercury (mg/kg)



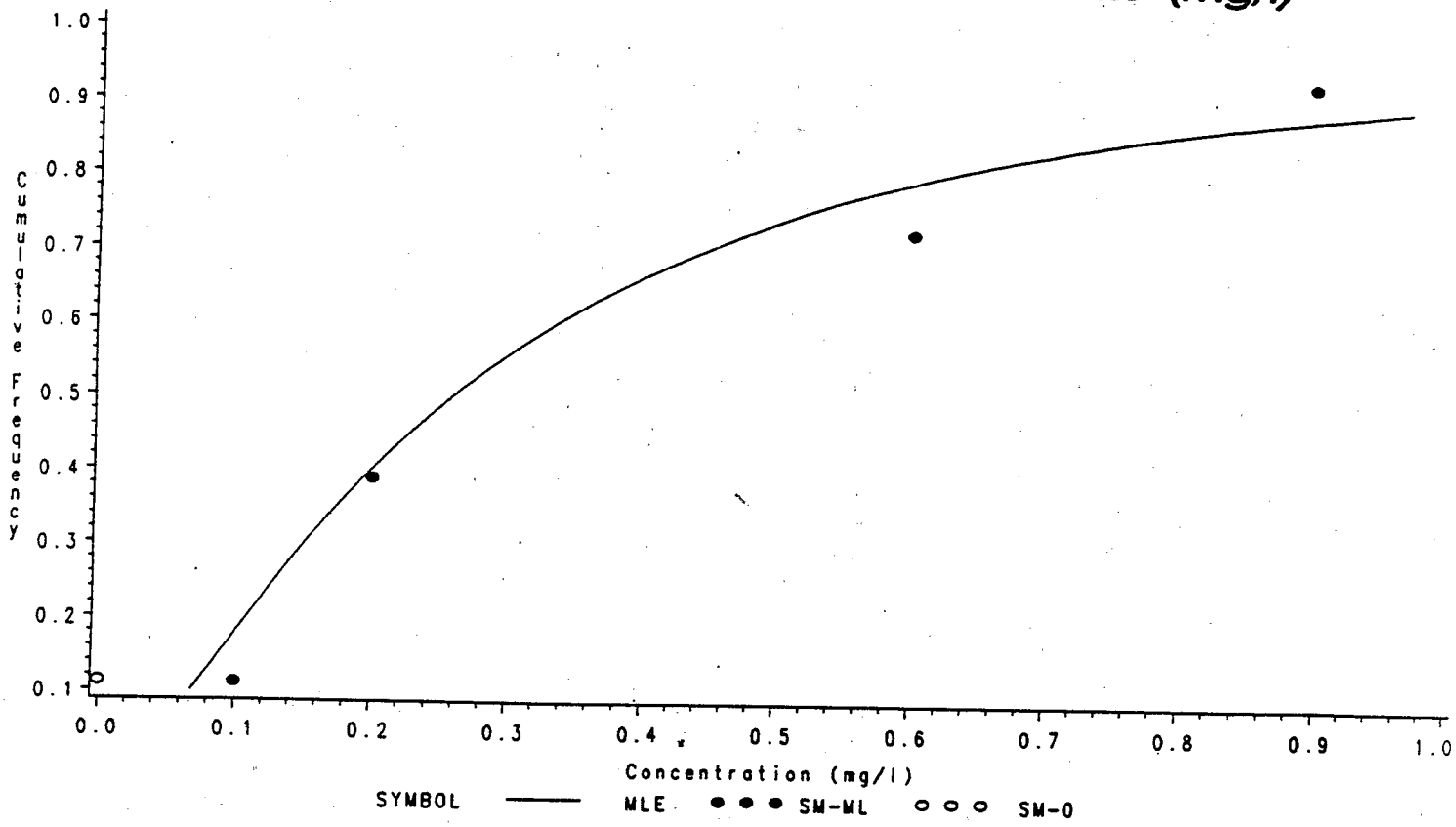
## Cumulaltive Frequency for Nickel (ug/l)



