News Column

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Plant analysis for testing nutrient levels in soybeans

When crop fields appear variable, one question commonly asked is whether this is due to a nutrient problem. An excellent tool that can be used to answer this question is plant analysis or tissue testing.

For corn, soybean, wheat, and other crops, there are two primary ways plant analysis can be used: as a *routine monitoring tool* to ensure nutrient levels are adequate in the plant in normal or good looking crops, and as a *diagnostic tool* to help explain some of the variability and problems we see in soybean growth and appearance in fields.

Plant analysis as a routine monitoring tool

For monitoring nutrient levels purposes, collect 20-30 sets of the upper, fully developed trifoliate leaves, less the petiole, at random from the field anytime between flowering and initial pod set (growth stages R1-4). The top fully developed leaves are generally the dark green leaves visible at the top of the canopy, which are attached at the second or third node down from the top of the stem.

Sampling later, once seed development begins, will give lower nutrient contents since the soybean plant begins to translocate nutrients from the leaves to the developing seed very quickly. Sampling leaf tissue under severe stress conditions for monitoring purposes can also give misleading results and is not recommended.

The sampled leaves should be allowed to wilt overnight to remove excess moisture, placed in a paper bag or mailing envelope, and shipped to a lab for analysis. Producers should not place the leaves in a plastic bag or other tightly sealed container, as they will begin to rot and decompose during transport, and the sample won't be usable.

Which nutrients should you request analysis?

In Kansas, nitrogen (N), phosphorus (P), potassium (K), sulfur (S), zinc (Zn) and iron (Fe) are the nutrients most likely to be deficient in soybeans. Normally the best values are the "bundles" or "packages" of tests offered through many of the labs. The packages can be as simple as N, P and K, or can consist of all the mineral elements considered essential to plants. K-State offers a package that includes N, P, K, Ca, Mg, S, Fe, Cu, Zn, and Mn for $32.00.

The data returned from the lab will be reported as the concentration of nutrient elements, or potentially toxic elements in the plants. Units reported will normally be in terms of "percent" for the primary and secondary nutrients (N, P, K, Ca, Mg, and S) and "ppm," or parts per million, for the

micronutrients (Zn, Cu, Fe, Mn, B, Mo, and Al). Most labs/agronomists compare plant nutrient concentrations to published sufficiency ranges. A sufficiency range is simply the range of concentrations normally found in healthy, productive plants during surveys.

Table 1 gives the range of nutrient content considered to be "normal" or "sufficient" for top, fully developed soybean leaves at early pod set. Keep in mind that these are the ranges normally found in healthy, productive soybeans.

Table 1. Nutrient content considered "normal" or "sufficient" for soybeans

Nutrient	**Units**	**Growth Stage** (Top, fully-developed leaves at pod set)
Nitrogen	%	4.25-5.50
Phosphorus	%	0.25-0.5
Potassium	%	1.70-2.50
Calcium	%	0.35-2.00
Magnesium	%	0.26-1.00
Sulfur	%	0.15-0.50
Copper	ppm	10-30
Iron	ppm	50-350
Manganese	ppm	20-100
Zinc	ppm	20-50
Boron	ppm	20-55
Molybdenum	ppm	1.0-5.0
Aluminum	ppm	<200

Plant analysis as a diagnostic tool

Plant analysis is an excellent diagnostic tool to help understand some of the variation seen in the field. When using plant analysis to diagnose field problems, producers should try to take comparison samples from both good/normal areas of the field, and problem areas. Collect soil samples from the same good and bad areas, and don't wait for flowering to sample soybeans. Early in the season, when plants are 8-10 inches tall, collect whole plants from 15 to 20 different places in the sampling areas. Later in the season, collect 20-30 sets of top, fully developed leaves. Handle the samples the same as those for monitoring, allowing them to wilt to remove excess moisture, and avoiding mailing in plastic bags.

Soil samples are important in diagnostic work, because while a plant may be deficient in a nutrient, it may not be due to a shortage in the soil. Other factors such as soil compaction, insect or disease damage to the roots, low pH limiting nodulation, or many other issues can limit nutrient uptake in soybeans.

Plant samples can be sent to the K-State Soil Testing Laboratory for analysis at:

K-State Research and Extension
2308 Throckmorton PSC
1712 Claflin Rd.
Manhattan, KS 66506-5503

For more information on plant analysis testing, including available tests, forms, and costs, please visit the K-State Soil Testing Lab website at:
http://www.agronomy.k-state.edu/services/soiltesting/index.html

Summary

In summary, plant analysis is a good tool producers can use to monitor the sufficiency of soil fertility levels and inoculant effectiveness, and a very effective diagnostic tool. Producers should consider adding this to their toolbox.

Information provided by Dorivar Ruiz Diaz, Extension Soil Fertility Specialist.