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Agronomic Crops

CLEMSON COOPERATIVE EXTENSION

Soybean Tissue Sampling

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Introduction

One of the most important factors in growing a successful soybean crop is fertility and nutrient status of the crop during the growing season. Tissue sampling can be a great tool to use during the growing season to either diagnose suspected plant nutritional problems or to monitor the overall effectiveness of the fertility program.

Many companies are promoting in- season tissue sampling of crops in order to monitor the nutritional status during the growing season. Tissue sampling is used in many high yield situations for this purpose. However, the most effective use of tissue sampling is in the form of a diagnostic testing used to detect and/or confirm nutrient deficiencies in the soybean crop.

It should be noted that tissue sampling should never replace soil sampling for establishing the overall fertility program regardless of the crop being grown. The full benefit and effectiveness of a tissue sampling program should be used in conjunction with a soil sampling program. Utilization of both sampling procedures will often help detect problems and assist in planning future fertility programs. Often times a tissue sample can be misleading as there can be additional factors other than soil fertility which can influence nutrient uptake into the soybean plant. Factors such as soil pH, soil compaction, herbicide damage, wet conditions, drought, cloudiness, insect damage, and disease can affect nutrient uptake in the plant. These factors may result in the crop appearing deficient when in actuality there are plenty of available nutrients in the field. Tissue sampling is one of the many steps in the process of determining the overall problem. As with any crop issue, producers must determine the cause before trying to cure the problem.

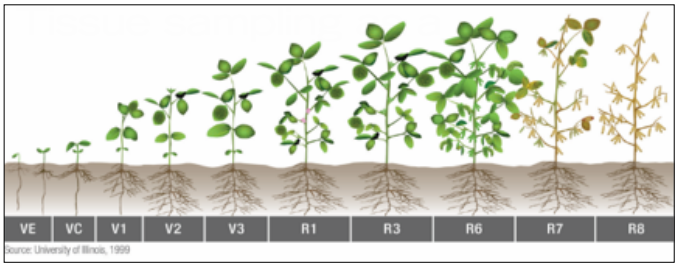

Figure 1: Soybean Growth Stages (University of Illinois)

Diagnostic Tool

One of the tools available to diagnose nutritional problems is tissue sampling. It is critical for accurate diagnosis that correct plant parts are collected for testing according to growth stage of the soybean plant.

If sampling plants in the seedling to early vegetative stage of growth, it may be necessary to sample the entire plant above ground. Collect 25-30 plants in the area to be sampled. If sampling later on in the vegetative stages to early reproductive stages (R1 or R2) collect the most recently matured trifoliate leaves (not including the petiole) from one of the top 3 or 4 nodes of the plant (see figure 2). This should be done on 20-25 plants in the trouble area. Ideally when testing an area for a diagnostic problem separate samples should be taken from healthy portions as well as problem areas of the field. Just sampling the problem area may not provide the most accurate results as those plants may have been nutrient deficient for a long period of time, and may not give an accurate representation of current nutrient availability in the field. The healthier looking plants in the field may give a better assessment of the potential nutrient issues affecting the soybeans. If it is at all possible, it is also a good idea to take a third sample of soybeans in the same field that may be just beginning to show signs of nutrient deficiency. This will give a good comparison of healthy beans, problem beans, and beans in between. It is critical that each of these samples be properly labeled as from which portion of the field they were taken. In addition to the tissue samples, soil samples should also be taken next to the same plants as the tissue samples were taken. The soil samples will

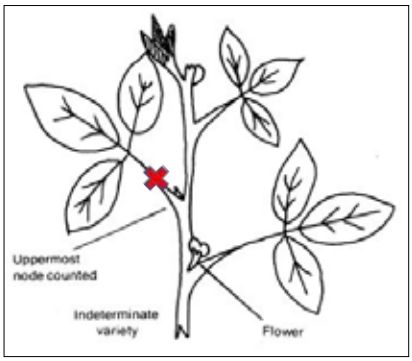

Figure 2. For R1-R2 growth stage, sample fully expanded trifoliate leaves (top three or four nodes). Exclude petiole

better allow for interpretation of the overall fertility status in the field and will aide in determining the ultimate cause of the nutritional problem. As with the tissue samples, the soil samples should be properly labeled so that they correspond to the tissue samples taking from the field.

