Corn Stalk Nitrate Test (CSNT)

Recent increases in nitrogen (N) fertilizer costs have caused producers to strive for better use of the N already on the farm (manure, sods, cover crops, etc.) to meet N requirements of silage corn. However, at the end of the growing season, unless drastic yield losses are observed, it is often difficult to determine if the corn crop had enough N for optimum yield that growing season. An end-of-season stalk nitrate test for evaluation of the N supply during the growing season is useful as a management tool as it helps identify if adjustments in N management are needed in future years. In 1996 researchers at Iowa State University developed a new tissue test: the Corn Stalk Nitrate Test (CSNT).

Since it was first developed, the CSNT has gained use in several parts of the US and over the past three years we have tested its performance under New York growing conditions. In this fact sheet we summarize our research findings and give interpretations for New York soils and growing conditions.

Sampling procedure

Timing

For corn silage, samples could be collected starting one week prior to harvest until four days after harvest. Low CSNTs for 1st year corn can occur even if sufficient N from sod decomposition was available. We recommend CSNT sampling of 2nd or higher year corn only.

Method

The portion of the stalk used for the test is important as the test is calibrated for the nitrates that accumulate in this part of the stalk. First measure up 6 inches from the soil surface and cut the plant. Then measure 8 inches up from this first cut, and make a 2nd cut. These cuts result in an 8-inch sample taken from between 6 and 14 inches above the ground (see Figure 1). Make sure not to touch the soil with the corn stalk segment; contamination with soil will impact test results. Split each stalk into four parts by cutting it lengthwise using a clean kitchen knife. Discard 3 of the 4 quarters. This will quicken the drying process without compromising on the number of plants sampled. In a uniform field (≤15 acres in size), fifteen 8-inch segments should be randomly cut and combined to make one sample to be submitted for analysis. Areas differing in management or soil type should be sampled separately. Similarly, fields that are more than 15 acres large should be subdivided into smaller sampling units.

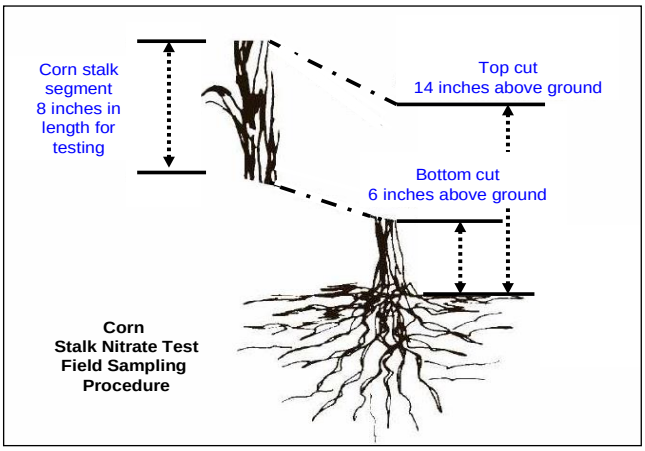

Figure 1: Sample an 8-inch segment of the corn stalk between 6 and 14 inches above the ground.

Sample submission

Samples can be stored in a fridge for several days but should be submitted as soon after collection as possible. Samples should be placed in a paper bag (not plastic). This allows for some drying to occur and minimizes growth of mold. See http://nmsp.cals.cornell.edu to download a sample submission form. Samples can be submitted for CSNT analyses to:

Quirine Ketterings
Nutrient Management Spear Program
Dept. of Animal Science, 323 Morrison Hall,
Cornell University, Ithaca NY 14853

Interpretation of test results

Research conducted in New York supports the following interpretations:

- Low = less than 250 ppm N
- Marginal = 250 to 750 ppm N
- Optimal = 750 to 2000 ppm N
- Excess = greater than 2000 ppm N

Low – Marginal – Optimal - Excess

Low (deficient)
Plants had difficulty accessing enough nitrogen in these fields. Nitrogen access was hindered by inadequate supply, root restrictions, lack of moisture, or nutrient deficiency interactions. At harvest time, leaves are dead to or above the ear leaf and/or the entire plant has a light to very light green color.

Marginal
In some years, yields could have been increased with some additional N. In those years, plants look like described as above. In other years, the N supply was sufficient. Since it is difficult to predict what kind of growing conditions a season will bring, farmers are advised to target CSNTs in the optimal range.

Optimal (sufficient)
Nitrogen availability was within the range needed for optimum economic production of corn. In this range, three of the five lower leaves will be dead by harvest time while the top leaves remain medium to dark green.

Excess
If the sample has more than 2000 ppm N, the corn had access to more N than it needed for optimum yield. Most likely, fewer than three leaves from the bottom will have died; the top leaves remain medium to dark green. If manure and/or N fertilizer was applied, the application(s) supplied more N than the crop needed that growing season.

Multiple Year Assessment
This test is not meant as a one time measurement; it is most effective when used for multiple years on the same field (or fields with similar histories) to determine how the fields respond to the way N is being managed. However, if fields test 3000 ppm or higher in CSNT, there will be opportunities to cut N application rates without impacting yield after just one year of results. Crop history, manure history, other N inputs, soil type, and growing conditions all impact CSNT results and crop management records that include these pieces of information can be used to evaluate CSNT results and determine where changes can be made.

Summary
The CSNT reflects N availability during the growing season. The greatest benefit of this test is that it allows evaluation and fine-tuning of N management for each specific field. It does, however, require multiple years of testing to gain experience with on-farm interpretation. Corn stalk nitrate test results >2000 ppm indicate excessive levels of available N during the growing season. If excess CSNTs occur multiple years in a row, consider lowering fertilizer and/or manure application rates.

Additional Resources:
- New York State Corn Nitrogen Calculator: nmsp.cals.cornell.edu/software/calculators.html
- Cornell Guide for Integrated Field Crop Management: www.fieldcrops.org.
- Cornell University Agronomy Fact Sheet #2: Nitrogen Basics – The Nitrogen Cycle. nmsp.cals.cornell.edu/guidelines/factsheets.html.
- Cornell Nutrient Guidelines for Field Crops: nmsp.cals.cornell.edu/guidelines/nutrientguide.html

Disclaimer:
This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

Cornell University
Cooperative Extension

Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

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2013 (updated)