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UK COOPERATIVE EXTENSION SERVICE
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Corn Stalk Nitrate Test

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There is no preplant soil test for nitrogen (N) that gives a reliable, economically optimum N fertilizer recommendation for corn. Recommendations are based on previous trials and experiences on similar soil types, crop rotations, drainage, and tillage as well as time and method of N application. Although these previous trials and experiences are reliable, there remains a tendency by producers to increase N rates to ensure sufficiency. Corn plants show no visual symptoms for over-fertilization with N. This means that producers can apply too much N for years and never suspect a problem of over-fertilization. Many producers associate dark green plants with optimal rates of N and, therefore, fertilize to maintain green plants late in the growing season. Visual symptoms of leaf yellowing cannot always be used to determine if the corn is deficient of N. Even with adequate N fertilization, visual N deficiency symptoms often are observed on the lower leaves. With rapidly increasing N prices, it becomes economically advantageous to find the optimum N rate without applying excess amounts. An end-of-season corn stalk nitrate test is now available to help evaluate this year's N application rate and N management program for possible adjustments in the coming year.

This test has been calibrated in Iowa and is explained in Iowa State University Extension publication PM-1584, *Corn stalk testing to evaluate nitrogen management.* It is available on the Web at:

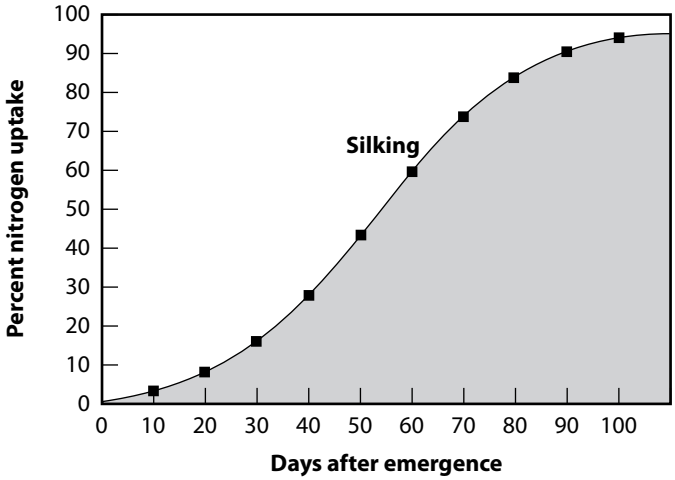
<http://www.extension.iastate.edu/Publications/PM1584.pdf>.

This method has also been tested in Kentucky and appears to be a good guide to help producers make needed adjustments in their N management program.

Basis for the Test

The corn plant begins to take up N rapidly about six weeks after emergence and continues to accumulate N in the stalk and leaves as the ear approaches formation (Figure 1). During the grain fill period, N moves from the leaves and stalk to the ear. If the plants have inadequate N available to them, they will leave very little N in the lower corn stalk and leaves during the grain-filling period. Corn plants that have more N than needed for maximum yields will accumulate nitrate nitrogen in their lower stalks by the end of the season.

Figure 1. A typical N uptake curve for corn.



The corn stalk nitrate test can be used at the end of the season to verify whether the N management program supplied sufficient N for optimum yields, or it can be used to compare alternative N management practices. The test cannot be used to fine-tune the N management program during the season of growth.

Collecting Corn Stalk Samples

Plant samples should be collected within a three-week period beginning at black layer formation. Nitrate nitrogen levels in the stalk will remain consistent over this three-week period. Later sampling may result in unreliable readings.

1. Randomly select 15 stalks per sample from the field.
2. Sample the fields in a manner similar to taking a soil sample. Take stalks that represent the area being sampled.
3. Avoid stalks affected by insects or diseases and stalks with small ears or no ears at all.
4. Remove sheaths.
5. Cut an 8-inch sample of stalk beginning 6 inches above the ground and terminating at 14 inches above the ground.
6. Place the samples in a paper sack, rather than plastic, to avoid mold growth or deterioration.
7. Immediately send samples to the laboratory for nitrate analysis. Most agricultural testing laboratories will perform this test.

The concentration of nitrate in the stalk at the end of the season is a reflection of many factors that influence N availability in the soil and N uptake by the plant. Therefore, it may be difficult to attain "optimal" status concentrations in the same field with the same N management each year. Lower concentrations might be found in years with excessive rainfall, resulting in large amounts of N losses, especially if all N is preplant applied. Higher concentrations might be found when low rainfall, diseases, insects, or other yield-limiting factors reduce yields. The goal of N management programs should be to obtain "optimal" status most years. After other contributing factors are considered (weather, rotations, N timing, disease, insects, etc.), the recommended N rate should be increased on the "low" fields and reduced on the "excess" fields. Although fields in the "marginal" status will not result in yield losses most of the time, small N fertilization increases should be made if a field tests in the marginal category most of the time.

Interpretation of test results.

Plant Nitrogen Status	Stalk Nitrate Nitrogen (ppm)	Interpretation
Low	0-250	High probability that N is deficient. Visual signs of N deficiency usually are apparent.
Marginal	250-700	N availability is close to "optimal" but could result in lower yields that will cause economic penalties.
Optimal	700-2000	High probability that yields are not limited by N availability. Visual sign of N deficiency on lower leaves are often observed in this range.
Excess	More than 2000	High probability that N is greater than needed for maximum yields.

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