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LONG TERM NITROGEN FATE IN KENTUCKY BLUEGRASS

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Introduction

Extensive research has been conducted in the last 10 years on nitrate-nitrogen leaching in turfgrass systems. The majority of research has indicated that turfgrass poses little risk to the environment from nitrate leaching. Research conducted at MSU by Miltner et al. reported that the majority of ^{15}N labeled urea nitrogen applied to Kentucky bluegrass never even reached the soil. The majority of applied nitrogen was taken up by the plant, immobilized in the thatch layer, or lost to volatilization. Only 0.23% of the ^{15}N labeled urea was collected in the drainage water of lysimeters 1.2 m below the soil surface over a three year period following application.

Research has also shown that turfgrass builds organic matter for a period of about 10 years following establishment and then reaches an equilibrium where no further net N immobilization occurs. The question under investigation is whether or not after an extended period of time, 10 years, will the amount of nitrate-nitrogen leaching from a turfgrass system change. The research is important because it will indicate if the amount of nitrate nitrogen leached from a mature turf occurs at a level where an alteration in fertilizer practices needs to be considered.

Materials and Methods

Four intact large lysimeters at the Hancock Turfgrass Research Center and the surrounding turfgrass area will be used to examine nitrogen fate on a mature turf. The lysimeters were established with Kentucky bluegrass sod in the fall of 1990 prior to a USGA-sponsored N fate study conducted from 1991-1993.

The research was initiated in 1998 and will potentially last for the next 25 years. The experimental design is relatively simple. Two of the large lysimeters and 1/2 of the surrounding area originally established in 1990 will be treated annually with 240 kg N ha^{-1} (5 lb. N/1000 $ft.^2$). The remaining two lysimeters and surrounding area will be treated with 96 kg N ha^{-1} (2 lb. N/1000 $ft.^2$). Lysimeter percolate will be collected periodically, volume measured, and a subsample collected for N analysis. This procedure will continue indefinitely.

In the fall of 2000, ^{15}N labeled urea was applied to the plot area to determine mass nitrogen balance. The leachate from the large lysimeters will be monitored for N and $^{1}5N$. In addition, ^{15}N labeled urea was applied to micro-plot areas for intensive sampling of the turfgrass system. Soil, thatch, verdure, and roots will be sampled for $\%^{15}N$ enrichment to determine mass nitrogen balance for the system. The number of microplots installed was sufficient to enable periodic sampling for the next 25 years.

Results

The 240 kg N ha^{-1} (5 lb. N/1000 $ft.^2$) treatment has yielded nitrate concentrations in the leachate greater than 10 ppm nitrate-nitrogen since September of 1999 (Figure 1). With the exception of one sampling date, the 96 kg N ha^{-1} (2 lb. N/1000 $ft.^2$) treatment has always had nitrate-nitrogen concentrations less than 4 ppm.

The 240 kg N ha^{-1} (5 lb. N/1000 $ft.^2$) treatment has leached a total of 65 kg N ha^{-1} or 12% of the total applied nitrogen since 1998 (Figure 2). The 96 kg N ha^{-1} (2 lb. N/1000 $ft.^2$) treatment has leached a total of 15 kg N ha^{-1} or 7% of the total applied nitrogen.

Future Directions

Leachate will continue to be monitored indefinitely and mass nitrogen balance will be determined for the turfgrass/soil profile in 2001 and 2002.

Acknowledgements

This research is currently supported by grants from the United States Golf Association and the Michigan Turfgrass Foundation.

Figure 1. NO_3-N Concentration (1998-2000)

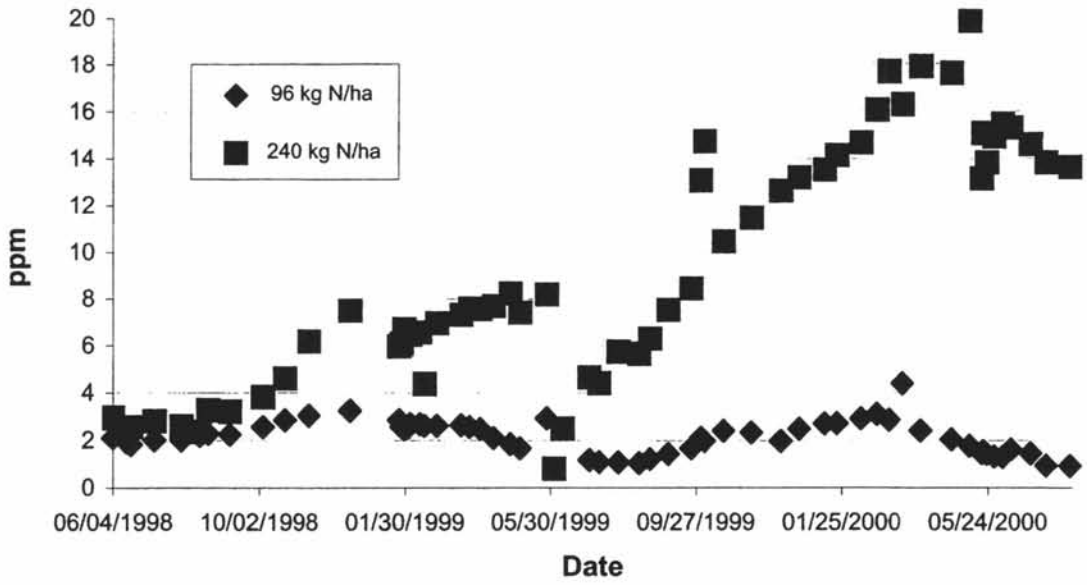

Figure 2. Total N Recovered (1998-2000)