Collecting two to three different samples in the field gives the ability to do in-field comparisons as well as provides adequate samples to compare against the Nutrient Sufficient Range for Soybeans.

Table 1. Suggested Sufficiency Ranges for Early Growth Soybeans. (Sabbe et al., 2000)

Macronutrients					
N	P	K	Ca	Mg	S
3.5-	0.30-	1.7-	1.1-	0.30-	
5.5%	0.60%	2.2%	2.5%	0.60%	

Table 2. Suggested Sufficiency Ranges for Flowering Soybeans (R1-R2) based on samples from fully expanded trifoliate leaves from top three or four nodes. (Sabbe et al., 2000)

Macronutrients					
N	P	K	Ca	Mg	S
3.25-	0.30-	1.5-	0.8-	0.25-	0.25-
5.0%	0.60%	2.25%	1.4%	0.70%	0.60%

Micronutrients				
Fe	Mn	Zn	Cu	B
25-300	17-100	21-80	4-30	20-60
ppm	ppm	ppm	ppm	ppm

Table 1 and Table 2 give the sufficient nutrient range for soybeans in the early vegetative stage and for soybeans in the R1 – R2 growth stage. It must be noted that these are ranges. It is possible for the nutrient to register slightly higher or lower than the range mentioned and the plant still not show signs of deficiency or toxicity to that nutrient.

Tissue Sampling as a Monitoring Tool

Often times in high yield situations or situations where the overall fertilization program is being evaluated it may be beneficial to use tissue sampling as a monitoring tool. In this process of plant analysis nutrient status of the plant can be compared to the overall fertilization program. When using tissue sampling in a monitoring situation, sample during the early reproductive growth stages (R1-R2). The standards that these samples will be held to in a monitoring situation are similar to those used for diagnostic purposes in Table 2. Potentially the biggest benefit of the monitoring approach is to keep records of tissue samples over a number of years for each field so that the fertilization program can be evaluated and how nutrients are being utilized by the soybean crop can be assessed.

Sample Collection and Handling.

Accurate results from a tissue sample will depend greatly on how the samples were collected and handled prior to being received at the lab. As mentioned earlier, if samples are to be taken in young vegetative soybeans then samples of the whole above ground plant should be taken from 25-30 plants in the sample area. For soybeans in the reproductive (R1-R2) growth stages, samples should be taken from fully developed trifoliate leaves in the top three or four nodes. Again, samples should be taken from 20-25 random plants in the problem area. Samples should be free of dust. Place the samples in clean paper bags or envelopes. If samples are wet allow them to dry before shipping. Never place tissue samples in plastic bags. Make sure to properly label all samples. Specifically, in diagnostic sampling samples should be labeled correctly from the field so that samples can be separated between good, bad, and transition parts of the field. Samples may be brought to your local Clemson Cooperative Extension Office to be processed and sent to the lab.

Summary

Tissue sampling should never be used in place of soil sampling for developing a fertilization program for soybeans. A tissue sample represents a single time point and may not be a true representation of the nutrient utilization of the plant over the whole season. Tissue samples are of greatest use in diagnosing potential nutrient deficiencies or toxicities. They can be used to aide in monitoring the nutrition of the soybean during the growing season and utilized in evaluating the overall fertilization program. Caution should be taken to ensure that proper collection and handling procedures are followed for the sampling process. For help interpreting results, please contact your local County Extension Office.

Reference:

Sabbe, W. E., G. M. Lessman and P. F. Bell. 2000. Reference sufficiency Ranges for Plant Analysis in the Southern Region of the United States, Southern Cooperative Series Bulletin #394. North Carolina