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Review Report, "Hypoxia in the Northern Gulf of Mexico: An Update by the EPA Science Advisory Board"

The report is comprehensive and exhaustive in its coverage of the hypoxia problem and recommendations for reducing the impacted area in the Northern Gulf of Mexico. In reading this report, I think that it would make an excellent "text" for an inter-disciplinary course on water quality and land use, with particular emphasis on agricultural issues related to N and P. I offer the following specific comments for consideration by the committee.

Pages 98-99:
Recommendation: "Sustainability of soils in the MARB must be fully addressed by measurement of changes in soil N pools as a result of new management systems….N mass balances."
Comment: No new management system is recommended, nor is research recommended to develop new management systems. Research on changes in soil N pools will definitely increase the understanding of N transformations and loss. I would propose that research with changes in N pools associated with different tillage systems, especially those that increase surface residue, and reduce fuel and machinery cost while increasing soil organic matter, would be most useful.

Page 134:
Topic: "nutrient management is more cost-effective at low levels of N loss reduction"
Comment: Nutrient management needs to be defined in this context. Is it a comprehensive plan that is verified for implementation, or is this discussion referring to the writing of nutrient management plans, and then assuming in a model that a certain reduction has occurred?

Page 135:
Topic: Increased enrollment in CRP reduces nitrate flux at a cost of xxx dollars
Comment: Is this cost only the cost of program payments and reduction in crop subsidy? Past programs that have taken large amounts of land out of production have resulted in major economic losses to towns in certain regions, and such costs are real to those communities. While there is no doubt that putting land in properly managed CRP reduces sediment and nutrient losses, clarification of what is included in these costs will help readers determine if this is a viable strategy for all areas, or just some areas.
Page 135 and 137:
Topic: Fertilizer tax discussion
Comment: There is no mention of how any type of fertilizer tax would affect our place in global markets and the WTO. We are importing large amounts of fertilizer N, probably over 50% of total N needs, and we have had anti-dumping tariffs on Russian and Ukraine produced ammonium nitrate and urea for the past several years. Some comment as to the

implications of taxing nutrients, especially imported nutrients, on our (U.S.) trade policy is warranted, even if there would be no effect.

Page 138:
Topic: "transition from corn to perennial crops could benefit farmers."
Comment: I agree with the premise, but some support is needed, especially in a section dealing with social welfare. In fact, if the benefits to farmers were really great, we would see a conversion happening, as opposed to the transition that has occurred from more complex rotations in the past to the current corn-soybean system. Please comment on possible benefits to farmers.

Pages 151-152:
Topic: Discussion of taxes on nutrients.
Comment: Would nutrients in manures and legumes (net N fixation) also be taxed to change behavior? Not certain that legume N should be taxed, but N and P in manure has been a major environmental problem in localized areas, and should be considered for taxation if it is felt that taxing fertilizer might change behavior.

Page 156:
Topic: Ag drainage and bio-reactors
Comment: No mention is made of costs associated with controlling losses prior to getting into the tile. Such costs are needed in order to compare the cost of the bio-reactors to better nutrient management, if it is possible. This is an interesting technology and deserves discussion, but is it potentially cost effective compared to preventing losses to the tile.

Page 169:
Topic: Changing cropping systems to include more perennials
Comment: Nutrient pollution reduction with increased perennials in the cropping system is a clear concept. However, equipment and labor considerations to bring more perennials, and generally more livestock, into the farming system need to be investigated for economic viability. Also, what types of policies and incentives will be needed to make this happen. There are reasons why fewer farms have livestock and associated perennials today than 50 years ago, and these reasons need to be assessed under our current economic conditions.

