Cornell University
Cooperative Extension

Agronomy Fact Sheet Series **Fact Sheet 55**

Tissue Testing for Corn, Alfalfa, and Soybeans

Plant tissue testing is a technique that is used to monitor nutrient status and diagnose nutrient deficiencies of crops. Tissue testing is most common for high value crops, such as fruit trees, grapes and berries, but in recent years it has become more popular for a wider variety of crops, including corn, alfalfa and soybeans. Plant tissue analysis can be used to determine levels of essential nutrients such as nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, copper, zinc, boron, manganese, sodium, chlorine, molybdenum, and cobalt. For many of these nutrients a soil test can indicate the likelihood of a crop response to additional nutrients. Plant tissue testing is used to evaluate if these nutrients are actually being taken up in adequate amounts by the crop (sufficiency), or if there is a shortage (deficiency). Some nutrients are of particular concern for field crops grown in New York. These include zinc and nitrogen in corn, sulfur and boron for alfalfa, and sulfur in soybeans. Tissue testing early in the season allows a crop manager to detect and correct deficiency problems before they affect yield or crop quality. If samples are taken later in the season, the tissue test can guide fertility management for the following season.

This fact sheet provides information on proper sampling procedures and sufficiency ranges for tissue testing of corn, alfalfa and soybeans.

Sampling at the proper time

Because sufficiency ranges vary depending on the development stage of the plant and specific plant part sampled, it is important to follow the sampling instructions carefully and to use the corresponding interpretation range (see Table 1).

When a deficiency symptom is visible, it is recommended to sample affected *and* healthy plants in the same field and to analyze these samples separately. Comparing healthy plants and affected plants can help guide the diagnosis. If possible, take samples as soon as symptoms occur so that the problem can be corrected quickly.

What to collect

Samples should be taken during mid-morning to mid-afternoon when leaves are dry. Table 1 lists the specific plant parts that should be collected for each of the growing stages of that crop.

Table 1: Stage to sample, parts to collect and the number of samples required for corn, soybeans and alfalfa.

When to sample	What to sample	How many?
Corn		
Seedling stage	Whole plant 1/2 inch from the bottom up	15 plants
Prior to tasseling	Most recently unfurled leaf below the whorl	15 leaves
Silking	Ear leaf	15 leaves
Soybeans		
Prior to flower, early bloom, and prior to pod set	For all 3 stages collect leaf from most recently developed trifoliate	25 plants
Alfalfa		
Early bloom	Top 6 inches or top 1/3 of plant	12 to 30 plants

Avoid collecting samples immediately after rain events, or sampling of plants that are diseased or dead, impacted by insect damage or mechanically injured, stressed from too much or too little moisture, extreme heat or cold, or samples taken from headlands and other border rows in the field. Also avoid the use of a metal container to collect or transport samples (the metal can contaminate the sample).

It is recommended to collect a soil sample along with the tissue samples. Soil sampling can supplement the tissue sample results by providing information such as soil pH, organic matter, and plant available nutrients. Soil samples and plant tissue samples together can provide a powerful diagnostic analysis of nutrient deficiencies in the field.

Table 2: Sufficiency ranges for corn, soybeans and alfalfa. Macronutrients recorded as percent (%) and micronutrients as parts per million (ppm).

	Macronutrients (%)					
	Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulfur
Corn						
Seedling stage	3.50-5.00	0.30-0.50	2.5-4.0	0.30-0.70	0.15-0.45	0.15-0.50
Prior to tasseling	3.00-3.50	0.25-0.45	2.0-2.5	0.25-0.50	0.13-0.30	0.15-0.50
Silking	2.75-3.50	0.25-0.50	1.7-2.5	0.20-1.00	0.20-0.60	0.20-0.50
Soybeans						
Prior to flower	4.70-6.10	0.30-0.50	2.0-3.0	1.00-1.50	0.03-0.60	0.20-0.50
Early bloom	4.25-5.50	0.25-0.50	1.7-2.5	0.35-2.00	0.25-1.00	0.20-0.40
Prior to pod set	4.00-5.50	0.25-0.50	1.7-2.5	0.35-2.00	0.25-1.00	0.20-0.40
Alfalfa						
Early bloom	3.75-5.50	0.25-0.70	2.0-3.50	1.75-3.00	0.20-0.60	0.25-0.50

	Micronutrients (ppm)				
	Boron	Copper	Iron	Manganese	Zinc
Corn					
Seedling stage	5-25	6-20	40-250	25-160	20-60
Prior to tasseling	4-25	3-15	10-200	15-300	15-60
Silking	4-25	6-20	20-250	20-150	20-70
Soybeans					
Prior to flower	30-60	7-15	50-400	20-150	25-60
Early bloom	20-50	10-30	50-350	21-150	20-50
Prior to pod set	20-55	10-30	50-350	20-100	20-50
Alfalfa					
Early bloom	30-250	10-30	30-250	30-100	20-70

Cleaning/Washing the sample

Samples should be cleaned if soil, dust, fertilizer, or spray residues are present, as these residues can cause inaccurate results. Samples can be cleaned most easily using a dry brush or a quick wash with a P-free detergent solution and then distilled water (this can be purchased in grocery stores). Prolonged washing can cause nutrient leaching and should be avoided. Let samples (air) dry before mailing but do not expose them to direct sunlight. Use paper bags to mail the samples. Record where and when samples were taken and mail them to the laboratory as soon as possible (ideally within 24 hours).

Interpreting the results

Sufficiency ranges refer to the range of nutrient concentrations in which no yield reduction is expected. Table 2 shows the sufficiency ranges for corn, soybeans and alfalfa for the various growth stages.

Summary

Tissue testing can be a useful diagnostic tool for management of corn, alfalfa and soybeans. Proper collection of a tissue sample is essential; the most important factors for collecting samples include sampling at the proper stage of growth and collecting a large and representative sample. Tissue testing will enable effective troubleshooting of nutrient deficiencies and can help with implementation of management changes that can prevent problems from occurring in future crops.

Additional Resources

- Plant Nutrition Manual by J. Benton Jones, Jr. CRC Press LLC. www.crcpress.com.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

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