

Correlation and Calibration of the Illinois Soil Nitrogen Test for Use as a Nitrogen Fertility Management Tool

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Objectives:

1. Evaluate the production of mineral N during incubation of soils differing in N fertilizer responsiveness.
2. Refine the critical amino sugar-N levels for turfgrass quality responsiveness.
3. Determine the impact of long-term fertility management practices on soil amino sugar-N values and nitrate leaching potential and to evaluate amino sugar-N concentration changes over time using the long-term N leaching plots at Michigan State University.

Start Date: 2010 (current cycle)

Project Duration: 2 years

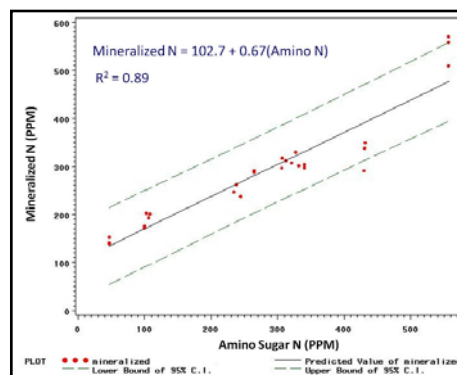
Total Funding: \$46,962

A USGA report “Nitrogen and phosphorus fate in a 10-year-old Kentucky bluegrass turf” authored by Frank (2005) has found leaching of ^{15}N labeled urea from a 10-year-old Kentucky bluegrass turf. This and other recent studies suggest that over time mineralization of N may exceed immobilization on fertilized turf which may increase the potential for nitrate leaching.

The Illinois Soil Nitrogen Test (ISNT) was developed to identify sites in production agriculture that are non-responsive to N fertilizer inputs. The test measures amino sugar-N fractions that supply the plant N through mineralization. This fraction is relatively stable compared to NO_3^- and NH_4^+ , and thus may provide an accurate measure of potential nitrogen fertility on managed turfgrass. Our goal is to determine if the ISNT has any utility in predicting turfgrass response to nitrogen fertilizer. If the ISNT could be used to determine soil nitrogen status in turfgrass, this might allow superintendents to reduce excess time and money spent on unnecessary fertilizer applications. More importantly, this test may predict the impact of our fertility practices and could reduce environmental contamination associated with NO_3^- leaching.

In order to evaluate the production of mineral N during incubation of soils differing in N-fertilizer responsiveness, soils have been collected from North Dakota, Illinois, Indiana, Ohio, Michigan, Wisconsin, and Minnesota. Soils were incubated at 25°C for 12 weeks. Mineralization tests were conducted at weeks 0, 1, 2, 4, 8, and 12. Incubations to

determine mineralization rates developed from procedures described in Mulvaney et al., 2001. Extracts and leachates were then analyzed for $\text{NH}_4\text{-N}$ and $(\text{NO}_3 + \text{NO}_2)\text{-N}$ by accelerated diffusion methods. We determined that there is a strong correlation between the level of amino sugar-N in the soil and the amount of N that mineralizes from the soil.



Results show a strong relationship between the amount of amino sugar nitrogen as determined by the Illinois Soil Nitrogen Test and the amount of potentially mineralizing nitrogen in the soil.

We have conducted several experiments during 2010 and 2011 to investigate the yield response of turfgrass (clipping yields, as well as quality and color responses) to added nitrogen in soils with various amino sugar-N levels. Results of these trials suggest turfgrass response to added nitrogen may be lower on soils with higher amino sugar-N levels. However, the results are not as conclusive as what has been found in production agriculture.

Part of our hypothesis is that as amino sugar-N levels increase in soil, the N needs of the turf are increasingly met by mineralized organic N. Therefore, on high amino-N soils there may be an increased chance that added fertilizer nitrogen would be more susceptible to leaching. If true, then the ISNT may be useful as a tool to identify sites that are prone to contribute to

nitrate contamination of groundwater due to added fertilizer. In order to test this hypothesis, soil samples have been gathered from microplot lysimeters at Michigan State University for the years 2000-2010. Our goal with the analysis of these samples is to determine if the nitrate leaching events observed on the lysimeters at Michigan State can be correlated to changes in the amino-nitrogen level in the soil.

We expect to develop sampling procedure guidelines and interpretation of the ISNT results based on amino sugar-N and mineralization rates in order to make fertility reduction management recommendations on golf courses. We also expect to demonstrate that the ISNT can be utilized to explain nitrate leaching events. Since Frank (2005) reports that a 50% reduction in added fertilizer effectively eliminates nitrate leaching potential, we believe the ISNT may serve as an appropriate test to assist superintendents in reducing nitrate leaching from golf courses.

Summary Points

- Laboratory experiments have showed that the Illinois Soil Nitrogen Test value can be correlated to the amount of potentially mineralizing nitrogen in the soil.
- Our field studies suggest that the relationship between amino sugar-N and response of turfgrass to added fertilizer nitrogen is not as consistent as what has been reported in production agriculture. Additional studies are being conducted to analyze if a relationship between amino sugar-N levels and turfgrass fertility response exists.
- Analysis of soils gathered from lysimeters at Michigan State University from 2000-2010 will determine if the ISNT has any utility for predicting soils with the potential to leach nitrate due to fertilizer nitrogen.