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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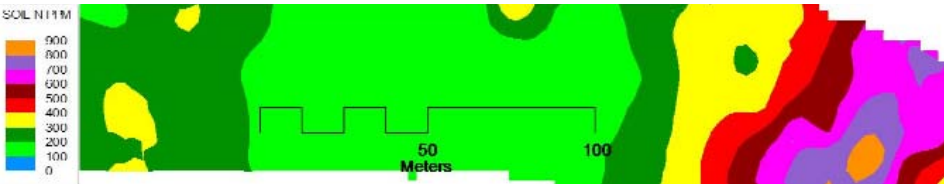

Spatial variability of amino nitrogen on a golf course fairway in Minnesota. The goal is to develop sampling interval recommendations for golf courses.

Nitrogen (N) fertilization of turfgrass continues to be scrutinized due to environmental concerns. Not all research indicates that turfgrass fertilization with nitrogen posses little or no risk to the environment. Neither soil nor plant tissue testing is routinely used to evaluate fertilizer needs because most forms of nitrogen are too dynamic in a plant-soil system to be accurate and reliable predictors of available nitrogen.

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. 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.

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Our previous research shows that the amino nitrogen fraction does not fluctuate as rapidly in the soil as do NH_4^+-N and NO_3^--N, thus making it a better predictor of season-long N fertility requirements.

In order to determine the spatial variation of amino nitrogen in the soil, soil samples were collected from two fairways on each of two golf courses in Minnesota and analyzed for amino N concentration. Heritage Links Golf Course is approximately 8-years-old. The original farmland was significantly altered to fit this par 71, 18-hole facility. Midland Hills Country Club is an 18-hole course that is approximately 85-years-old. Soil cores were collected on 0.9-meter centers to a depth of 45 cm using a hydraulic soil 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 greater degree of spatial heterogeneity than the two fairways from Midland Hills. 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. Our early results suggest that 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 a golf course fairway. Soil cores have also been collected from fairways at two golf courses in Ohio and these await analysis.

Soil samples have been collected from the monolith lysimeters at Michigan State University. In addition, we have gathered soil samples from microplot lysimeters 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. The authors gratefully acknowledge the contributions of Dr. Kevin Frank, Michigan State University, for providing soil samples for analysis.

Summary Points

- Yield response to nitrogen is observed at values similar to those reported for yield responses to corn. Future studies will 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.
- Analysis of soils gathered from lysimeters at Michigan State University will determine if the ISNT has any utility for predicting soils with the potential to leach nitrate due to fertilizer nitrogen.