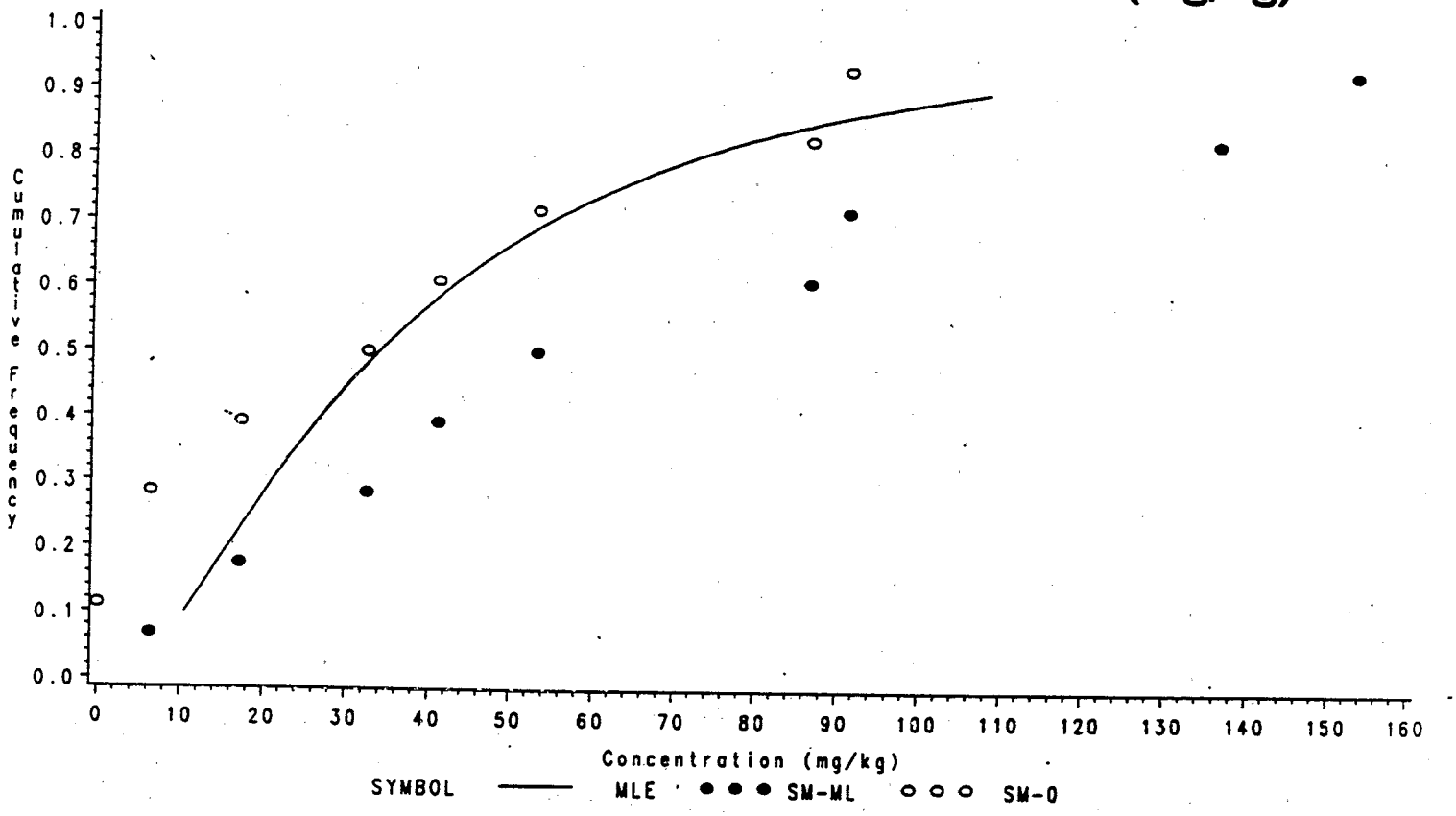

## Cumulative Frequency for Nickel (mg/kg)



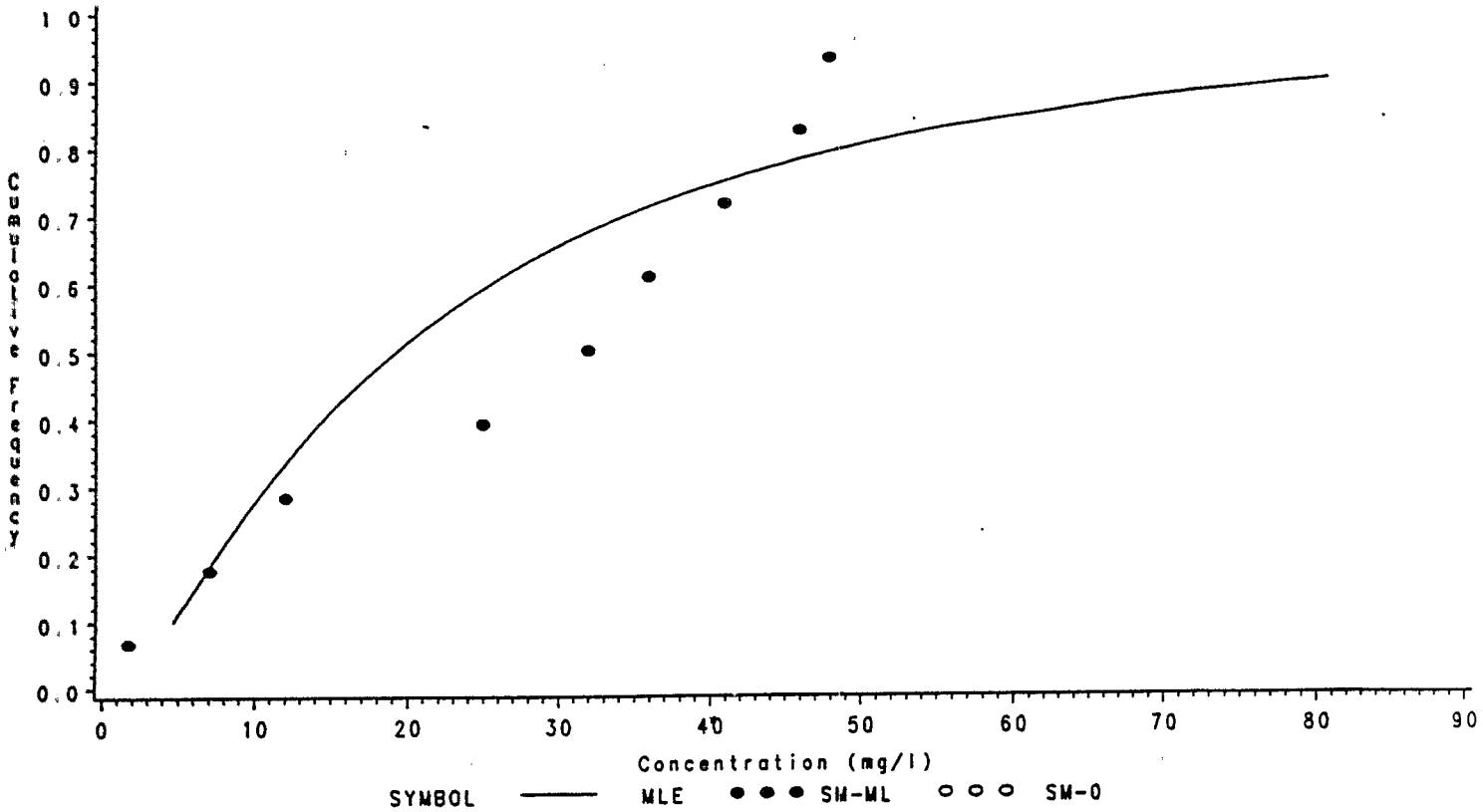
## Cumulative Frequency for Nitrate + Nitrite (mg/l)



