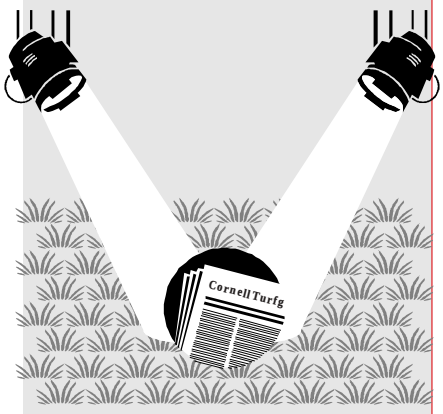
CUTT

Can Soil Tests Predict Phosphorus Runoff Losses?

Program Spotlight

Areas of the Midwest have enacted laws and ordinances banning the application of phosphorus to home lawns without a soil test showing the need for the nutrient; New York State has considered similar legislation.

The use of soil testing to limit phosphorus fertilization will not necessarily reduce the environmental impact of the site for the range of soil phosphorus values found in this study.



In many freshwater systems, excessive inputs of phosphorus (P) lead to an increase in the occurrence of algal blooms which harms the body of water in many ways. Oxygen is removed from the water, killing fish; drinking water quality deteriorates; and the lake or river's recreational value is compromised.

Phosphorus is transported to bodies of water during spring snow melt and rainstorms through runoff. Runoff from areas of bare soil (agricultural land and construction sites) can transport significant amounts of soil to surface water. Because P is relatively immobile and tends to accumulate in the upper soil profile, the P lost from these areas is proportional to the amount of soil test P. In agricultural settings, best management practices for meeting water quality goals include maintaining soil P at levels that meet crop needs but below certain environmental thresholds.

Recently, attention has been turned to reducing P losses from urban settings as a way to improve the quality of our lakes, streams and rivers. Although P losses from turfgrass areas have been found to be relatively low compared to agricultural sources, turfgrass areas represent a significant and ever-increasing fraction of land in most watersheds and are subsequently a potentially important source of P in urban runoff.

Areas of the Midwest have enacted laws and ordinances banning the application of P to home lawns without a soil test showing the need for the nutrient, and New York State has considered similar legislation. All prior lawn P fertilizer bans have allowed P applications during the first year of establishment or with a soil test demonstrating need. These exceptions are based on two suppositions: first, the source of the P lost from turfgrass is mainly from the fertilizer particle or the P in the soil, neglecting any losses of P from the turfgrass tissue or thatch layer; and secondly, that the agronomic need for P is somehow related to an environmental soil P threshold. We know from previous research that environmental thresholds for agricultural soils are commonly 2-3 times greater than the soil test P level required to meet plant needs.

The Cornell Study

During fall 2003, a study conducted at the Cornell University Turf and Landscape Research Center examined the relationship between soil P and runoff P from turfgrass. A previous study examining the effect of various fertilizer applications on runoff created an area with a wide range of soil P levels. Runoff was caused using a rainfall simulator and a runoff sample was collected and analyzed for dissolved P content. Sod was stripped from each plot and runoff was again forced and collected from the bare soil. On each plot, the soil was sampled, and soil P analyzed (based on the Morgan soil test extraction method, the standard procedure in New York at the Cornell Soil Testing Laboratory).

Table 1 shows the results of the experiment. We observed similar concentrations of P in runoff from turfgrass and bare soil. However, when the sod was stripped the infiltration rate decreased by a factor of 3, resulting in a lower P loss (load) from the turfgrassed areas. The P load is calculated by multiplying the concentration of P in the runoff by the total amount of runoff. Phosphorus loads can be used to assess the environmental impact of a site. In this case, the turf area reduced the environmental impact compared to bare soil by reducing the amount of runoff produced.

In this study, the soil test P value for the site was a good indicator of the P load in runoff from bare soil, but the same cannot be said for turfgrass areas. Therefore, the use of soil testing to limit P fertilization will not necessarily reduce the environmental impact of the site for the range of soil P values found in this study. We are continuing to examine the relationship between soil P and runoff P, as well as searching for other factors that can be used to accurately assess the potential for P loss from turfgrass areas.

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