Colorado State University
Extension

Plant Analysis

Fact Sheet No. **0.116** Crop Series | **Production**

by J.R. Self*

Plant analysis can be a valuable tool in determining the general nutritional status of crops. It can be particularly helpful in diagnosing nutritional deficiency symptoms because various elements have similar visual symptoms. In some cases, symptoms that appear to be caused by nutrient deficiencies may actually be caused by other factors such as disease, herbicide residues, insects, high or low temperature, or too much or too little moisture.

Plant analysis should not be confused with tissue testing. For tissue testing, a special kit is used in the field to test plant nutrients in the cell sap of certain plant parts. Tissue tests are quick but largely qualitative. These tests can reveal which elements are excessive or deficient but cannot measure the magnitude of the excess or deficiency. For plant analysis, the whole plant or particular plant parts are analyzed quantitatively. In addition, the results of plant analysis are reported as precise numerical concentrations that can be compared to previously established critical levels and sufficiency ranges.

Collecting and Handling Tissue Samples

Plant sampling is often the most limiting factor in a successful plant analysis program. Exercise extreme care when selecting the plant part to be sampled. A large variation in nutrient concentrations exists among different parts on the same plant. Proper sampling requires that a definite plant part be taken, such as a particular leaf, group of leaves, or portion of a plant at a specified time in the plant growth cycle. When no specific sampling instructions are given, the rule of thumb is to sample the most recently matured leaves. Young emerging leaves, older mature leaves, and seed are not considered suitable plant tissues for analysis since they do not ordinarily reflect the general current nutrient element status of the whole plant. The recommended time to sample many plants usually occurs just prior to the beginning of the reproductive stage.

Accurate analysis requires that plant tissue samples be carefully collected and handled prior to shipment to the laboratory. Elemental composition of plants varies with age, the portion of the plant sampled and numerous other factors. Therefore, it is essential to follow standard sampling procedures (See Table l). Plan to collect enough plant material to fill a sandwich-size bag.

Once the plant is sampled, proper handling of the sample becomes of utmost importance. If the plant to be sampled is dusty, dust off with a light brush or wash to remove contaminants. Caution should be practiced as some nutrients can be leached out of the sample contaminated by water. Use distilled water if possible. In order to prevent spoilage of the plant material, it is important that the sample be thoroughly air-dried prior to mailing to a laboratory for analysis. Fresh plant tissue decomposes rapidly when placed in polyethylene bags or tightly-sealed containers unless kept under refrigeration. Place samples in a clean paper or cloth container. Close and seal the shipping container to avoid contamination.

Interpreting Analysis

The success of plant analysis as a diagnostic technique depends on the interpretation of the test results. The procedure used by many plant analysis laboratories is to compare the elemental concentration found in the plant tissue against a sufficiency range found in normal plants as established by research. Plant analysis has not been conducted to establish "sufficiency ranges" for crops grown in Colorado. However, plant analysis is very

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Quick Facts

- The Colorado State University Soil, Water and Plant Testing Laboratory provides a plant analysis service.
- It is often easier to diagnose nutritional disorders if a plant sample is taken from both good and poor areas within a field.
- Soil samples taken from both good and poor areas within a field, along with plant samples, can increase the chances of determining the problem.
- Accurate plant analysis requires that plant tissue samples be carefully collected and handled prior to shipment to the laboratory.

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Table 1. Plant sampling instructions.

Plant	Stage of Growth	Plant Part to Sample	No. of Plants to Sample
Corn	Less than 12 inches tall	Whole plant	20-25
	12 inches to pre-tassel	Uppermost fully developed leaf	25-30
	Tasseling to silk initiation	Leaf below and opposite ear leaf	25-30
Small grain and forage grasses	Seeding to heading	Whole plant	80-100
	Early heading	Top 4 leaves	80-100
Alfalfa or clover	1/10 bloom	Top 6 inches of plants	40-50
Soybeans	Initial flowering to pod set	Uppermost fully developed trifoliate leaf	40-50
Sunflowers	Prior to or at early flowering	Uppermost fully developed leaf	25-30
Grain sorghum	Prior to head emergence	2nd fully developed leaf	25-30

useful in identifying plant growth problems resulting from nutrient stress if paired plant samples can be taken from both good and poor areas in the field where the same variety, soil moisture and environmental conditions exist.

Summary

1. It is often easier to diagnose nutritional disorders if a plant sample is taken from both good and poor areas within a field.
2. Soil samples taken from both good and poor areas within a field, along with plant samples, can increase the chances of determining the problem.
3. Severely nutrient-deficient plants can have erratic nutrient concentrations in the tissue due to growth under severe stress. In fields with deficient plants, it can be helpful to sample some plants that are normal or nearly normal but growing near deficient plants.
4. In some cases, extreme plant stress such as drought, heat, cold, insects or disease can cause excessive variation in the nutrient concentrations of plant tissue.
5. When sending plant samples to a lab for problem diagnosis, also send a note listing conditions under which the plants were growing such as soil type, moisture, position on the landscape, cropping history, fertilizer and chemicals applied this year and in recent years and a description of the problem.
6. Even though it is often too late to fertilize after deficiencies are discovered through plant analysis, it is important to recognize a problem exists so corrective fertilizer applications can be made for the next crop.
7. Yield losses due to a nutrient deficiency usually occur before the deficiency is severe enough to cause visual symptoms.

Colorado State University provides a plant analysis service. The routine analysis for plants costs $48.00 and includes NO_3-N, N, P, K, Zn, Fe, Cu, Mn, Ca, Mg, Na and B, and sulfur. Samples should be sent to: Soil, Water and Plant Testing Laboratory, Room A319 Natural and Environmental Sciences Building, Colorado State University, Fort Collins, CO 80523-1120. (303) 491-5061, www.soiltestinglab.colostate.edu.