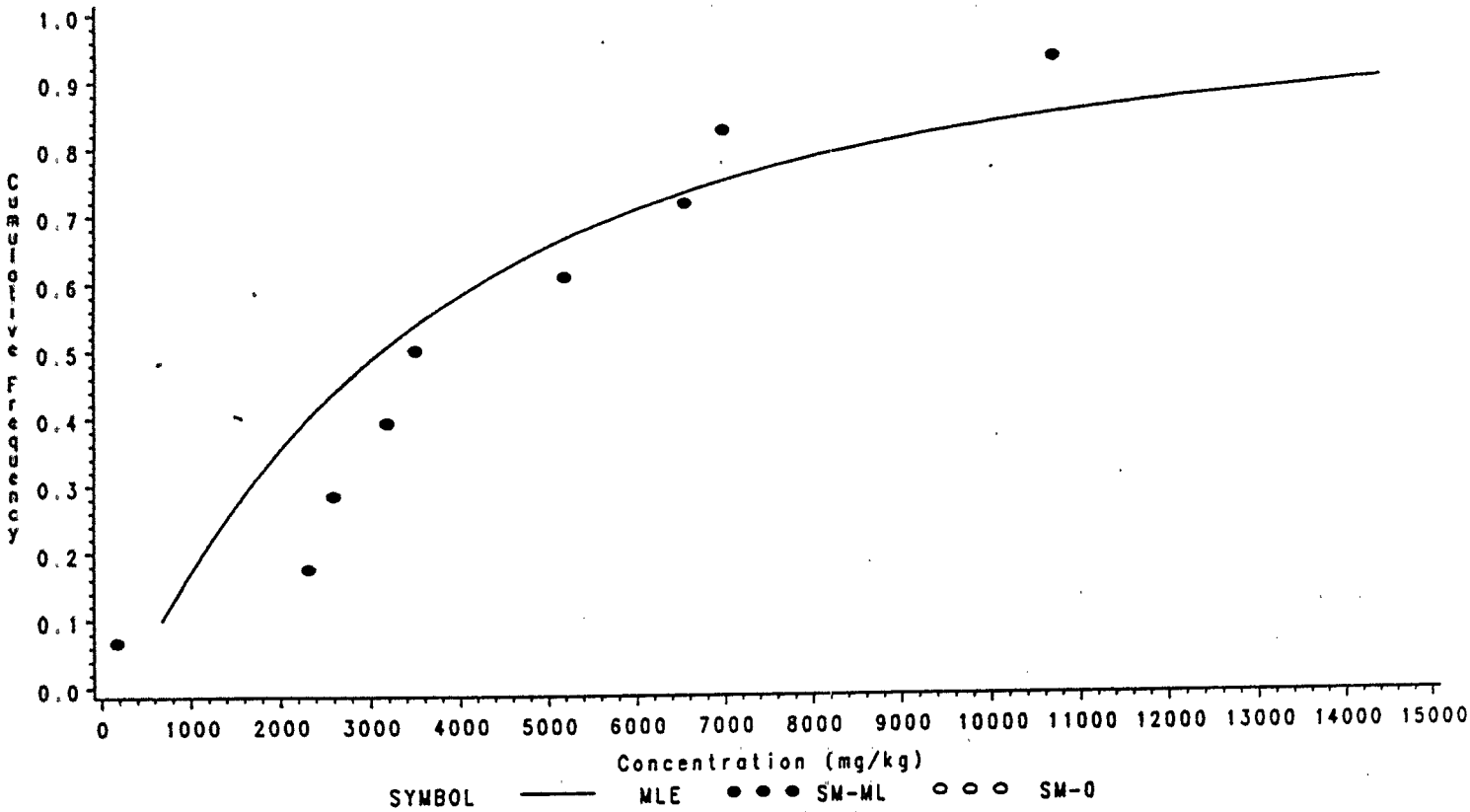

## Cumulative Frequency for Nitrate + Nitrite (mg/kg)



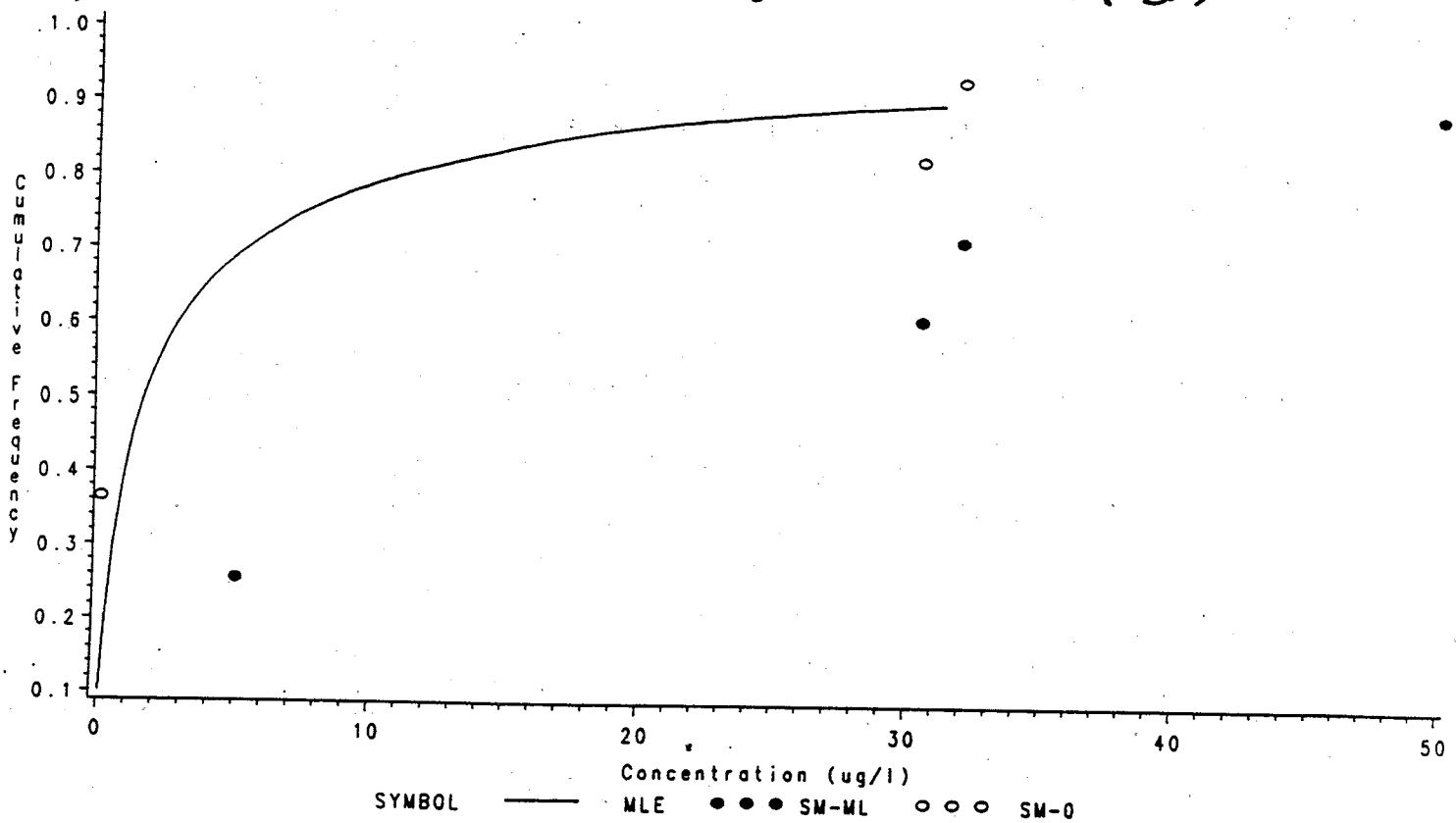
## Cumulative Frequency for Total Phosphorous (mg/l)



