CERTIFIED CROP ADVISER

End of Season Cornstalk Test

By Greg Patterson, *CCA*

Recent studies have shown that the nitrogen (N) status of a corn crop can be assessed by measuring nitrate concentrations in the lower portion of cornstalks at the end of the growing season. This finding led to the development of a new tissue test called the "end-of-season cornstalk test".

Why the test is needed

Recent surveys in Iowa using the late spring soil test and the end-of-season cornstalk test indicate that a high percentage of cornfields receive substantially more fertilizer N than is economically optimal. This means that many corn producers can increase their profits by identifying these fields and reducing rates on N fertilization accordingly.

The underlying reason for over-fertilization is that corn plants show no visual symptoms that enable producers to recognize when above-optimal rates on N have been applied. This means that producers can apply too much N year after year and never suspect a problem with their nitrogen management. The end-of-season cornstalk test makes it possible for producers to avoid this pitfall.

Many producers associate a dark green plant with optimal rates of fertilization, and they fertilize to maintain dark green plants late in the growing season. This practice needs to be questioned, because corn leaves tend to lose their deep green colour late in the season at economically optimal rates of fertilization. The end-of-season corn stalk test, therefore, helps producers distinguish between fertilizing to maximize greenness and fertilizing to maximize profits.

How the test is done

The time for sampling is between one and three weeks after 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. Leaf sheaths should be removed from the segments. Stalks severely damaged by disease or insects should not be used.

Fifteen 8-inch segments should be collected to form a single sample to be sent for analysis. Areas differing in soil types or management histories should be sampled separately. Collecting one composite sample from each of several small areas (less than an acre) that seem to be representative of larger areas within a field is an effective strategy.

Samples should be placed in paper (not plastic) bags to enable some drying and minimize growth of mold. The sample should be sent to a laboratory for analysis as soon as possible after collection. The time normally required to mail samples to a laboratory is not a problem. Samples should be refrigerated (but not frozen) if stored for more than a day before mailing. Concentrations are expressed as ppm (parts nitrate-n per million parts dry stover).

Interpretation of stalk nitrate concentrations

Stalk nitrate concentrations can be divided into four categories; low (less than 250 ppm N), marginal (250 – 700 ppm), optimal (700 to 2000 ppm N) and excess (greater than 2000 ppm N).

The low category indicates a high probability that greater availability of N would have resulted in higher yields. It should be noted that concentrations in this range give little indication of the magnitude of yield increase that might be expected from more available N. Visual signs of N deficiency usually are clear when nitrate concentrations are in this range.

The optimal category indicates a high probability that N availability was within the range needed to maximize profits for the producer. The higher end of this range is more appropriate when fertilizer N is relatively cheap and grain prices are relatively high. The lower end of the range is most appropriate when fertilizer N is relatively expensive and grain prices are relatively low. Some visual signs of N deficiency may be observed in this range. It is a matter of balancing input costs with potential returns from increased yields.

The excess category indicates a high probability that N availability is greater than if fertilizer N had been applied at rates that maximize profits for producers.

The concentration of nitrate 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 fertilizers are applied, it is unrealistic to expect any producer to attain optimal concentrations in all fields in all years. Indeed, experience has shown that the optimal range is difficult to consistently attain with existing management practices.

When interpreting the results of the test, consideration must be given to weather conditions that occurred during the growing season. Rates of fertilization that are most profitable over many years and in excess concentrations in other years.

Lower-than-desired concentrations should be expected in years having unusually large amounts of in-season rainfall that results in unusually large losses on N and (or) high yield potential. Higher-than-desired concentrations should be expected in years when unusually low rainfall limits N losses and (or) yield potential. It is possible that deficiencies of N early in the growing season sometimes limit yield potential in ways that are not directly indicated by the stalk test. Additions of more fertilizer than needed after such damage has occurred will result in concentrations of stalk nitrate that correctly indicate that higher rates of fertilizations would not have increased yields. This problem is avoided if enough N is applied before planting or if the late-spring soil test routinely is used to ensure that such deficiencies are unlikely.

After appropriate consideration is given for weather conditions, fertilization rates should be increased for areas that usually test in the low range and decreased on areas that usually test in the excess range. The test does not directly indicate how much N rates should be increased or decreased, but continued use of the test for several years enables producers to make adjustments toward optimal rates. Concentrations in the excess range indicate that use of the late spring soil test to guide N fertilization will probably increase profits for the producer.

Who should use the test

All corn producers should consider using the test on a few fields each year as especially producers who grow corn on manured soils or grow corn after alfalfa should use the stalk test. Recent studies indicate that most producers greatly underestimate the amount of N supplied by animal manures and alfalfa resulting in the application of unneeded fertilizer.

Those who learn that their fields usually test in the optimal range need not make larger investments in time or money. Those who discover that they usually apply too much N to some or all of their fields will find it profitable to adjust rates of application. Thoughtful use of the test for a few years should help producers optimize rates for their fields.

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This industry driven program helps ensure that Ontario crop producers are well served by those providing their crop production advice. This article was written by one of those CCA's.