Page 174:
Topic: "reducing surface runoff losses of P via conservation tillage can enhance nitrate leaching."
Comment: While this is true in some cases, I do not think that such a broad general statement can be made. In particular, where no-till, especially continuous no-till, or conservation tillage is resulting in increases in soil organic matter, then N will be sequestered in the organic matter. At some point, the system will reach equilibrium, but during the buildup period of soil organic matter, leaching may not be increased. With the major benefits of reduced sediment and P loss with no-tillage and strip tillage, the

statement in the document should not leave the impression that nitrate leaching is always increased with conservation or no-tillage.

Page 175:
Topic: Line 25 “energy rich” referring to ash.
Comment: Should this be “P rich ash”?

Page 176:
Topic: “Increases in N fertilizer prices” and thus increased value of manure will create more opportunities for moving manure.
Comment: The increased cost of diesel fuel to haul manure has offset much of the increased value of the nutrients. Also, increased energy costs for processing manure will also offset increased nutrient values to some extent, and this will vary with region and local situations.

Page 178-182:
Topic: “Nitrogen application timing”
Comment: Much discussion is given to fall versus spring N applications, and justifiably so, given the large amounts of fall N applications and losses associated with these applications. However, more discussion should focus on split N applications for at-planting versus side-dress applications as the system is moving to more UAN solution and urea fertilizers that offer more flexibility than anhydrous.

Page 181, line 6: 1.2 to 1.8 cm not mm

Page 181:
Comment: Tile drained lands are wetter in spring and thus make spring anhydrous application difficult, especially when trying to complete timely planting. These lands may be most amendable to a split at-planting and side-dress application, although growers have great concern about being able to make the side-dress N application. Some discussion of these factors by individuals from the area would be helpful, and I think address grower and dealer concerns about how to make the change from fall applied anhydrous to spring and summer applications.

Page 183:
Line 9: “yield response to N on a site- and season-specific basis”

Page 183:
Line 27: Sawyer and Randall reference is 2005 in the text but 2007 in the reference list.

Page 184:
Line 12: I agree that high yields are necessary for efficient use of all resources. Thus, I think that some reference should be made for the need to have total crop production

systems with proper genetic selection, plant populations, and pest control in conjunction with "balanced fertilization" to optimize nutrient use at each specific site.

Page 185:
Line 29: Karlen et al. 2005 is not in the reference list. The statement being supported by this reference is very interesting, and I wanted to check the reference. I am not certain what is meant by "it could also increase grower risk, especially when above-normal rainfall occurs shortly after the side-dress N is applied." Is the implication that the side-dress N could be moved directly into tile drains? Please clarify because in most situations I would expect heavy rain to move side-dress N downward, and possibly increase denitrification losses if soils are saturated. But given high evapotranspiration at side-dress time and rapid corn growth, I would expect greater losses from all preplant applications of N in tile-drained fields simply because more N is being applied earlier in the season. However, I can understand the direct movement into the tile drains in soils with good structure and macropores, but the implication that losses could be greater with side-dress split applications is not what I would expect.

Page 185:
Comment: Paragraph is devoted to "controlled release fertilizers" which is very appropriate. However, a paragraph should also be given to "stabilized" fertilizers, i.e. nitrification inhibitors and urease inhibitors, especially with the increase in urea and UAN use in the region.

Page 186:
Lines 2-10: Very good discussion.

Page 186:
Lines 12-29: There is no mention of tillage in this paragraph. This is a very important discussion and given the discussion in the previous paragraph, I think that the tillage method(s) used in the study discussed should be given. Also, was the tillage method used in the study representative of broad areas in crop production.

Page 189:
Comment: Lines 13-14: "The effects of tillage are not clear" More discussion is needed on this point. In many climates, continuous no-till clearly increases soil organic matter. However, in colder climates with high soil organic matter levels naturally, this may not be the case. The authors might clarify if this is what is being implied, especially in the northern part of the Mississippi River basin. This paragraph is very important and I think adding more discussion of tillage systems and N fertilizer influence on soil organic matter within different types of tillage could increase the value of this section.

