nitrogen on an oven dry-weight basis.

Future research includes the formation of a nitrogen balance. In addition, construction of a water balance can be made leading to a better understanding of water use efficiency in the turfgrass environment. The findings of the project will provide a clearer understanding of how golf course management practices affect the environment. It will allow the public to directly view how management practices on sand-based greens affects groundwater and the environment. It will demonstrate to the public the high level of effort being placed on insuring that the environment is preserved through current golf course practices.

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

University of Illinois

Bruce Branham

Start Date: 1998
Number of Years: 5
Total Funding: $124,270

Objectives:

1. *Detemine 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.*

The objectives of this project is to determine how nitrogen is lost from fertilized turf stands, which is being conducted at the University of Illinois; and to determine the long-term fate of nitrogen at Michigan State University (MSU). The project at MSU includes the development of long-term turfgrass plots that will be treated the same every year for an indefinite period. We envision these plots as a kind of "Morrow" plots for turf. The Morrow plots are an experimental field at the University of Illinois that has continually produced corn since 1868. The plots at MSU will be continually under turf management for the indefinite future at the same, known level of management inputs. These plots will be an invaluable resource for future researchers long after this study is over. The project at MSU consists of establishing the long-term plots on a site that contains four large lysimeters that will be monitored for nitrogen leaching under two fertility regimes. The high maintenance plots receive 5 lbs nitrogen per 1000 square feet per year while the low maintenance plots receive 2 lbs. nitrogen per 1000 square feet per year. The lysimeters will be monitored continuously for nitrate leaching under these two fertility programs. Beginning in 2000, a study will be initiated to monitor the fate of labeled fertilizer nitrogen in these plots.

The results from monitoring the leachate of the two nitrogen regimes in 1998 indicate slight increases in nitrogen leaching compared to the baseline levels established in these same plots during a study conducted from 1991 through 1993. Average nitrogen losses ranged from 1.83 to 2.85 mg N L^{-1} for the 2 lbs. N/1000 ft^2/Yr treatment and 2.37 to 4.61 mg N L^{-1} for the 5 lbs. N/1000 ft^2/Yr treatment. While these values are well below the drinking water standard of 10 mg N L^{-1}, they are above the levels detected by Miltner et al. (1996) in a similar study. Values detected by Miltner et al. were generally below 1 mg N L^{-1} with a maximum detection of 3.8 mg N L^{-1}

Research at the University of Illinois is focused on gaseous losses of nitrogen from fertilized turf stands. Turfgrasses are fertilized yearly but lose insignificant amounts of nitrogen to leaching. Yet, turfgrass systems must be losing nitrogen or fertilization could be stopped without any loss in turfgrass growth or quality. Since nitrogen leaching appears negligible, the only other avenue for loss of nitrogen from the turf is through nitrogen volatilization. Nitrogen volatilization losses can occur by two different pathways. Ammonia volatilization and denitrification will both be studied in these experiments.

Most of our time in 1998 was devoted to developing the systems needed to study nitrogen volatilization under field conditions. In particular, denitrification is very difficult to study under field conditions. One of the most vexing problems encountered was a method to measure the volume of the lysimeters to be used in the field measurements. The lysimeters, plastic tubes inserted into the turf, must protrude above the turf surface so that a cover can be placed over the lysimeter and a sample of the air inside the lysimeter taken to determine gaseous nitrogen loss. Determining the head space volume inside the lysimeter is critical to getting an accurate estimation of the total nitrogen gasses volatilized. While many easy approaches were considered, none of them provided acceptable results. The method developed introduces a known volume of neon gas into the lysimeter prior to sampling, after equilibration, a sample is withdrawn and the concentration of neon gas is determined by mass spectroscopy. The dilution of the neon gas can be used to accurately determine the head space volume of the lysimeters.

Our field system has been tested and is ready for our first field studies which will begin in May of 1999. These trials should be sufficiently sensitive to determine nitrogen volatilization losses from fertilized turf stands.