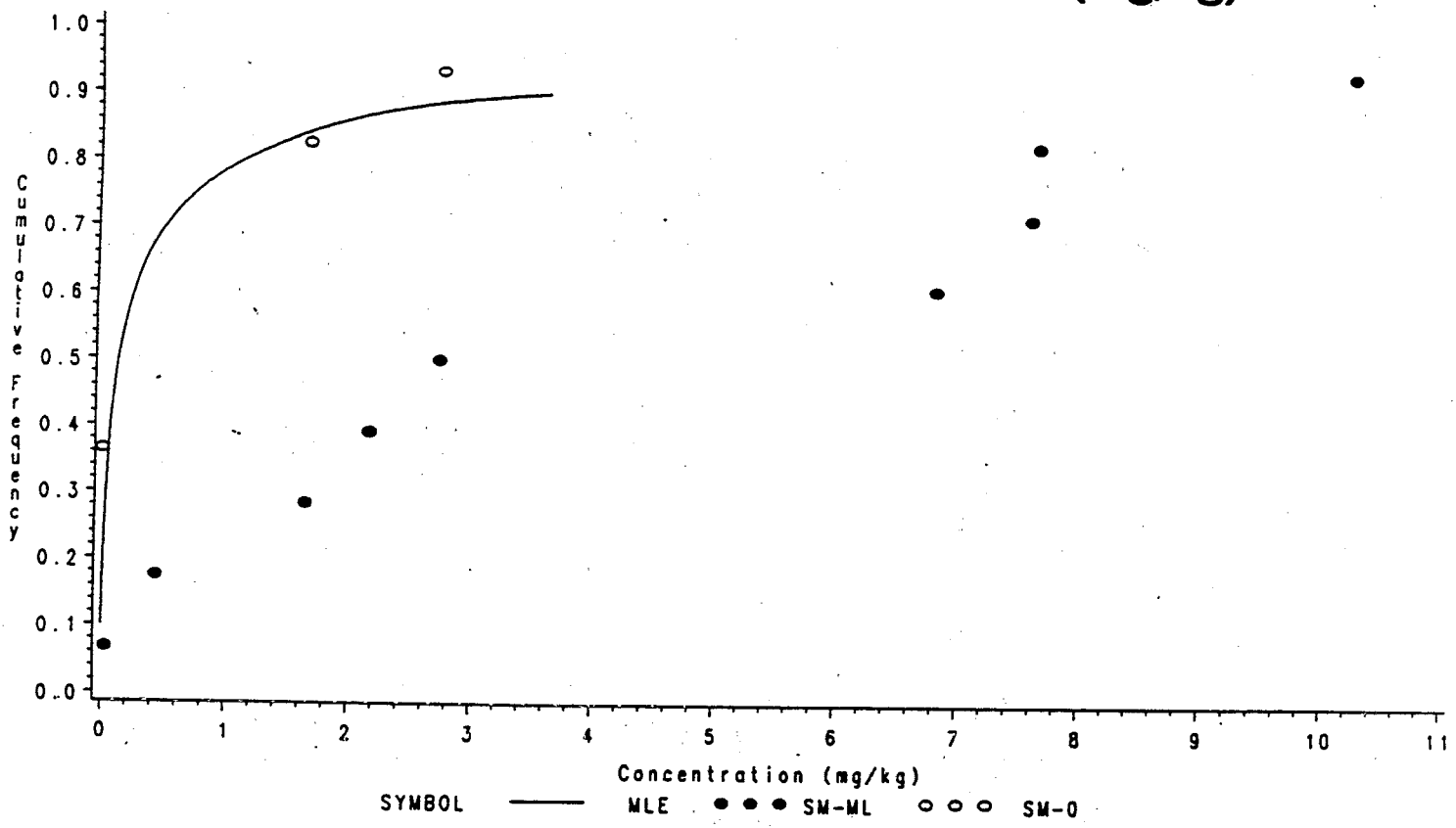

## Cumulative Frequency for Total Phosphorous (mg/kg)



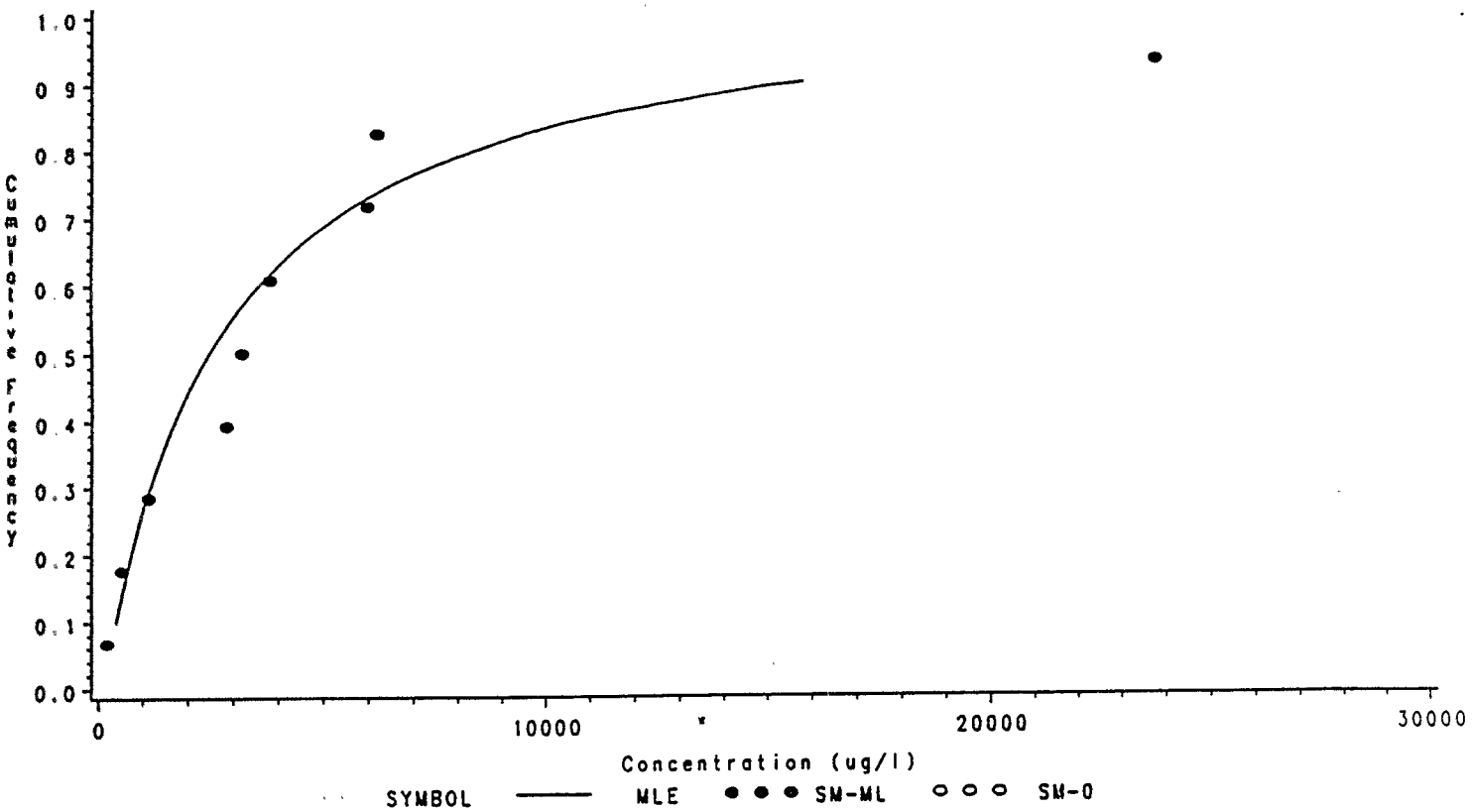
## Cumulative Frequency for Selenium (ug/l)



