

# Gaseous Losses and Long-Term Fate of Nitrogen Applied to Kentucky Bluegrass Turf

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## Objectives:

1. To initiate a set of long-term field plots to measure nitrate leaching and total nitrogen fate of a mature turfgrass stand that has been under continual fertilization for over 10 years.

Start Date: 2000

Project Duration: 3 years

Total Funding: \$64,612

Extensive research has been conducted on nitrate-nitrogen leaching in turfgrass systems and the majority of this research has indicated that nitrogen applications to turfgrass pose minimal risk to the environment with respect to nitrate leaching. However, many of these studies were conducted over short time frames or on newly established turfgrass areas.

Research conducted at Michigan State from 1991-1993 on Kentucky bluegrass revealed that a very small amount of applied nitrogen leached through a 1.2 meter deep sandy loam soil. Now, after ten years of continual fertilization and management, research to determine if the amount of nitrate-nitrogen leaching through the profile has changed is underway.

In 1998, leachate collection from the lysimeters was resumed to determine if the amount of nitrogen leaching through the soil profile had changed since the initial study in 1991. Beginning in 1998, two lysimeters and the surrounding Kentucky bluegrass turf area have received fertilizer at a rate of 98 kg N/ha/yr (2 lb N/1000



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



Separating soil from microplots for  $^{15}\text{N}$  analysis

$\text{ft}^2/\text{yr}$ ) in the form of urea. The other two lysimeters and surrounding turf area have received 244 kg N/ha/yr (5 lb N/1000  $\text{ft}^2/\text{yr}$ ) in the form of urea.

Since 1998, nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) concentrations at the low N rate have typically been between 2.5 and 4 ppm, well below the EPA standard for drinking water of 10 ppm. At the high N rate,  $\text{NO}_3\text{-N}$  concentrations have often been above 10 ppm with multiple spikes above 15 ppm. Our initial results indicate that total yearly applications of urea exceeding 98 kg N/ha/yr (5 lb N/1000  $\text{ft}^2$ ) may be excessive and lead to high nitrate-nitrogen concentrations in leachate.

To facilitate identification of fertilizer nitrogen,  $^{15}\text{N}$ -labeled urea was applied in October, 2000 to the lysimeters and microplots. Microplots will be sectioned to determine nitrogen allocation among soil depths, topgrowth, roots, and thatch.

Although microplot samples are still being analyzed, initial results from the dates ana-

lyzed indicate total nitrogen recovery in thatch, soil, and verdure components to be on average 75 and 70% of applied nitrogen for the low and high nitrogen rates, respectively.

Leachate will continue to be monitored and nitrogen allocation among turfgrass and soil components will be determined from soil cores harvested through autumn of 2002. The results of this research should provide definitive answers on how nitrogen dynamics change over time in turfgrass systems.

## Summary Points

- Yearly nitrogen rate applications of 244 kg N/ha (5 lb N/1000  $\text{ft}^2$ ) over a ten year period have resulted in nitrate-nitrogen concentrations in excess of 10 ppm with multiple spikes above 15-20 ppm.
- Initial analysis of microplots treated with  $^{15}\text{N}$  enriched urea indicate that total nitrogen recovery in the thatch, soil, and verdure was approximately 70 and 75% of the applied nitrogen at the high and low nitrogen rates, respectively.