

Nitrogen and Phosphorus Fate in a 10-year-old Kentucky Bluegrass Turf

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Objectives:

1. Determine if reducing the amount of fertilizer nitrogen applied to a continually fertilized turfgrass stand will reduce the amount of nitrate-nitrogen leaching from the soil profile without compromising turfgrass quality.
2. Determine the fate of phosphorus in a turfgrass stand that soil tests indicate has adequate phosphorus levels.

Start Date: 2003

Project Duration: three years

Total Funding: \$41,708

Extensive research on nitrate-nitrogen ($\text{NO}_3\text{-N}$) leaching in turfgrass systems indicates that, in most cases, leaching poses little risk to the environment. Most of the research, however, was conducted on research sites that were either recently disturbed or established, and the potential exists for $\text{NO}_3\text{-N}$ concentrations in leachate to increase on mature turf sites.

In 2003, the MSU long-term N fate research project, funded by the USGA, was completed. The fate of nitrogen (N) was examined for a 10-year-old Kentucky bluegrass (*Poa pratensis* L.) turfstand using intact monolith lysimeters and microplots.

From October, 2000 through 2002, half of the lysimeters and microplots were treated annually with urea at a high N rate of 245 kg N ha^{-1} (49 kg N ha^{-1} application⁻¹). This equates to 5 lb N/1000 ft^2 per year or 1 lb N/1000 ft^2 per application. The remaining lysimeters and microplots were treated annually with urea at a low N rate of 98 kg N ha^{-1} ($24.5 \text{ kg N ha}^{-1}$ application⁻¹). This equates to 2 lb N/1000 ft^2 per year or $0.5 \text{ lb N/1000 ft}^2$ per application. The October, 2000 urea application was made with ^{15}N double-labeled urea to



Lysimeter where leachate samples are collected for long-term N and P fate research.



Separating soil from microplots for ^{15}N analysis

facilitate fertilizer identification among clippings, verdure, thatch, soil, roots, and leachate.

The average total N recovery for the low and high N rates was 78 and 74%, respectively. $\text{NO}_3\text{-N}$ concentrations in leachate for the low-N rate were typically below 5 mg L^{-1} . For the high N rate, $\text{NO}_3\text{-N}$ concentrations in leachate were typically greater than 20 mg L^{-1} .

Over approximately two years, 1 and 11% of labeled fertilizer-N was recovered in leachate for the low and high N rates, respectively. These results indicate that total yearly applications of 245 kg N ha^{-1} in the form of urea to a 10-year old Kentucky bluegrass stand with monolith lysimeters in place, resulted in elevated levels of $\text{NO}_3\text{-N}$ in leachate.

The current N and P fate research is a continuing project that is using the same lysimeters and plot area, albeit under a different fertilization program. For the current research, the amount of nitrogen applied is 98 and 196 kg N ha^{-1} split over four applications. Phosphorus from triple superphosphate will be applied at two rates: 49 and 98 kg P ha^{-1} split over two applications. The phosphorus application

dates will coincide with the nitrogen application dates.

Leachate, soil, and plant samples from 2003 are still being analyzed for ^{15}N enrichment. Initial results from leachate analysis for 2003 indicates $\text{NO}_3\text{-N}$ concentrations for the high nitrogen rate treatments have not declined from previous levels, and there has been no elevation in $\text{NO}_3\text{-N}$ concentration for the low nitrogen rate.

Summary Points

- The average total N recovery for the low and high N rates was 78 and 74%, respectively. $\text{NO}_3\text{-N}$ concentrations in leachate for the low-N rate were typically below 5 mg L^{-1} . For the high N rate, $\text{NO}_3\text{-N}$ concentrations in leachate were typically greater than 20 mg L^{-1} .
- Although data are still being analyzed, initial results indicate little phosphorus leaching from the profile.
- Initial results from leachate analysis for 2003 indicates $\text{NO}_3\text{-N}$ concentrations for the high nitrogen rate treatments have not declined from previous levels, and there has been no elevation in $\text{NO}_3\text{-N}$ concentration for the low nitrogen rate.