

END OF SEASON CORNSTALK NITRATE TEST

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The End of Season Cornstalk Nitrate test (ECNT) is a tool to assess the overall nitrogen management on corn. As the name implies, this is a cornstalk tissue test done at the end of the season. Studies have shown that the nitrogen status of corn can be assessed by measuring nitrate concentrations in the lower portion of cornstalks. The tendency for NO₃-N to accumulate in cornstalks has long been of interest because high concentrations can be toxic to animals feeding on the stover. Conversely, NO₃-N is depleted from the lower portion of the mature cornstalks when N is deficient. The effects of N removal can be readily observed as "firing", the premature death of lower leaves.

An optimal range in stalk NO₃-N concentrations has been established by calculating cumulative returns to fertilizer investments. The results showed that the optimal range varied with the cost of fertilizer and value of grain. For conditions prevailing in the Corn Belt, a 700 to 2,000 ppm NO₃-N concentration is considered the critical optimal range. An obvious advantage of this test is that it does not require in-field reference strips to use as check plots.

Basis of the Test

The ECNT is a management tool that should interest all corn producers and all who advise corn producers. The calibration studies showed that small increases in rates of fertilization tended to produce one of two kinds of response. The first is an increase in yield with little or no increase in stalk nitrate concentration. The second is an increase in stalk nitrate concentration with little or no increase in yield. The first type of response indicates that supplies of available N were limiting plant growth at the end of the season; the second indicates that supplies of available N were not limiting growth during this period. Therefore, the test provides feedback as to the adequacy of N during the growing season. The concentration of NO₃-N in the stalk at the end of the season reflects all factors that influenced N availability and N needs during the growing season. Because many of the factors influence N availability after fertilizer is applied, it is unrealistic to expect any producers to attain optimal N concentrations in all fields in all years.

Interpreting Stalk Nitrate Data

Stalk nitrate concentrations can be divided into three general categories; LOW (less than 700 ppm NO₃-N), OPTIMAL (700 to 2000 ppm NO₃-N), and EXCESS (greater than 2000 ppm NO₃-N). The LOW range indicates high probability that greater availability of N would have resulted in higher yields. Visual signs of N deficiency usually are present when nitrate concentrations are in this range. The OPTIMAL range indicates high probability that N availability was within the range needed to maximize profits for the producer. The higher end of the optimal range is more appropriate when N fertilizer is relatively cheap and grain prices are relatively high. The lower end of the range is most appropriate when N fertilizer is relatively expensive and grain prices are relatively low. The EXCESS range indicates a high probability that N availability was greater than that required to maximize economic returns. Quite often the excess range is associated with over application of animal manures and N fertilizer.

How the Test is Done

The time for stalk sampling is between 2-3 weeks after physiological maturity or black layers have formed on about 80% of the kernels of most ears. The portion of each plant sampled is the 8-inch segment of stalk found between 6 and 14 inches above the soil. Remove leaf sheaths from the segments. Avoid stalks severely damaged by disease or insects. Collect 15 segments to form a single sample for analysis. Collect plants at random within an area not larger than 10 acres. Areas with different soil types or management histories should be sampled separately. Place samples in paper (not plastic) bags to allow some drying and minimize growth of mold, and send to a laboratory as soon as possible. Refrigerate samples (do not freeze) if stored for more than a day before mailing. Most soil testing laboratories will perform this test. The MSU Soil Testing Lab will charge \$12 per sample.

Who Should Use the Test

All corn producers should consider using the end of season corn stalk test (ECNT) on a few fields each year. Those who find their fields test in the optimal range need not make any N fertilizer adjustments. Those who find they consistently exceed 2000 ppm are usually applying too much N and will find it profitable to reduce N rates. Use of this test for a few years should help producers optimize N fertilizer rates for their fields. All producers who grow corn on manured soils should use the stalk test as most producers underestimate the amount of N supplies by animal manure. All producers who grow corn after alfalfa also should consider using the stalk test. The test procedure is illustrated in Figures 1-4. The Information collected from the samples can be recorded in Table 1.



Figures 1-4. End of season cornstalk test sampling procedure and interpretation

