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End-of-Season Corn Stalk Nitrate Test

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The End-of-Season Cornstalk Test, developed at Iowa State University (Blackmer & Mallarino, 1996), allows growers to conduct a "post-mortem" evaluation of the adequacy of their nitrogen program for the current growing season. The test is described as "post-mortem" because stalk samples are taken after the grain is physiologically mature. Given that this is a very late season test, the interpretation of the results offers no assistance in fine-tuning nitrogen (N) management for the current year, but rather provides insight into N management options for coming years.

The basis for the test lies in the fact that corn plants deficient for nitrogen will usually remobilize stored N from the lower portions of the stalk and leaves to the developing grain; resulting in lower stalk nitrogen concentrations at the end of the season. Plants that take up excessive amounts of soil nitrogen (more than is needed for maximum yields) will store excessive amounts in the lower stalk sections by the end of the growing season; resulting in higher stalk nitrogen concentrations.

The stalk nitrate test is probably best suited for identifying fields/situations where soil nitrogen uptake was excessive (no yield benefit) and, thus, costly to the grower and possibly the environment. Typical situations where N uptake may be excessive include manured fields or fields following alfalfa that received additional (and possibly unnecessary) nitrogen fertilizer applications for the subsequent corn crop. Some growers may be particularly interested in evaluating the adequacy of their N management program this year given the occurrence of multiple "monsoon" events that likely caused significant soil nitrate-N loss and nitrogen deficiency in the corn crop.

Sampling Procedures in the Field

The procedure for collecting stalk samples is fairly straightforward and reasonably speedy to perform in the field (Blackmer & Mallarino, 1996). Typically, samples should be collected one to three weeks after 80% of the kernels reach the kernel black layer stage (physiological maturity). Some fields throughout the state are mature now, but many more will reach that point of development over the next several weeks. If you are unfamiliar with staging kernel development in corn, take a look at my article on the subject (Nielsen, 2002).

Aim to sample areas within fields using spatial patterns similar to how you would collect soil samples. Within each area of the field, collect individual stalk segments from fifteen

representative plants as outlined below. Each group of 15 stalk segments will be combined into a single sample for that area of the field.

- Cut an 8-inch stalk segment from each plant, BEGINNING at the 6-inch mark above the ground. Remove any leaves and leaf sheaths from the segment.
    - Do not sample diseased stalks, unusually stunted plants, stalks damaged by hail or insects (e.g., European corn borer), or stalks with no ear or extremely small ears.
    - Keep the stalk segments as cool and clean as possible while you finish collecting the other samples.
- Place each group of 15 stalk segments into a paper (NOT plastic) bag for shipment to the testing laboratory.
    - Paper bags minimize mold growth during shipment and facilitate additional drying.
    - Samples should be refrigerated (NOT frozen) if stored for more than a day before mailing to the lab.
- Mail the stalk samples to a laboratory for nitrate analyses. Most soil testing labs will also conduct stalk nitrate tests, but be sure to check with your usual laboratory before collecting and mailing samples (Brouder, 2003).

Interpretation of Results

The results of the analytical tests for stalk nitrate content are usually reported in terms of parts per million (ppm) nitrate-N and their interpretation is fairly simple. Recognize, though, that the results merely indicate whether nitrogen uptake itself was inadequate, adequate, or excessive relative to the nutrient needs of the crop in the current growing season. The following categories for stalk nitrate values are based on field calibration research trials conducted across Indiana in 1996 and 1997 (personal communication w/ S. Brouder, Purdue Univ.) and differ slightly from those published by Blackmer & Mallarino (1996).

1. Low = Less than 450 ppm nitrate-N = High probability that nitrogen is deficient
2. Optimal = 450 - 2000 ppm nitrate-N = Yields are not limited by nitrogen
3. Excessive = Greater than 2000 ppm nitrate-N = Uptake exceeds requirements

The true value of this test comes from repeated observations over years for a given field. If a field regularly tests in the optimal range (450 – 2000 ppm), the grower's nitrogen program is evidently performing well. If a field is regularly identified as being low or inadequate (less than 450 ppm), then additional N fertilizer amounts may be justified in future years. Fields that regularly exhibit stalk nitrate values in the excessive category (greater than 2000 ppm) are likely candidates for lower investments in N fertilizer in future corn years. The use of the pre-sidedress soil nitrate test (Brouder & Mengel, 2003) may also be warranted for fields that regularly test in the excessive category for stalk nitrates in the fall.

Related References:

Blackmer, A.M. and A.P. Mallarino. 1996. **Cornstalk Testing to Evaluate Nitrogen Management (PM-1584).** Iowa State Univ. Extension. Available on the Web at: http://www.extension.iastate.edu/Publications/PM1584.pdf. [URL verified 9/9/03].

Brouder, S. 2003. **Directory of Certified Soil Testing Laboratories.** Purdue Univ. Extension. Available on the Web at http://www.agry.purdue.edu/ext/soiltest.html. [URL verified 9/9/03].

Brouder, S. and D. Mengel. 2003. **The Pre-sidedress Soil Nitrate Test for Improving N Management in Corn (AY-314-W).** Purdue Univ. Extension. Available on the Web at: http://www.agry.purdue.edu/ext/pubs/AY-314-W.pdf. [URL verified 9/9/03].

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