

Illinois Soil N Test (ISNT) useful tool for NYS Corn producers

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Introduction

Plants take up nitrogen (N) from different sources including fertilizer and N mineralized from organic sources such as plant residue and roots, manure and soil organic matter.

Soil N-supply estimates (soil series and drainage specific book values) were derived for more than 600 New York soil types. These estimates of soil N supply reflect the N uptake by continuous corn grown without additional N. Typically, for New York soils, soil N supply will range from 50 to 140 lbs N/acre.

Field management can impact the soil N supply resulting in a desire to have a soil test that allows us to fine-tune soil N supply estimates to specific fields. Until recently, our best option for assessing N availability from organic sources was the pre-sidedress nitrate test (PSNT). However, the PSNT presents some practical challenges as it requires a 12" deep soil sample that needs to be taken during the busy field season. Furthermore, recent studies have shown the test to be less reliable (47% accuracy) in wet springs.

Since 2002 researchers from the Nutrient Management Spear Program at Cornell University in collaboration with Cornell Cooperative Extension, other agricultural professionals, and farmers have been testing the usefulness and accuracy of the Illinois Soil N Test (ISNT), an organic N test proposed by researchers in Illinois as a better option for predicting if a corn crop needs additional N. This test was of interest for New York agriculture because it estimates a readily mineralizable organic N pool (a more stable pool of soil N as opposed to nitrate) possibly creating greater flexibility for timing of sampling and depth of sampling, potentially improving on the PSNT in several ways. We embarked on a statewide project to calibrate and validate the test for use by corn growers in New York.

Initial Calibration Studies (2002-2004)

Research in NYS (2002-2004) showed the ISNT does not have to be taken during the growing season,

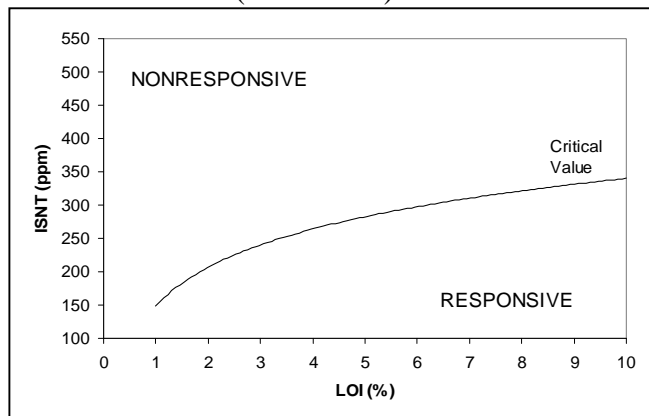


Figure 1: ISNTxLOI curve from predicting N needs of corn

only requires an 8" deep soil sample, and is stable for 2-3 years, all of which offer substantial advantages over the PSNT. However, knowing a soil's ISNT is not sufficient; to interpret ISNT values, we have to know the organic matter level determined by loss-on-ignition (LOI) (Figure 1). If the ISNT (in ppm) and LOI (in %) test results place the field above the critical value curve in Figure 1, the field is unlikely to respond to additional N, while for a field below the critical value curve, N will need to be added to achieve optimum corn yields.

There are different methods for measuring the organic matter content of a soil. In the LOI method, a soil sample is placed in an oven and exposed to a very high temperature for several hours to burn off any organic material in the sample. After burning the organic material all that is left is ash (soil minerals). The weight of the burned sample divided by the initial weight of the sample (corrected for moisture) determines percent LOI. This is often converted and reported as %OM on soil test reports. The Cornell Nutrient Analysis Laboratory (CNAL) estimates organic matter by ashing for 2 hours at 500°C. Not all laboratories use the same method. If a different method is used, the interpretation shown in Figure 1 will not be accurate.

Use of ISNT and LOI for Corn in Rotation (2005-2007)

From 2005-2007 a total of 34 corn N response trials were conducted across NYS. Of these trials 16 fields were 1st year corn following sod, 12 fields were 2nd year corn, three were 3^{rd+} year corn, while three sites were corn following soybeans.

