Conducting Tissue Testing in Corn

Q. Why should a grower consider plant tissue testing in corn?

Tissue testing of actively growing corn plants during the growing season is a tool along with soil testing to help develop a fertility program. Tissue testing provides a snapshot of the plant's nutrient content at the time of sampling and is being used increasingly by growers who are pushing to maximize yield potential. Benefits of tissue testing are as follows:

- It is a troubleshooting tool to diagnose a suspected nutrient deficiency or reveal hidden nutrient stresses.
- Helps identify and monitor a crop's nutrient status and how well plants utilize the soil and applied nutrients.
- Serves as a check on the effectiveness of fertility programs.
- Helps to make more informed decisions on side-dress and foliar nutrient applications.
- Helps improve yield goals and determine future fertilizer needs.

Plant tissue testing can be used to improve your fertility program and help push corn yields to the next level.

Q. When should you conduct plant tissue testing?

Early samples can be collected while there is still time to apply nutrients to the current year's crop. Sampling later in the season can be used to evaluate the current crop and make nutrient adjustments for the next year. Taking multiple plant tissue samples throughout the growing season is recommended to monitor the crop's nutrient status and get the most benefit out of the testing. At a minimum, testing should be conducted three times starting at the V4 or V5 growth stage of corn, sometime between V9 and V12, and again at tasseling or early R1 (silking). Tissue samples can be taken later during reproductive growth of corn right up to when the crop is harvested. Testing in early reproductive growth could reveal a treatable deficiency, whereas later tests can help in the fine-tuning of nutrient levels in preparation for next year's crop.

Q. How should plant tissue samples be taken and prepared for testing?

A reliable tissue test requires sampling a certain plant part at a given stage of growth.

- Corn up to 12 inches tall (V5 corn is generally 8 to 12 inches tall) – sample the entire plant above ground cutting the stalk off about ½ inch above the ground level.
- Corn more than 12 inches tall but prior to tasseling (V6 to V18 corn) – sample the first fully-developed leaf from the top (first leaf below the whorl) cutting the leaf at its base where it joins the sheath.
- Corn that has tasseled through reproductive growth (VT to R6 corn) – sample the leaf below the top ear cutting the leaf at its base where it joins the sheath.

Sampling should be from no less than 20 plants randomly selected in the area or field to be represented by the testing, combining them into one composite tissue sample. In problem fields where there is a need to compare different areas, samples should be collected separately from both the affected plants and adjacent normal plants at the same growth stage. Combine testing with a soil sample taken in the same location which

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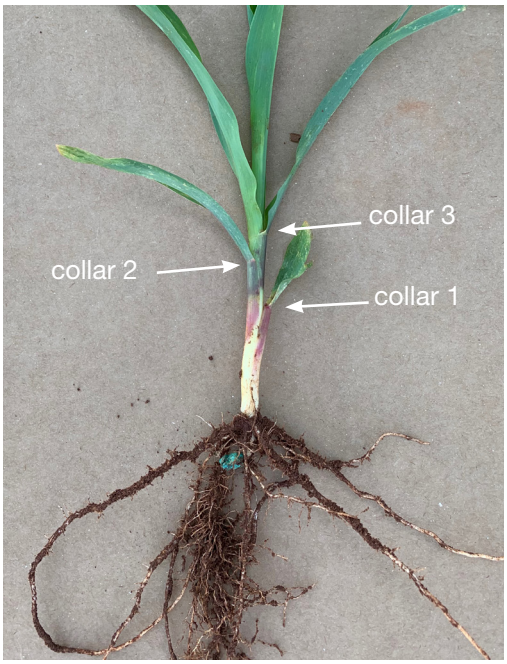

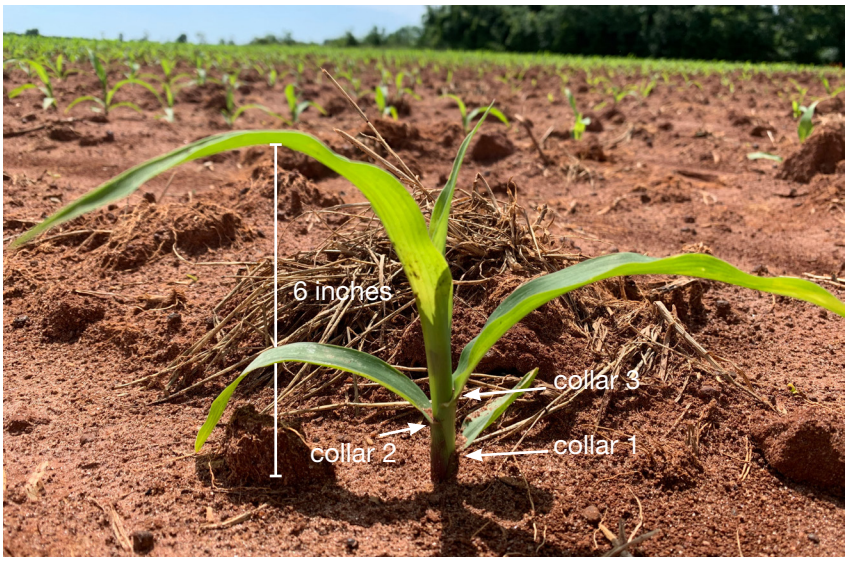

Figure 1. Corn plants in the V3 growth stage showing 3 visible leaf collars and a plant height of 6 inches measured from the soil surface.

will provide more data to draw conclusions and make better decisions. Be consistent when taking multiple samples throughout the growing season by sampling the same areas in the field on the same time of day every time you pull samples.

