

## **PHOSPHORUS FATE AND USE IN TURFGRASS**

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### **Introduction**

Efforts to improve water quality in streams and lakes throughout Michigan to meet federally mandated total maximum daily loads (TMDL) for nutrients and pollutants has drawn attention to phosphorus applications to turfgrass and their potential to contaminate water bodies. TMDL is defined as the amount of a given substance or pollutant that can be allowed to enter a body of water, like a stream or river, without causing that body of water to exceed its water quality standards. Several local ordinances restricting phosphorus use in Michigan have already been enacted already but with the recent passage of a state-wide phosphorus bill in Minnesota, the focus on phosphorus fertilization of turfgrass has gained increased attention. The legislature in the state of Minnesota recently passed the Phosphorus Fertilizer Bill that bans phosphorus applications to all established turf areas, with the exception of golf courses, unless there is a soil test that indicates a phosphorus application is necessary. The law will come into effect on Jan. 1, 2004 for the seven county Twin Cities metro area.

### **Research on Phosphorus Fate**

Phosphorus has low water solubility and limited leaching potential in most turf systems, with the exception being sand based rootzones. Certainly phosphorus leaching is only one concern related to phosphorus fertilizer applications as runoff losses are often implicated as a potential source of phosphorus contamination of surface water bodies. Research by Kussow (2000) indicated that phosphorus runoff losses from a 5.5% slope averaged 0.30 lb./acre/year and that 81% of the phosphorus collected was during time periods when the soil was frozen. Kussow (2000) stated in the article that, "For all practical purposes, there was no relationship between runoff losses of P and the rates of fertilizer phosphate applied." Research conducted by Shuman (2002) investigated runoff from a 5% slope when phosphorus was applied at 5 and 10 lb. P/acre. The research found that the total amount of phosphorus transported from all runoff events was approximately 14% of that applied (Shuman, 2002).

### **Phosphorus Applications to Turfgrass**

The turfgrass industry is a wide-ranging industry with many different specializations including golf, athletic fields, home lawns, and sod production. For the purpose of this discussion, generalizations of phosphorus applications to home lawns will be discussed. Using the Scotts 4-Step program as a general model for the amount of phosphorus applied to a typical home lawn there would be 8.7 lbs. P/acre applied. When the "Triple Products" are considered, those products having a N:P<sub>2</sub>O<sub>5</sub> ratio of 1:1, the amount of phosphorus applied is much greater. A single 1 lb. N/1000 ft.<sup>2</sup> application of a 16-16-16 product delivers approximately 19 lbs. P/acre, greater than 2 times the amount of phosphorus applied from the 4-Step program. Continuing education efforts to reduce the use of these "Triple Products" would certainly help reduce the amount of phosphorus applied to home lawns.

## **Phosphorus Soil Test Results in South East Michigan**

Dr. Darryl Warncke, director of the soil testing lab here at MSU, and Jon Dahl, manager of the lab, recently analyzed a sub-sample of home lawn soil tests from south east Michigan, including the counties of Oakland, Macomb, and Wayne. There were 500 soil samples submitted from 2000-2001 and approximately 74% of these samples tested high for phosphorus and would require no phosphorus applications. Of the remaining samples, 24% tested medium and only 2% tested low for phosphorus. One could therefore conclude that at least in this portion of Michigan that the majority of home lawn sites do not need any supplemental phosphorus applications. These results also reflect the importance of soil testing for making fertilizer recommendations to turfgrass.

## **Changes to MSU Phosphorus Recommendations**

As a result of a recent meeting to discuss phosphorus recommendations for turfgrass in Michigan and after analyzing phosphorus research conducted by Dr. Paul Rieke, changes to the recommendations used by the MSU soil testing lab have been made. To view a part of the research that was used to alter the recommendations please see the “Turfgrass Soil Management Research Report – 1997” contained in the Michigan Turfgrass Conference Proceedings, Vol. 27, p. 27-28. The changes to the recommendations are presented in Table 1.

## **Future Phosphorus Research at MSU**

Data on phosphorus leaching from mature turf stands growing in native soils is generally lacking. Data that would indicate the propensity for phosphorus to leach from established turf sites that have high phosphorus levels is critical and will provide scientific rigor to the expanding debate of phosphorus use and fate in turfgrass. In cooperation with the Long Term N Fate research project that is being conducted at MSU, we will begin measuring the leaching potential of phosphorus through monolith lysimeters in 2003. The research objective is to determine the fate of phosphorus in a turfgrass stand that soil tests indicate has adequate phosphorus levels.

Phosphorus from triple superphosphate (20% P) will be applied at two rates, 1 and 2 lbs.  $P_2O_5/1000\text{ ft.}^2/\text{year}$  split over two applications (0.5 and 1.0 lbs.  $P_2O_5/1000\text{ ft.}^2$  per application). The phosphorus application dates will be May 1 and September 1.

The results should shed further light on the fate of phosphorus in turfgrass systems. The impact of phosphorus applications to a turf grown on soils testing medium for phosphorus level will be quantified in terms of phosphorus levels by soil depth and leachate monitoring.

## **Literature Cited**

Kussow, W.R. 2000. Six-Year nitrogen leaching and runoff study on residential turf. Mich. Turfgrass Conf. Proc. 29:84-86.

Shuman, L.M. 2002. Phosphorus and nitrate nitrogen in runoff following fertilizer application to turfgrass. J. Environ. Qual. 31:1710-1715.

Table 1. Soil test values and previous and current phosphorus recommendations (lbs. P<sub>2</sub>O<sub>5</sub>/1000 ft.<sup>2</sup>) for turfgrass in Michigan.

Soil Test Value (lbs. P/Acre)	Previous recommendation for lawns, general grounds, golf course fairways	Current recommendation for lawns, general grounds, golf course fairways	Previous recommendation for mature sand rootzones	New recommendation for mature sand rootzones	Recommendation for establishment
10 or less	3	2	4	3	4
11 – 15	3	2	3.5	3	3.5
16 – 20	2.5	1.5	3.5	2.5	3.5
21 – 25	2	1	3	2	3
26 – 30	1	0.5	3	1	3
31 – 35	0.5	0	2.5	0.5	2.5
36 – 40	0.5	0	2	0.5	2
41 – 45	0	0	1.5	0	1.5
46 – 50	0	0	1	0	1
51 – 55	0	0	1	0	1
56 – 60	0	0	0.5	0	0.5
61 – 66	0	0	0.5	0	0.5
66 – 70	0	0	0	0	0