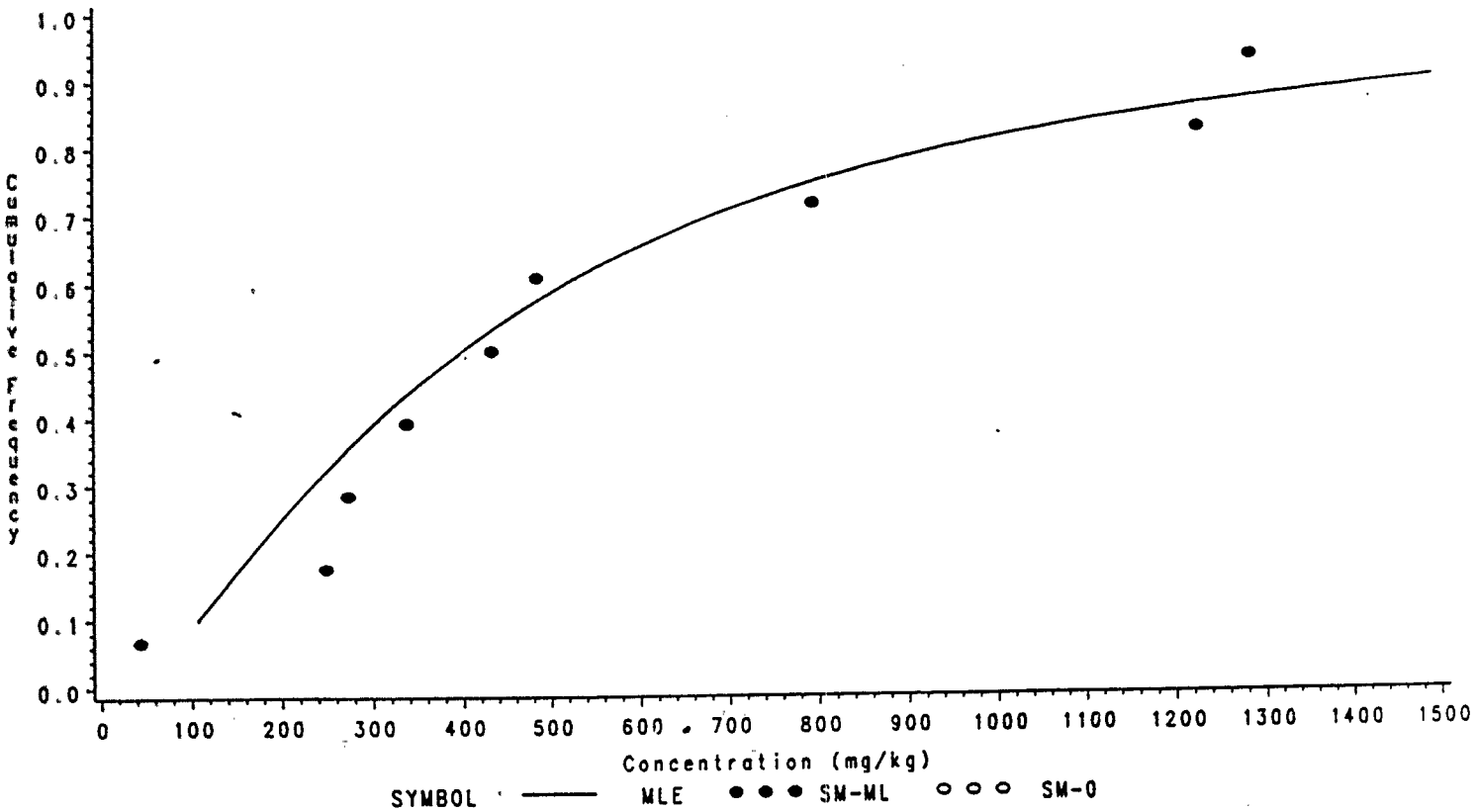

## Cumulative Frequency for Selenium (mg/kg)



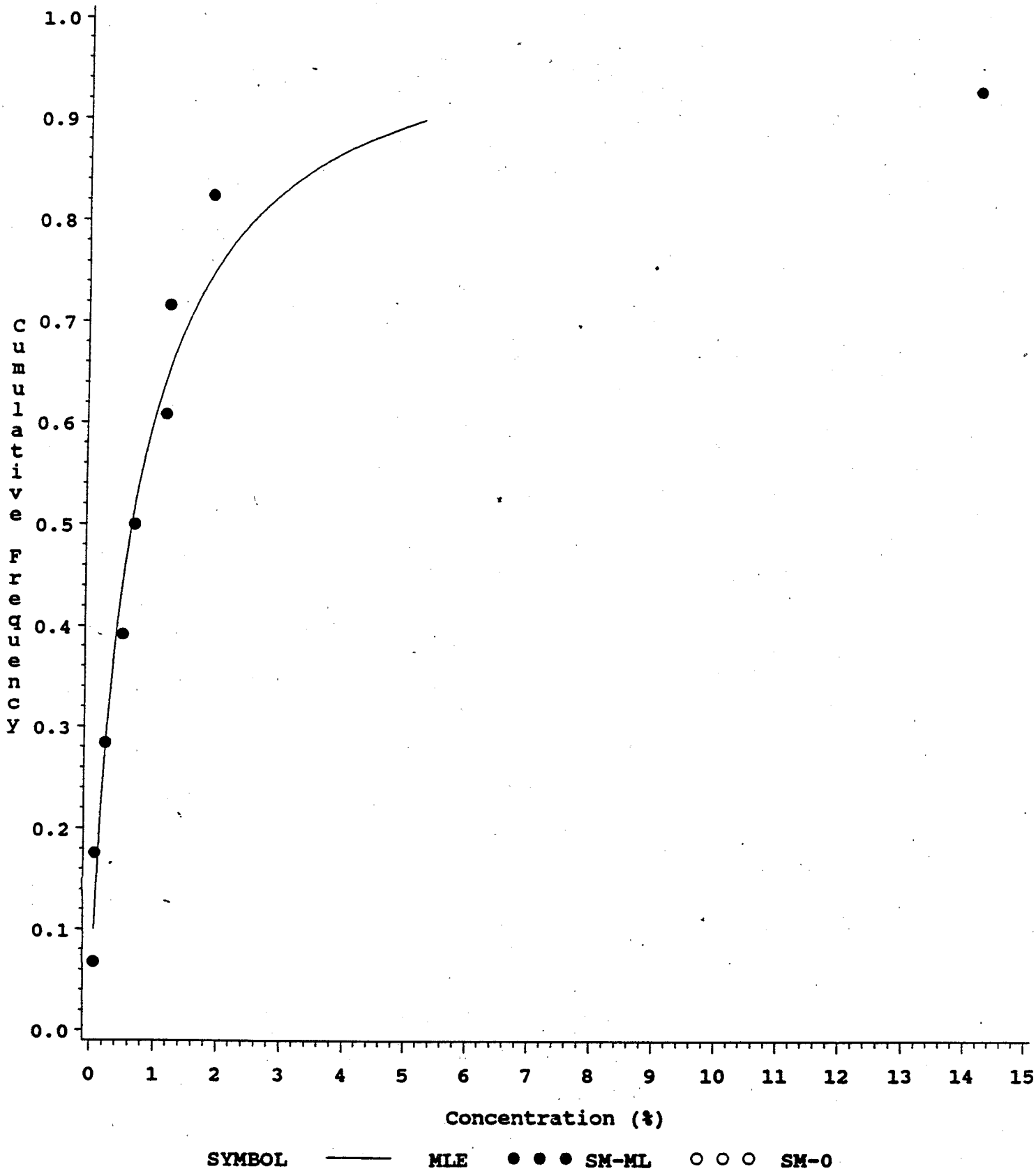
## Cumulative Frequency for Zinc (ug/l)




## Cumulative Frequency for Zinc (mg/kg)



# Cumulative Frequency for Percent Solids (%)



# Appendix C

# Data Listing

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=ALDRIN/DIELDRIN(TOTAL)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.100 | UG/L |
| 19975 | . | 0.100 | UG/L |
| 19976 | . | 0.100 | UG/L |
| 19977 | 2.50 | . | UG/L |
| 19978 | 0.75 | . | UG/L |
| 19979 | . | 0.184 | UG/L |
| 19980 | . | 0.100 | UG/L |
| 19981 | . | 0.100 | UG/L |
| 19982 | . | 0.100 | UG/L |

### Pollutant=ALPHA-CHLORDANE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.100 | UG/L |
| 19975 | . | 0.100 | UG/L |
| 19976 | . | 0.100 | UG/L |
| 19977 | . | 0.100 | UG/L |
| 19978 | . | 0.100 | UG/L |
| 19979 | . | 0.184 | UG/L |
| 19980 | . | 0.100 | UG/L |
| 19981 | . | 0.100 | UG/L |
| 19982 | . | 0.100 | UG/L |

### Pollutant=AMMONIA (AS N)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 45.00 | . | MG/L |
| 19975 | 0.48 | . | MG/L |
| 19976 | 40.00 | . | MG/L |
| 19977 | 11.00 | . | MG/L |
| 19978 | 45.00 | . | MG/L |
| 19979 | 33.00 | . | MG/L |
| 19980 | 56.00 | . | MG/L |
| 19981 | 54.00 | . | MG/L |
| 19982 | 100.00 | . | MG/L |

## Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=ARSENIC ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 20.000 | UG/L |
| 19975 | . | 20.000 | UG/L |
| 19976 | . | 20.000 | UG/L |
| 19977 | . | 20.000 | UG/L |
| 19978 | . | 20.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 20.000 | UG/L |
| 19981 | . | 20.000 | UG/L |
| 19982 | . | 20.000 | UG/L |

---------- Pollutant=BENZENE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

---------- Pollutant=BENZO(A)PYRENE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=BERYLLIUM ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 5.000 | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | . | 5.000 | UG/L |
