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

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Objectives:

1. Determine the quantity and form of gaseous nitrogen losses from turf.
2. Develop long-term (20+ years) field plots examining the fate of nitrogen applied to a mature turf.

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.

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

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 2 lb. N/1000 ft.^{2}/yr in the form of urea. The other two lysimeters and surrounding turf area have received 5 lb. N/1000 ft.^{2}/yr in the form of urea.

At the University of Illinois, Dr. Richard Mulvaney has developed a specialized mass spectrometer to measure NO_2 gas volatilized from labeled nitrogen fertilizer.

Since 1998, nitrate-nitrogen 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, nitrate-nitrogen concentrations have often been above 10 ppm with multiple spikes above 15 ppm. Our initial results indicate that total yearly applications of urea exceeding 5 lb.N/1000 ft^2 may be excessive and lead to high nitrate-nitrogen concentrations in leachate.

To facilitate identification of fertilizer nitrogen, ^{15}N labeled urea was applied in October, 2000, to the lysimeters and microplots. Microplots will be sectioned to determine N allocation among soil depths, top-growth, roots, and thatch. Samples are currently being analyzed for % ^{15}N enrichment.

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.

Brian Horvath explains how air samples are taken from Kentucky bluegrass turf. The study determined the amount of nitrogen volatilization that occurs from turf.

Summary Points

- At the high N rate, NO_3-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 5 lb.N/1000 ft^2 may be excessive and lead to high nitrate-nitrogen concentrations in leachate.
- Microplots will be sectioned to determine N allocation among soil depths, top-growth, roots, and thatch. Samples are being analyzed for % ^{15}N enrichment.