

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

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Objectives:

1. To determine the critical value of amino nitrogen in the soil, above which no response to N fertilizer input would be expected.
2. To determine fairway-scale spatial variability of amino nitrogen on golf courses.
3. To determine the impact of long-term fertility management practices on soil amino N values and nitrate leaching potential.

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Project Duration: two years

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The Illinois Soil Nitrogen Test (ISNT) was developed to identify sites in production agriculture that are non-responsive to nitrogen (N) fertilizer inputs. The test measures amino sugar N fractions that supply the plant N through mineralization. Briefly, soil is heated in a basic solution that converts the amino sugar into ammonia. The ammonia is absorbed by a boric acid indicator solution. The boric acid solution is titrated to measure the ammonium that gives the relative amount of amino sugar in the soil.

Our previous research suggests that the amino nitrogen fraction does not fluctuate as rapidly in the soil as do ammonium N and nitrate N, thus making it a better predictor of season-long N fertility requirements.

Soil samples from were collected from two fairways on each of four golf courses, in Minnesota and Ohio, and analyzed for amino N concentration. Heritage Links Golf Course is approximately 8 years old. The original farm land was significantly altered during coarse construction. Midland Hills Country Club is approximately 85 years old. Both of these courses are located in Minnesota. In Ohio, the golf courses tested were Kinsale Golf Course, which is approximately 4 years old, and Cranberry Hills, which is approximately 40 years old. Soil cores were collected on ~9 m centers to a depth of 45 cm using a 3.8 cm diameter hydraulic probe mounted on a utility vehicle.

General geostatistical methodology was used and maps were generated using the interpolation technique, ordinary kriging. Kriged maps of the four sampled fairways in Minnesota showed that the two fairways from Heritage Links displayed a



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greater degree of spatial heterogeneity than the two fairways from the other golf courses tested. This may be the result of the relatively young age of the site and that the soil organic matter and amino N content have not equilibrated since construction.

The distribution of amino N over the fairways tested at Midland Hills and the two Ohio Golf Courses was more uniform. The older golf courses had higher amino N levels, regardless of management intensity. Soil amino N content varies over space, but there is adequate spatial correlation so that soil sampling techniques will permit identification of areas with higher and lower amino N values on golf course fairways.

Six experiments that investigate the yield response of turfgrass to added nitrogen in soils with various amino nitrogen levels have been completed in Ohio and Minnesota. Results of these 6 trials suggest turfgrass clipping yield response to added nitrogen is lower on soils with higher amino N levels. Field studies to investi-

gate the relationship between soil amino N level and clipping yield response to added nitrogen will be conducted in early 2008 in Illinois, Wisconsin, and Indiana. The studies will be conducted on areas that tested very low and very high for amino nitrogen. Our goal is to determine if the ISNT has any utility in predicting turfgrass response to nitrogen fertilizer.

Part of our hypothesis is that as amino 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.

Soil samples have been gathered from microplot lysimeters at Michigan State University for the years 2000-2006. 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. Amino nitrogen level on these plots exceeded the hypothesized threshold for amino N concentration at which we expect to observe leaching.

Summary Points

● Yield response to nitrogen is observed at values similar to those reported for yield responses to corn. Studies will be conducted in several states in spring 2008 to investigate yield response on a variety of soils with widely varying amino nitrogen levels.

● Soil amino N content varies over space, but there is adequate spatial correlation so that standard soil sampling techniques will permit identification of areas with higher and lower amino N values on a golf course fairway.