| 19979 | . | 5.000 | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 5.000 | UG/L |
| 19982 | . | 5.000 | UG/L |

---------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

---------- Pollutant=CADMIUM ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 9.40 | . | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | 6.40 | . | UG/L |
| 19979 | 18.40 | . | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 5.000 | UG/L |
| 19982 | . | 5.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=CHROMIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 53.90 | . | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | 12.10 | . | UG/L |
| 19977 | 32.10 | . | UG/L |
| 19978 | 81.60 | . | UG/L |
| 19979 | 128.00 | . | UG/L |
| 19980 | 33.50 | . | UG/L |
| 19981 | 50.20 | . | UG/L |
| 19982 | 18.70 | . | UG/L |

### Pollutant=COPPER

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 1340.00 | . | UG/L |
| 19975 | 77.10 | . | UG/L |
| 19976 | 80.30 | . | UG/L |
| 19977 | 115.00 | . | UG/L |
| 19978 | 758.00 | . | UG/L |
| 19979 | 174.00 | . | UG/L |
| 19980 | 1850.00 | . | UG/L |
| 19981 | 62.00 | . | UG/L |
| 19982 | 69.60 | . | UG/L |

### Pollutant=DDT,DDE,DDD(TOTAL)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.338 | UG/L |
| 19975 | . | 0.338 | UG/L |
| 19976 | . | 0.338 | UG/L |
| 19977 | . | 0.338 | UG/L |
| 19978 | . | 0.338 | UG/L |
| 19979 | 0.92 | . | UG/L |
| 19980 | 2.88 | . | UG/L |
| 19981 | . | 0.338 | UG/L |
| 19982 | . | 0.338 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=GAMMA-CHLORDANE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.113 | UG/L |
| 19975 | . | 0.113 | UG/L |
| 19976 | . | 0.113 | UG/L |
| 19977 | . | 0.113 | UG/L |
| 19978 | . | 0.113 | UG/L |
| 19979 | . | 0.207 | UG/L |
| 19980 | . | 0.113 | UG/L |
| 19981 | . | 0.113 | UG/L |
| 19982 | . | 0.113 | UG/L |

