

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: five years

Total Funding: \$68,886

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. The potential for increased $\text{NO}_3\text{-N}$ leaching from mature turf sites is largely unknown.

In 2002, the MSU Long-Term N Fate research project, funded by the USGA since 1998, 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, lysimeters and microplots were treated annually with urea at a low N rate 98 kg N ha⁻¹ (24.5 kg N ha⁻¹ application⁻¹) and a high N rate of 245 kg N ha⁻¹ (49 kg N ha⁻¹ application⁻¹). From 2000-2002, $\text{NO}_3\text{-N}$ concentrations in leachate for the low N rate were typically below 5 mg L⁻¹ and for the high N rate greater than 20 mg L⁻¹.

The current N and P fate research is a continuing project that is using the same lysimeters and plot area, but the amount of nitrogen applied for the high N rate treatment has been reduced. 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 (20% P) is applied at two rates, 49 and 98 kg P ha⁻¹ split over two applications. The phosphorus application dates coincide with nitrogen application dates in the spring and autumn.

In 2003, the concentration of $\text{NO}_3\text{-N}$ leaching from the high N rate treatment did not decline from the previous years. The average $\text{NO}_3\text{-N}$ concentration



Dr. Kevin Frank (above right) explains to members of USGA's Research Committee the efficiency of nitrogen use by mature Kentucky bluegrass when fertilized at a low (2 lb./1000 ft²/year) and a high rate (5 lb./1000 ft²/year). Results indicate that the high rate of nitrogen fertilization is much more than the turf needs and can result in unacceptable levels of nitrate-nitrogen in leachate.

leached from the low and high N rate treatments was 6.3 and 31.6 mg L⁻¹.

In 2004, the concentration of $\text{NO}_3\text{-N}$ leaching from the high N rate treatment declined drastically from previous years. The average concentration of $\text{NO}_3\text{-N}$ in leachate for the high N rate was 8.5 mg L⁻¹. This is a decrease in $\text{NO}_3\text{-N}$ concentration of 23.1 mg L⁻¹ from 2003. For the low N rate, the average concentration of $\text{NO}_3\text{-N}$ in leachate for the low N rate was 1.2 mg L⁻¹.

In 2005, the concentrations of $\text{NO}_3\text{-N}$ in leachate for the low and high N rates were similar to values from 2004. The average concentration of $\text{NO}_3\text{-N}$ in leachate for the low and high N rate was 3.1 and 13.7 mg L⁻¹, respectively.

In 2006, the concentrations of $\text{NO}_3\text{-N}$ in leachate for the low and high N rates were similar to values from 2004 and 2005. The average concentration of $\text{NO}_3\text{-N}$

in leachate for the low and high N rate was 4.1 and 11.2 mg L⁻¹, respectively.

Through June 2007, the average concentration of $\text{NO}_3\text{-N}$ in leachate for the low and high N rate was 2.1 and 4.6 ppm, respectively. The concentration of $\text{NO}_3\text{-N}$ in leachate for the high N rate appears to have returned to approximately the same level as in 1998, 5.0 mg L⁻¹.

The concentration of phosphorus detected in leachate remains very low regardless of treatment. The mean concentration of phosphorus detected in leachate in 2007 for both the low and high phosphorus rates was less than 0.02 mg L⁻¹.

Summary Points

- After the fifth year of reducing the high N rate treatment from 245 to 196 kg N/ha, the concentration of $\text{NO}_3\text{-N}$ in leachate has returned to levels similar to 1998.
- Results continue to indicate low amounts of phosphorus leaching.