Page 190:
Comment: Lines 16-26: The discussion of technology costs, economic returns, and cost-share programs is very important to this section on precision agriculture. However, changes in fertilizer prices have been so rapid this past year, i.e. from $0.30 / lb of N to $0.45 to $0.50 per pound of N, the cost benefit ratio has changed, and some of the

technologies are more cost effective than this discussion might lead readers to believe. Possibly should update with current prices for N and for technology.

However, the major point that I suggest needs to be added to this section concerns the grower's perception of paying for technology to get the N rate "optimized" at each location in the field. From a research and environmental standpoint, getting the rate "optimized" reduces potential N loss (good for the environment) and minimizes cost of N fertilizer. However, growers understand that N is required for corn to grow well and produce economic yields. Growers generally know that the amount needed in various fields is different, and even within fields, the optimum amount differs. So the question for the grower is, "do I spend money for technology to optimize the rate (without a guarantee), or do I spend money for N fertilizer?" The point is that paying for the technology increases grower risk, as opposed to purchasing fertilizer N with the same amount of money per acre. This is one of the reasons for the reluctance to adopt some of these technologies.

The other part of this discussion about optimum rates is that the cost of being wrong with regard to N rate, is greater than ever in today's environment. Over fertilization costs are greater due to the high cost of N. However, under fertilization with yield loss is greater because of the higher value of the grain. Thus, there are incentives to optimize rates, and with decreased technology costs, I think that some of these precision tools may be more widely used if grain prices stay and high and N fertilizer prices remain high.

The preceding paragraph may or may not be useful for this publication, but I simply offer it as some reflections on working with growers and students to develop efficient production programs.

Page 192
Comment: There is no discussion of the need to update soil test P calibrations. I have seen Antonio Mallarino's work in Iowa updating P soil test calibrations, but I am not certain if similar work has been done in other states in the basin. If not, then it is a need to get the calibrations and recommendations up to date for optimizing P fertilization.

Page 194
Comment: Are the variable rate manure applications being done because of "permit" limitations for livestock operations, i.e. continue to apply P on land close to facility, as opposed to optimizing the use of the nutrients for increasing crop yields?

Page 194
Comment: Lines 19-22: This sentence deserves a paragraph in order to increase the emphasis. Many nutrient management plans have been written but not implemented and/or updated. This is very important and should be a stand alone paragraph with suggestions as to how plan implementation can be increased! I would share suggestions if I had any really good ideas on this!

Page 195-196
Comments: Recommendations are good. However, no mention is made of need for considering the influence of tillage systems on optimizing N rates, and fuel and machinery costs are causing major changes in tillage systems.

Discussion of adoption of conservation practices (page 196) – I suggest that it is important to consider that "costs" are viewed differently by different growers, and the views of costs depend on labor availability, farm organization and financial situation, as well as interest in technology. Thus adoption of conservation practices, as well as other technologies, will always be a very individual situation, unless the cost:benefit ratio is overwhelming to move to the new technology. For example, the benefits of using "Roundup-Ready" soybeans were so great, that adoption occurred rapidly, even with technology fees. We do not have such examples for nutrient management and fertilizer use, but we need to look for those targets (as the authors have mentioned in other sections) for the greatest benefits.

Page 201
Comments: Line 18: Please check this number. I do not believe that we currently can project that 70% of all domestic corn production will be used for ethanol. For example, wheat prices are currently "buying" acres that will come from corn in the southeast and western reaches of the corn belt. Perhaps the study cited concludes that 70% is the correct number, but it seems high to me.

Page 207
Comment: Line 27-28: "requires greater conservation, more no-till production and increased use of cover crops."

Page 208
Comment: Lines 15-17: Even with 2 year planting incentives, until processing plants develop a market, i.e. establish prices, for switchgrass, it is a very poor business decision for growers to plant this crop on more than just a few acres to learn production techniques. Since the fermentation processes are not commercialized at this point, there is a lot of uncertainty around this crop.