When the test was performed on 1st year corn fields the results were not great because our sampling time, 5-6 weeks after sod turnover, resulted in accurate estimates of soil organic N release but failed to

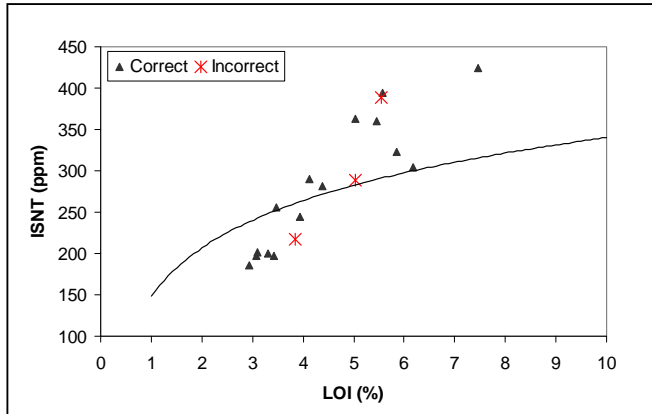


Figure 2: Accuracy of ISNTxLOI for 18 N response trials

register the large amount of nitrate released by sod turnover. We also found 1st year corn after grass/legume sod does not need N beyond 20-30 lbs N/acre in the starter (Agronomy Factsheet #21) so there is no reason to run take an ISNT and LOI (or PSNT) sample for 1st year corn fields.

Surprisingly, 2005-2007 N trials showed that not all corn after corn and corn after soybeans fields need extra N either; 10 of 18 sites were non-responsive to N beyond a small starter meaning optimum yields were obtained with 20-30 lbs N in the starter only. The ISNT predicted 15 of the 18 (83%) accurately (Figure 2). This is compared to an accuracy level of only 47% for the PSNT at these same trials. Furthermore, the 3 sites that were not predicted accurately by the ISNT all had other circumstances besides N rate (i.e. field variability, hail damage, etc.) that affected the crop N responsiveness and yields.

Implementation in NYS Soil Sampling for ISNT

New York research has shown that reliable ISNT results can be obtained by analyzing 6-8 inch samples using the same handling procedures as used for regular soil fertility samples (see Agronomy Fact Sheet #1). There is however one restriction in timing of sampling: **avoid soil sampling within 5 weeks of manure applications, after killing a sod (either by tillage or herbicide application) or after the addition of ammonium containing fertilizer.** Samples taken any other time in the year will reflect soil organic N mineralization potential for 2-3 years. The reason for this restriction is that aside from estimating a readily mineralizable organic N fraction in the soil, the ISNT test results also reflect ammonium-N in the soil. Ammonium tend to be elevated during the first 4-5 weeks after manure application (conversion from urea in the manure) or sod kill (decomposition of plant materials) so for most accurate estimates of soil N release, samples should be taken outside this window of elevated ammonium.

Interpreting the results

(1) Above the ISNTxLOI curve?

These fields most likely have enough readily mineralizable soil organic N and no additional N is needed (20-30 lbs N/acre as starter only).

(2) Below the ISNTxLOI curve?

For these fields a response to additional N is likely and the estimated N recommendation applies (see Agronomy Fact Sheet #35). Current year (past fall and/or current spring) manure credits should be estimated and deducted from the N fertilizer recommendation (Agronomy Fact Sheet #4). Keep in mind that ISNT results reflect potentially mineralizable soil N and that under severe drought conditions adding extra N will not result in higher yields, even if the soil N supply is low; in other words, in drought years, sites that are below the ISNTxLOI response curve still may not respond to additional N due to water-stress. Furthermore, additional N is not a substitute for low levels of other nutrients, low pH or other

problems in the field. When such sub-optimal conditions exist, sites will likely be non-responsive to N regardless of test results.

Sample Submission

Soil test submission forms are available at: <http://cna1.cals.cornell.edu/forms/SubmissionForms.aspx>. If submit a sample and request ISNT in addition to the regular fertility package (pH, OM, P, K, Ca, Mg, Fe, Al, Zn, Mn), added cost for the ISNT is \$10. If submitted as a stand-alone sample (i.e. ISNT and LOI only), the cost is \$15 per sample.

Summary

Field research in New York the past 5 years has shown the Illinois Soil Nitrogen Test (ISNT) to be a useful tool for New York corn growers. It can help identify fields that do not need additional N beyond a small starter application. For more information, visit the Nitrogen for Corn webpage at: <http://nmsp.css.cornell.edu/projects/Nitrogenforcorn.asp>. For a stand-alone ISNT test interpretation, see the Cornell Field Crop Fertility Guidelines at: http://nmsp.css.cornell.edu/nutrient_guidelines/ (check out software tools).

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