Nitrogen and Phosphorus Leaching and Runoff from Golf Greens and Fairways

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Objectives:

1. Quantify the amounts of nitrogen and phosphorus that leaches from USGA greens under various management practices.
2. Determine the amounts of nitrogen and phosphorus that runoff a Southeastern piedmont soil under various management variables including buffer zone width and irrigation scheduling with repect to fertilizer application.
3. Determine the effects of forms of phosphorus, dissolved organic carbon (DOC), soil compaction and crusting, and climatic variables on phosphorus leaching and runoff.
4. Develop best management practices to limit leaching and runoff of nitrogen and phosphorus from golf course greens and fairways.

Start Date: 1998
Project Duration: 3 years
Total Funding: $75,000

This project was initiated in 1998 to determine the potential transport of nitrogen and phosphorus by runoff of surface water from fairways and by leaching through golf greens. Experiments on leaching are being carried out at two venues (one greenhouse and one field) and runoff experiments at one field site on campus. A fourth site involves monitoring leachate from three greens at an Atlanta golf course.

Two runoff experiments were carried out in 2000 on bermudagrass plots with a 5% slope. We repeated an experiment using 10-10-10 at three rates and carried out a similar experiment except that 0.25" irrigation was added after application (watered-in) before simulated rainfall events. Most P was transported at the first rainfall event where step-wise increases in P concentration and mass were found for the 5 and 11 kg P/ ha rates. The results of "watering-in" have not yet been evaluated.

An eight-source experiment at one rate (11 kg P/ha) was carried out in the greenhouse on columns made to USGA specifications for greens and sodded with bermudagrass. Treatments were added 4 times. Cumulative P mass rose rapidly for the soluble 20-20-20 and the granular 16-25-12. The next two were the granular 13-13-13 and 10-10-10 with the other 4 sources being lower with respect to P leaching. Five sources had similar N rates (24 kg N/ha) and could be compared. A soluble 20-20-20 source had the highest N loss based on that added (15.7%) whereas a poly- and sulfur-coated microgranule 13-13-13 and sulfur-coated urea had the lowest (3.4 and 1.8%, respecitvely).

In the spring of 1999, we started a series of treatments that showed difference in P movement. Treatments were added first on April 2, 1999 (week 32) and again on weeks 40 and 47. The P treatments began to be evident as increased P concentration in the leachate after week 64 in Nov., 1999. The soluble 20-20-20 source gave a higher and earlier peak than for the controlled-release 13-13-13 for the high P rate.

Researchers at the University of Georgia discuss small runoff plots constructed to measure pesticide and nutrients applied to fairway bermudagrass.

In 1999, P in the leachate was again very low for the practice green built in 1994 in Atlanta. The new playing greens, built in Fall,1998, show a P concentration peak just after start-up with decreases thereafter. The P comes from starter fertilizer and possibly from the peat in the sand-peat mix.

Nitrate concentrations and mass followed a trend similar to that for P and were generally below the 10 mg/ L drinking water standard.

Summary Points

- Under saturated conditions, soil) greatest runoff was at the first simulated rainfall event (4 hours after treatment) and was significantly less at three subsequent samplings.
- Step-wise increases in phosphorus runoff were found at four hours after application for both concentration and total mass for increasing application rates.
- Phosphorus leaching peaked 9 and 15 weeks after treatment from a fast-release carrier, although little leaching was found through golf course putting greens.
- Preliminary calculations show that 21 and 22% of total phosphorus applied was found in the leachate water for the 11 and 21 kg P/ha rates, respectively, for the superphosphate and 14 and 29%, respectively, for the 16-25-12.
- Runoff experiment results indicated that a potential problem exists when phosphorus fertilizer is placed on fairways prior to a significant rain event, but judicial management could easily prevent this from becoming a problem.