Turf Grass and Nitrogen Fertilization in the USA

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Turf grasses cover 31-40 million acres across the continental USA (Milesi et al. 2005). The area under turf grass is roughly the size of the New England states and occupies an area up to three times larger than that of irrigated corn (The Lawn Institute). The majority of this turf area (~75%) is in residential lawns. About 80% of all U.S. households have private lawns (Templeton et al. 1998) that average 1/5 of an acre in size (Vinlove and Torla, 1995). Another ~15 % of total turf grass area is in low maintenance parks and ~ 10% is in athletic fields and golf courses.

Nitrogen fertilization is required to maintain healthy and aesthetically pleasing turf color, high shoot density and the ability to resist and recover from stress and damage. Nitrogen fertilizer may be derived from atmospheric deposition and decomposition of soil and grass clipping organic matter. As these inputs are not generally sufficient to maintain lawns of adequate quality, supplemental N fertilization is required. Turf grass is maintained under a variety of conditions. Approximately 50% of all turf grass is not fertilized while the remainder is fertilized at varied intensities (Petrovic, personnel communication—June 5 2007). We have arrayed the different turf managements into three groups according to the estimated amount of N-fertilizer applied annually (Table 1), residential lawns maintained by homeowners (1.5 lbs/1000 ft^2), residential lawns cared for by professional lawn care companies (6 (4 to 10) lbs/1000 ft^2), and athletic fields and golf courses (8 (4-10) lbs/1000 ft^2). The estimate of total N-fertilizer used on turf grass in the USA is 2442 million pounds/year, or 9% of the total average annual N-fertilizer used between 1999 and 2005.

This fertilizer N is susceptible to loss to the atmosphere, and surface and ground water when it is not properly managed. Research in lawns has shown that leaching of nitrate can range between 0 and 50% of N applied. If fertilizer is not applied when grass is dormant or applied in large amounts soon before irrigation or large rainfall events then leaching and runoff will be minimal (Mangiafico and Guillard, 2006). N runoff losses are poorly quantified but a range of loss similar to leaching is probable (Petrovic, personnel communication). The chemical form of fertilizer N does not impact leaching/runoff unless it is applied in late autumn (Petrovic, 2004). Shuman (2002) notes that runoff can be limited by applying minimum amounts of irrigation following fertilizer application and avoiding application before intense rain or when soil is wet. Volatile losses of ammonia can be significant when urea is applied. Measured denitrification losses are usually small, but depend upon timing of N application relative to soil water status, irrigation and temperature. Typically 25% of N applied is not accounted for in runoff, leaching, and uptake/removal, or soil sequestration (Petrovic, personnel communication), which suggests that volatilization and denitrification are important loss vectors.

Under fertilization can lead to reduced grass stand and weed encroachment which results in more leaching and runoff N losses than from well managed lawns (Petrovic, 2004;

Petrovic and Larsson-Kovach, 1996). When properly managed, turf grass provides a variety of services that include decreasing runoff, sequestering carbon dioxide and providing a comfortable environment in which to live.

Table 1. Estimate of Fertilizer N used on Turf grass in the USA in the year 2000, based on a total area of 31 million acres.

Type of Turf Fertilized	Area (Million Acres)	N Rate (lb/acre)*	Total N Used Million lbs
Nominal Fertilization	11.625	65.37	759.93
Professional Lawn Care	2.3	261.5 (174-436)	601.38
High Maintenance Areas (golf/sports)	3.1	348.6	1080.7

* 43,578 ft^2/acre, used values of 1.5, 6 and 8 lbs N/1000 ft^2
In recent years, about 11Tg of fertilizer N /year was used in the US. The above numbers convert to 1.1 Tg/year of N being used on turf (roughly 10% of US Total)

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