# *Nitrogen and Phosphorus Fate in a 10+ Year Old Kentucky Bluegrass Turf*

**Kevin W. Frank**
Michigan State University

**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 ($NO_3$-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 for increased $NO_3$-N leaching from mature turf sites is unknown.

In 2002, 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*) turf stand 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 $ha^{-1}$ $yr^{-1}$(2 lb./1000 $ft^2$/year) and a high N rate of 245 kg N $ha^{-1}$ (5 lb./1000 $ft^2$/year). From 2000-2002, $NO_3$-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 $L^{-1}$.

*In the fall of 2000, 56 polyvinyl chloride microplots (shown above) were installed in the plot area adjacent to the lysimeters. Microplots were extracted and partitioned into verdure, thatch, roots, and soil on seven sampling dates to evaluate the fate of labeled nitrogen among turfgrass and soil components.*

*A research team at Michigan State University led by Dr. Kevin Frank (above) investigated the efficiency of nitrogen use by mature Kentucky bluegrass when fertilized at a low (2 lb./1000 $ft^2$/year) and a high rate (5 lb./1000 $ft^2$/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.*

The current N and P fate research is a continuing project that uses 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 $NO_3$-N leached from the high N rate treatment did not decline from the previous years. The average $NO_3$-N concentration leached from the low and high N rate treatments was 6.3 and 31.6 mg $L^{-1}$, respectively. In 2004, the concentration of $NO_3$-N leaching from the high N rate treatment declined dramatically from previous years. The average leachate concentration of $NO_3$-N for the high N rate was 8.5 mg $L^{-1}$. This is a decrease in $NO_3$-N concentration of 23.1 mg $L^{-1}$ from 2003. For the low N rate, the average concentration of $NO_3$-N in leachate was 1.2 mg $L^{-1}$. In 2005, the concentrations of $NO_3$-N in leachate for the low and high N rates were similar to values from 2004. The average concentration of $NO_3$-N in leachate for the low and high N rate was 3.1 and 13.7 mg $L^{-1}$, respectively.

The concentration of phosphorus detected in leachate remains very low regardless of treatment. The mean concentration of phosphorus detected in leachate in 2005 for both the low and high phosphorus rates was 0.05 mg $L^{-1}$.

## Summary Points

- After the third year of reducing the high N rate treatment from 245 to 196 kg N/ha, the reduction in $NO_3$-N concentrations in leachate remained consistent with the results from 2004.
- Results continue to indicate low amounts of phosphorus leaching.