### Pollutant=HEPTACHLOR

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 0.25 | . | UG/L |
| 19975 | . | 0.063 | UG/L |
| 19976 | . | 0.063 | UG/L |
| 19977 | . | 0.063 | UG/L |
| 19978 | . | 0.063 | UG/L |
| 19979 | . | 0.115 | UG/L |
| 19980 | . | 0.063 | UG/L |
| 19981 | . | 0.063 | UG/L |
| 19982 | . | 0.063 | UG/L |

### Pollutant=HEXACHLOROBENZENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=HEXACHLOROBUTADIENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=LEAD

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 121.00 | . | UG/L |
| 19975 | . | 50.000 | UG/L |
| 19976 | . | 50.000 | UG/L |
| 19977 | . | 50.000 | UG/L |
| 19978 | . | 50.000 | UG/L |
| 19979 | 70.30 | . | UG/L |
| 19980 | 79.30 | . | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | . | 50.000 | UG/L |

### Pollutant=LINDANE(GAMMA-BHC)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.138 | UG/L |
| 19975 | . | 0.138 | UG/L |
| 19976 | . | 0.138 | UG/L |
| 19977 | 0.13 | . | UG/L |
| 19978 | . | 0.138 | UG/L |
| 19979 | . | 0.253 | UG/L |
| 19980 | 0.25 | . | UG/L |
| 19981 | . | 0.138 | UG/L |
| 19982 | . | 0.138 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=MERCURY

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 0.200 | UG/L |
| 19975 | . | 0.200 | UG/L |
| 19976 | . | 0.200 | UG/L |
| 19977 | 0.30 | . | UG/L |
| 19978 | . | 0.200 | UG/L |
| 19979 | 1.30 | . | UG/L |
| 19980 | 0.45 | . | UG/L |
| 19981 | 0.50 | . | UG/L |
| 19982 | 4.05 | . | UG/L |

### Pollutant=MOLYBDENUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 14.40 | . | UG/L |
| 19975 | . | 10.000 | UG/L |
| 19976 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 10.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

### Pollutant=N-NITROSODIMETHYLAMINE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 50.000 | UG/L |
| 19975 | . | 50.000 | UG/L |
| 19976 | . | 50.000 | UG/L |
| 19977 | . | 50.000 | UG/L |
| 19978 | . | 50.000 | UG/L |
| 19979 | . | 100.000 | UG/L |
| 19980 | . | 50.000 | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | . | 50.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=NICKEL

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 40.000 | UG/L |
| 19975 | . | 40.000 | UG/L |
| 19976 | . | 40.000 | UG/L |
| 19977 | 79.80 | . | UG/L |
| 19978 | 61.80 | . | UG/L |
| 19979 | 105.00 | . | UG/L |
| 19980 | 41.90 | . | UG/L |
| 19981 | . | 40.000 | UG/L |
| 19982 | 41.60 | . | UG/L |

### Pollutant=NITRATE+NITRITE (AS N)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 0.20 | . | MG/L |
| 19975 | . | 0.100 | MG/L |
| 19976 | . | 0.100 | MG/L |
| 19977 | 0.90 | . | MG/L |
| 19978 | 0.20 | . | MG/L |
| 19979 | 0.60 | . | MG/L |
| 19980 | 0.60 | . | MG/L |
| 19981 | 0.60 | . | MG/L |
| 19982 | 0.20 | . | MG/L |

### Pollutant=PCB(TOTAL)

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 1.750 | UG/L |
| 19975 | . | 1.750 | UG/L |
| 19976 | . | 1.750 | UG/L |
| 19977 | . | 1.750 | UG/L |
| 19978 | . | 1.750 | UG/L |
| 19979 | . | 3.218 | UG/L |
| 19980 | . | 1.750 | UG/L |
| 19981 | . | 1.750 | UG/L |
| 19982 | . | 1.750 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=SELENIUM

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 50.000 | UG/L |
| 19975 | . | 5.000 | UG/L |
| 19976 | . | 5.000 | UG/L |
| 19977 | . | 5.000 | UG/L |
| 19978 | . | 5.000 | UG/L |
| 19979 | 30.50 | . | UG/L |
| 19980 | . | 5.000 | UG/L |
| 19981 | . | 50.000 | UG/L |
| 19982 | 32.00 | . | UG/L |

### Pollutant=TOTAL KJELDAHL NITROGEN

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 142.00 | . | MG/L |
| 19975 | 9.00 | . | MG/L |
| 19976 | 55.00 | . | MG/L |
| 19977 | 31.00 | . | MG/L |
| 19978 | 70.00 | . | MG/L |
| 19979 | 119.00 | . | MG/L |
| 19980 | 115.00 | . | MG/L |
| 19981 | 175.00 | . | MG/L |
| 19982 | 152.00 | . | MG/L |

### Pollutant=TOTAL PHOSPHOROUS

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 32.00 | . | MG/L |
| 19975 | 1.70 | . | MG/L |
| 19976 | 7.00 | . | MG/L |
| 19977 | 25.00 | . | MG/L |
| 19978 | 12.00 | . | MG/L |
| 19979 | 48.00 | . | MG/L |
| 19980 | 36.00 | . | MG/L |
| 19981 | 46.00 | . | MG/L |
| 19982 | 41.00 | . | MG/L |

## Wet Weight Concentrations of Pollutants in Septage

### Pollutant=TOTAL SOLIDS

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 4880.00 | . | MG/L |
| 19975 | 733.00 | . | MG/L |
| 19976 | 653.00 | . | MG/L |
| 19977 | 142000.00 | . | MG/L |
| 19978 | 2310.00 | . | MG/L |
| 19979 | 18500.00 | . | MG/L |
| 19980 | 11300.00 | . | MG/L |
| 19981 | 6580.00 | . | MG/L |
| 19982 | 11700.00 | . | MG/L |

### Pollutant=TOXAPHENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 11.375 | UG/L |
| 19975 | . | 11.375 | UG/L |
| 19976 | . | 0.910 | UG/L |
| 19977 | . | 11.375 | UG/L |
| 19978 | . | 11.375 | UG/L |
| 19979 | . | 20.920 | UG/L |
| 19980 | . | 11.375 | UG/L |
| 19981 | . | 11.735 | UG/L |
| 19982 | . | 11.375 | UG/L |