Testing laboratories provide the materials and instructions for proper sampling and shipping of plant samples. It is important to clean plant samples if they are contaminated with soil, fertilizer, or spray residues by lightly washing with distilled water or following laboratory directions. Air dried samples should be shipped as soon as possible to the testing laboratory. Samples can be placed in a refrigerator if shipping is delayed (never freeze samples). Recommend sampling is on Monday morning, shipping that afternoon or the next day, and you should have results back by the end of the week.

Q. How should you interpret plant tissue testing results?

Plant tissue testing results can be compared to levels of sufficiency for nutrients that have been established by research or surveys (Table 1).

Sufficiency ranges are nutrient concentrations that are considered adequate for high yields. However, the ranges do not provide exact break points between a nutrient being sufficient, deficient, or toxic. A nutrient level test result should be evaluated as to where it is positioned relative to the middle of the range. If the result is close to the low end of the range, there is a greater chance of crop response by adding more of the nutrient. If the result is close to the high end of the range, adding more of the nutrient probably would not be of benefit. Laboratory reports generally indicate whether the individual nutrient level for the crop at the sampled growth stage is deficient, low, sufficient, high, or very high.

Tissue testing results need to be evaluated with caution to prevent erroneous interpretations. It is important to understand that crop nutrient levels vary during the growing season and nutrient uptake can be influenced by location, corn product or hybrid, and soil test levels. Stress caused by drought, excess moisture, pests or diseases, or severe deficiency of other nutrients can also influence the growth of plants and their uptake of nutrients. These factors should be considered when interpreting

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Table 1. Plant tissue sufficiency levels for field corn.				
Nutrient	**12 inches tall or smaller[1]**	**Pre-tassel[1]**	**Tassel to Silk[1]**	**Mature[2]**
%N	3.5-5.0	3.0-3.5	2.7-4.0	2.5-3.5
%P	0.3-0.5	0.25-0.45	0.25-0.5	0.25-0.5
%K	2.5-4.0	2.0-2.5	1.7-3.0	1.6-2.5
%Ca	0.3-0.7	0.25-0.5	0.21-1.0	0.2-0.8
%Mg	0.15-0.45	0.13-0.3	0.2-1.0	0.12-0.5
%S	0.15-0.5	0.15-0.5	0.21-0.5	0.12-0.4
ppm B	5-25	4-25	5-25	3-20
ppm Cu	5-20	3-15	6-20	4-20
ppm Fe	50-250	10-200	20-250	30-250
ppm Mn	20-300	15-300	20-200	15-150
ppm Zn	20-60	15-60	25-100	16-50

[1]Taken from Plant Tissue Sufficiency Levels of Row Crops, A&L Great Lakes Laboratories Fact Sheet #35.

[2]Taken from Reference Sufficiency Ranges for Plant Analysis in the Southern Region of the United States, Southern Cooperative Series Bulletin #394.

Note important ratios: The N:S ratio should be between 10 and 15 at all growth stages for optimum yields. Sulfur is limiting at N:S ratios greater than or equal to 18.

NOTE: Nutrient sufficiency level ranges can vary by location. Consult with your state extension specialists for plant tissue testing information pertinent to your area

plant tissue test results. It is often better to look at the results across multiple tissue tests taken in a growing season and make interpretations based on the trends for a given nutrient.

Tissue testing interpretation can help with decisions about nutrient applications such as nitrogen and micronutrients. Tissue tests also provide consistent interpretation data for making decisions on applications of potassium and phosphorus. Deficiencies of most micronutrients and sulfur are identified more accurately by plant tissue analysis than by soil tests. Tissue testing results prior to side-dressing and corn silking can be used to make adjustments in side-dress applications and foliar feeding of nutrients. The best timing for foliar fertilizer applications is around the yield-determining growth stages of V4-V5, V8-V12, and tassel initiation in the whorl. Conducting tissue tests around these timings helps to make more informed decisions about fertilizer applications in both the current and next year's crop. If a nutrient application is needed to address a deficiency, macronutriets (N, P, K, and S) are generally applied to the soil, whereas, micronutrients (B, Zn, Fe, Mo and Mn) are usually applied as foliar application. If foliar applications are to tank-mixed with a herbicide, consult the herbicide label for compatibility information.

Tissue testing is not better than soil testing as a diagnostic tool and should be only used to compliment and not substitute widespread use of soil testing. Tissue testing can be most useful when there are areas within a field that look normal and areas with poor growth or symptoms that could be related to nutrient supply. Both plant tissue and soil testing should be conducted in normal and poor areas to best diagnose the situation. Fertility plans are best made with the use of a combination of soil and plant tissue testing.

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Contact your local agronomist, trusted agronomic adviser, state extension office, or use laboratory services for recommendations and assistance when interpreting plant tissue test results.

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