

Nitrogen Management: Soil Amino Sugar Test

Soil amino sugar is highly correlated with responsiveness of soils to fertilizer-N. More amino sugar in soil decreases the response of corn to N fertilization.

Introduction:

In humid areas including Massachusetts, the result of soil N measurements prior to planting is not accurate and most often cannot predict N needs for the coming growing season. In these regions, using Pre-Sidedress Nitrate Test (PSNT) which predicts N supplying capacity of the soil during the entire growing season is recommended. This soil testing method is especially appropriate for those cropping system where producers are utilizing animal manure. However, using PSNT is not always accurate and convenient since: a) soil samples should be collected during busy growing season; b) it cannot be used in fields where nitrogen fertilizer or manure has been applied in a band application; c) may be much less accurate when used on sandy soils or soils with poor drainage; d) results may not be accurate if the weather condition is wet and cold and therefore, N release processes through bacterial activities is slow. That is why in some growing seasons under or over N fertilization occurs; even when management practices on a farm remain unchanged. While excessive N application increases the risk of environmental pollution as well as production costs, insufficient application of N may cause significant yield reduction.

Attempts have been made to introduce an alternative technique for determination of N sufficiency in soil for corn production. Ideally, a soil test for N would estimate the supply of organic N that gradually but continuously releases NO_3^- . This approach however, would be effective only if the organic N compounds are readily mineralized and highly correlated to fertilizer-N responsiveness.

Soil Amino Sugar Test (Illinois Soil N Test):

Most often, the total N content of soils is much higher than N available to the crop. The total soil N of an acre of soil is usually greater than 2,000 pounds per acre, while a high yielding corn hybrid in Massachusetts requires about 180 pounds per acre. Therefore, there must be some component of total soil nitrogen that acts as a reservoir for the growing crop.

Researches in Illinois reported that among various organic fractions in the soil, concentrations of amino sugar N is highly correlated with responsiveness of soils to fertilizer- N. In other words, accumulation of amino sugar N in soil reduces the yield response of corn to N fertilization. In these studies, soil concentrations of amino sugar N have shown a high correlation with both yield and fertilizer-N response.

For Soil Amino Sugar Test

- Soil samples should be collected from a depth of 8 inches.
- Sampling should be done 6-8 weeks after manure spreading or cover crop plow down to avoid any ammonium -N released in the soil by newly added organic materials.
- Results indicate organic N mineralization potential of the soil which is valid for 2-3 years. Therefore, when using this method, annual soil sampling is not needed.

How to Interpret the Results

When amino sugar N concentration of the soil is greater than 250 mg kg^{-1} , the corn plants most likely will not respond to additional N because there is enough readily mineralizable organic N in the soil. In this situation about 20-30 pounds of N in the starter fertilizer can be used. However, when amino sugar N concentration in the soil is less than 200 mg kg^{-1}

corn plants will most likely respond to N fertilizer application. The rate of N fertilizer can be determined as follows:

- 180 lbs N/acre for yield goal of 24 tons per acre, 160 lbs N/acre for yield goal of 20-24 tons per acre, and 140 lbs N/acre for yield goal of less than 24 tons per acre.
- Recommended N rates should be reduced if manure is applied in spring.
- Nitrogen credit from spring applied manure depends on rate of manure application, nutrient content of manure, and how fast manure was incorporated into the soil.
- Inorganic N in manure which accounts for almost half of the N is readily available after application. However, the rate of N release from organic N in manure is about 35, 12, and 5% in years 1, 2, and 3, respectively.
- As an example, if 6000 gallons of manure that contains 25 pound N per 1000 gallons was spread in spring and incorporated immediately into soil the total N credit for this season will be:

Inorganic N = $6000/1000 \times 25 \times 50\% = 75$ pounds

Organic N = $6000/1000 \times 25 \times 50\% \times 35\% = 26$ pounds

Total N credit = 101 pounds

The soil amino sugar test has potential economic implications for production agriculture, and also should be of value for controlling NO_3^- pollution of ground and surface water.

Resources:

Khan, S. A., R. L. Mulvaney, and R. G. Hoelt. 2001. A simple soil test for detecting sites that are nonresponsive to nitrogen fertilization. *Soil Sci. Soc. Am. J.* 65: 1751-1760.

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