### Pollutant=TRICHLOROETHENE

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | . | 10.000 | UG/L |
| 19977 | . | 10.000 | UG/L |
| 19978 | . | 10.000 | UG/L |
| 19979 | . | 20.000 | UG/L |
| 19980 | . | 10.000 | UG/L |
| 19981 | . | 10.000 | UG/L |
| 19982 | . | 10.000 | UG/L |

## Wet Weight Concentrations of Pollutants in Septage

---------- Pollutant=ZINC ----------

| EPA Sample Number | Quantified Amount | Minimum Level | Units |
|---|---|---|---|
| 19974 | 5990.00 | . | UG/L |
| 19975 | 182.00 | . | UG/L |
| 19976 | 519.00 | . | UG/L |
| 19977 | 6210.00 | . | UG/L |
| 19978 | 1120.00 | . | UG/L |
| 19979 | 23800.00 | . | UG/L |
| 19980 | 3810.00 | . | UG/L |
| 19981 | 2850.00 | . | UG/L |
| 19982 | 3190.00 | . | UG/L |

# APPENDIX L

## Calculation of the Amount of Sewage Sludge Used or Disposed for the Part 503 Frequency of Monitoring Requirements

# CALCULATION OF THE AMOUNT OF SEWAGE SLUDGE USED OR DISPOSED FOR THE PART 503 FREQUENCY OF MONITORING REQUIREMENTS

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November 23, 1992

# CALCULATION OF THE AMOUNT OF SEWAGE SLUDGE USED OR DISPOSED FOR THE PART 503 FREQUENCY OF MONITORING REQUIREMENTS

## INTRODUCTION

The Standards for the Use or Disposal of Sewage Sludge in 40 CFR Part 503 contain frequency of monitoring requirements for land application of sewage sludge, placement of sewage sludge on a surface disposal site, and firing of sewage sludge in a sewage sludge incinerator. These requirements indicate how often sewage sludge has to be monitored for pollutant concentrations, pathogen densities, and vector attraction reduction. They are based on the amount of sewage sludge used or disposed during a 365 day period.

For land application, the frequency of monitoring requirements are based either on the amount of bulk sewage sludge applied to the land or the amount of sewage sludge received by a person who prepares the sewage sludge for sale or give away in a bag or similar enclosure for application to the land. As those amounts increase, the frequency of monitoring increases.

For surface disposal and firing of sewage sludge in a sewage sludge incinerator, the frequency of monitoring requirements are based on the amount of sewage sludge placed on a surface disposal site and the amount of sewage sludge fired in a sewage sludge incinerator, respectively. For these two practices, the frequency of monitoring also increases as the amount of sewage sludge used or disposed increases.

This document discusses calculation of the amounts of sewage sludge used or disposed for the Part 503 frequency of monitoring requirements. The assumptions on which those requirements are based and the calculations for the amounts used or disposed are presented below. Also presented below are the Part 503 frequency of monitoring requirements.

## ASSUMPTIONS

- Wastewater is treated in "typical" secondary wastewater treatment plant (i.e., primary settling followed by biological treatment followed by secondary settling).
- Sewage sludge is stabilized in an anaerobic digester prior to use or disposal.
- Influent wastewater BOD5 concentration = 200 mg/l.
- Effluent wastewater BOD5 concentration = 30 mg/l.
- Influent wastewater TSS concentration = 200 mg/l.
- Effluent wastewater TSS concentration = 30 mg/l.

- TSS percent removal in primary treatment process = 60.
- Percent volatile solids in the influent to digester = 60.
- Percent volatile solids reduction in digester = 38.
- Percent fixed solids in the influent to digester = 40
- Solids concentration factor during secondary settling = 0.9

**CALCULATIONS FOR TREATMENT WORKS WITH A FLOW RATE OF ONE MGD**

- TSS removal in primary treatment process:

Influent TSS x Flow rate x Conversion factor x Percent removal

200 mg/l x 1 MGD x 8.34 x 0.6 = 1,000 pounds per day.

- BOD5 removal through secondary settling process:

Influent BOD5 - Effluent BOD5 = 200 - 30 = 170 mg/l

Concentration removed x Flow rate x Conv. fact. x Conc. fact.

170 mg/l x 1 MGD x 8.34 x 0.9 = 1,276 pounds per day.

- Sewage sludge to the digester:

Primary settling sludge + secondary settling sludge = total

1,000 + 1,276 = 2,276 pounds per day.

- Amount of sewage sludge used or disposed:

Fixed solids = total amount x percent of total solids.

Fixed solids = 2,276 x 0.4 = 910 pounds per day.

Volatile solids = total amount x percent of total solids x percent remaining after digestion.

Volatile solids = 2,276 x 0.6 x (1.0 - 0.38) = 847 pounds/day

Total amount used or disposed = Fixed solids + volatile solids

910 + 847 = 1,757 pounds per day

$$\text{Total amount} = 1{,}757 \frac{\text{pounds}}{\text{days}} \times 365 \frac{\text{days}}{\text{year}} \times 1 \frac{\text{metric ton}}{2{,}200 \text{ pounds}}$$

Total amount for 1 MGD = 292 metric tons per year.

Report amount in two significant figures:

Use 290 metric tons per year for 1 MGD treatment works (dry weight basis)

**CALCULATION FOR A TREATMENT WORKS WITH A FLOW RATE OF FIVE MGD**

Total amount = Amount for 1 MGD treatment works times 5

Total amount = 290 x 5 = 1,450 metric tons per year

Report amount in two significant figures:

Use 1,500 metric tons per year for five MGD treatment works (dry weight basis)

**CALCULATION FOR A TREATMENT WORKS WITH A FLOW RATE OF 50 MGD**

Total amount = Amount for 1 MGD treatment works x 50

Total amount = 290 x 50 = 14,500 metric tons per year

Report amount in two significant figures:

Use 15,000 metric tons per year for 50 MGD treatment works (dry weight basis)

**PART 503 FREQUENCY OF MONITORING REQUIREMENTS**

Results of the above calculations were used as the basis for the frequency of monitoring requirements in Part 503. Those frequencies are presented below.

**FREQUENCY OF MONITORING**

| Amount of sewage sludge used or disposed (metric tons per 365 day period-dry weight) | Frequency |
|---|---|
| Greater than zero but less than 290 | once per year |
| Equal to or greater than 290 but less than 1,500 | once per quarter (four times per year) |
| Equal to or greater than 1,500 but less than 15,000 | once per 60 days (six time per year) |
| Equal to or greater than 15,000 | once per month (12 times per year) |