



## Plant Analysis in Today's Agriculture

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Over the past 25 to 30 years, the popularity of plant analysis or tissue testing has gone through several popularity cycles. This analytical tool is still important in modern agriculture. The reason for this importance, however, has changed.

When this diagnostic tool was introduced, it was intended to either help diagnose nutrient related problems or monitor the nutrient status of high-yielding crops. In today's agriculture, nutrient deficiencies are not common. Therefore, the use of plant analysis as a diagnostic tool has diminished. Nevertheless, the value of plant analysis as a monitoring tool remains.

Technologies and procedures used in the collection of plant samples vary with the intended purpose. Suggested procedures for the diagnosis and monitoring purposes are discussed separately.

When used as a **diagnostic tool** we expect plant analysis to identify a nutrient deficiency if one is expected or confirm a deficiency that is suspected. In these situations, we are usually faced with normal and stunted and/or off-colored plants in the same field. The normal tendency of individuals is to collect the stunted plants and conduct an analysis of the plant tissue. Plant sampling, however, is more complicated if we expect tissue analysis to be an effective diagnostic tool. Three samples are needed if a nutrient deficiency problem is to be effectively identified. One sample of whole plants should be collected from the stunted area. A second sample should consist of whole plants collected from a marginal area where there is a slight reduction in growth or where the plants are slightly stunted. Plants that are normal and healthy should be used for the third sample.

An analysis of nutrient concentration only is usually not effective in diagnosing many problems. Calculation of nutrient uptake is a better choice. Why? Nutrients, even though one or more may be deficient, are usually more concentrated in stunted plants. For example, the concentration of nitrogen may be higher in plants that are 12 inches in height compared to plants that are much taller. The nitrogen is simply diluted by carbohydrates in plants that are much taller.

So, calculation of nutrient uptake is a better approach. In order to calculate nutrient uptake, it's necessary to: 1) dry the whole plants collected, 2) get an accurate weight, and 3) complete an analyses of the plant material. Nutrient uptake is calculated by multiplying plant dry weight by nutrient concentration. Knowing the number of plants sampled, uptake for an individual plant can be determined.

To measure nutrient uptake there must be access to an oven that will dry a sample rapidly and a scale or electronic balance that can measure small differences in weight. So, some planning is needed if there is intent to calculate nutrient uptake.

In diagnostic situations, soil samples should be collected whenever and wherever plant samples are collected. Analysis of soil samples can often provide a good indication of nutrient deficiencies. By comparing the results of the analysis of soil samples collected from the three locations described above, suspected nutrient deficiencies can be confirmed or rejected.

If intended as a **monitoring tool** plant analysis is used to assess the nutrient statuses of plants in relation to the fertilizer program used. If used for this purpose techniques for sample collection are different. This discussion will focus on corn and soybeans.

Since the results of the plant analysis will be compared to known standards, parts of plants are sampled at a certain stage of development.

**Table 1. Normal expected range in nutrient concentration in corn leaf tissue collected at silking.**

Nutrient	Expected Range
nitrogen (N), %	2.7 to 3.5
phosphorus (P), %	0.2 to 0.4
potassium (K), %	1.7 to 2.5
sulfur (S), %	0.1 to 0.3
calcium (Ca), %	0.4 to 1.0
magnesium (Mg), %	0.2 to 0.4
boron (B), ppm	4 to 15
copper (Cu), ppm	3 to 15
iron (Fe), ppm	50 to 200
manganese (Mn), ppm	20 to 250
zinc (Zn), ppm	50 to 150

**Table 2. Normal expected range in nutrient concentration in soybean trifoliate collected at early to mid-bloom.**

Nutrient	Expected Range
nitrogen (N), %	4.26 to 5.50
phosphorus (P), %	0.26 to 0.50
potassium (K), %	1.71 to 2.50
calcium (Ca), %	0.36 to 2.00
magnesium (Mg), %	0.26 to 1.00
boron (B), ppm	21 to 55
copper (Cu), ppm	10 to 30
iron (Fe), ppm	51 to 350
manganese (Mn), ppm	21 to 100
zinc (Zn), ppm	20 to 50

For corn, a sample of 10 to 12 leaves is needed. These leaves are collected at silk emergence when pollen is falling. The leaf sampled should be the one on the opposite side of the stalks and below the emerging silk. Timing of sample collection for corn is important. Samples should be collected before the silks turn brown. Nutrient concentrations decline substantially after this point in the life cycle and recognized standards cannot be used for comparison.

For soybeans, a sample of the most recently matured trifoliates collected at early to mid-bloom is the standard. The sample collected should consist of 30 to 50 trifoliates.

The results of the analysis of these tissue samples are compared to standards that are summarized in Tables 1 and 2.

Plant analysis, if used correctly, can be a useful management tool in modern agriculture. To get good information, stop and think before sample collection. Are samples being collected to diagnose a problem or to monitor the results of a fertilizer program?

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