

The Importance of Plant Tissue Sampling

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The use of plant tissue analysis to diagnose and monitor crop health is rapidly growing in popularity across the country. While soil testing is vital to ensure a crop has plenty of available nutrients going into the growing season, plant tissue testing is a way to monitor and potentially correct nutrient issues *in season*. Both are important tools in a grower's toolbox to ensure the highest possible yields.

WHY TAKE TISSUE SAMPLES?

Plant tissue sampling is a valuable crop management tool. Routine soil testing shows levels of nutrient reserves in the soil, which is necessary for a proper soil fertility program. Ensuring that the soil is properly stocked with nutrients for the upcoming crop is the best and most cost-effective way to produce maximum yields. But fall or spring soil tests cannot show how nutrients are available inside the plant during the season.

Even when nutrient levels are corrected with fertilizer, crops still have to take up required nutrients in the proper amounts for an effective fertility program to be realized. Drought, excessive rainfall, compaction, an anaerobic root zone, herbicides, too high or too low pH, cold soil temperatures, insects, diseases, and several other factors can all negatively affect crop nutrient uptake even if soil is properly fertilized. When deficiencies are visible or revealed by plant tissue samples, there is often an opportunity to use corrective measures to still produce a high yielding crop.



http://msue.anr.msu.edu/news/identifying_and_correcting_manganese_deficiency_in_soybeans

Genetics of modern crops are constantly evolving. Today's average crop yields were only dreamed of a generation ago. But new high-yielding genetics also generate a higher demand for nutrients. Removal rates are obviously higher, but crop growth rates are higher as well. This creates greater demand for nutrients during the growing season at faster rates. Even if your soil nutrition is correct, conditions may not allow for uptake at the proper rate. Uptake can also vary by growth stage. Nutrient demands are different in V2 corn than in R2 corn.

High-yielding producers routinely perform tissue tests in order to maintain high nutrient levels throughout the entire growing season. A reduction in plant nutrients at any point during the season will ultimately reduce yield, so they typically aim to keep nutrients in the upper half



of proper sufficiency ranges (discussed below). When high nutrient levels are maintained, growers have confidence that their nutrient management plan is working, that stresses such as compaction or pests have been taken care of, and the crop does not suffer from a phenomenon called “hidden hunger.”

Hidden hunger occurs when a crop appears to be growing normally but is actually slightly deficient in one or more nutrients. Plants with hidden hunger aren't typically starved enough for a nutrient to exhibit deficiency symptoms, but levels are low enough to negatively impact yield. For example, below-normal levels of sulfur can negatively affect nitrogen use within the plant. Several of the primary nitrogen-containing compounds also require sulfur. Therefore, even if nitrogen in the plant is at or above normal levels, slightly low sulfur prevents the full use of all that available nitrogen. This may not be a visible problem, and is another reason why it's just as important to perform tissue tests on crops that appear normal.

HOW SHOULD I SAMPLE?

There are two primary methods to tissue sampling: **nutrient monitoring** and **diagnostic sampling**. Nutrient monitoring refers to sampling even if your crop looks good. Diagnostic sampling refers to sampling if it doesn't look so great. Let's discuss each individually.

Diagnostic sampling is a valuable tool to help you determine if visible crop problems are due to a nutrient deficiency. Sometimes nutrient deficiency symptoms are obvious, but in many cases they aren't. Diagnostic sampling should always be done in pairs. Sample the area of concern as well as an area that appears healthy

for comparison. Each sample should also be paired with a corresponding soil sample from the same areas to determine if there is a soil fertility issue. For example, high magnesium can induce potassium deficiency, or several nutrients become unavailable at a low pH. Both a tissue and soil sample would be needed to paint the whole picture.

When collecting samples, make note of where on the plant the symptoms appear. Symptoms of mobile plant nutrients (N,P,K,Mg, etc) occur in the oldest leaves, while symptoms of immobile nutrients (S) occur in younger leaves. So when collecting samples from good and bad areas, make sure you are collecting leaves from the same parts of the plant. This will give you the most accurate representation of the issue.

A **nutrient monitoring** program should consist of scheduled sampling events. The goal is to maintain proper nutrient levels in the plant and to prevent any deficiencies from occurring. As soon as nutrient levels begin to drop, growth is negatively impacted, which results in yield loss. As mentioned earlier, high-yielding producers have found that keeping nutrients in the upper half of the sufficiency range has been key to achieving their goals.

Sampling programs generally consist of either sampling by growth stage or by a set time (weekly, bi-weekly, etc). The proper program will depend on the crop and level of management. Contact a Waypoint agronomist to assist in determining a program that will help ensure the highest profitable yield.



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Once your tissue samples are collected, it's important to send them promptly because tissue degrades quickly. Place them in a paper bag to allow natural drying, and keep them as cool as possible without freezing. Ship or deliver them to the lab using a one-day shipping method. Many customers are one ground-shipping day away from the nearest Waypoint laboratory. Otherwise next-day air labels are available. For more information on sample packaging and shipping, refer to our Plant Tissue Sampling Guide on our website, or call your nearest Waypoint lab for more information.

WHAT DO THE RESULTS TELL ME?

Plants use essential nutrients in many different structures as they grow. Photosynthesis, respiration, nutrient and water transport, and all other growth processes in plants are dependent on the presence of certain proteins and compounds in the plant. In turn, the production of these components depends on proper nutrient amounts being available. When your plant tissue sample is tested in our laboratory, it is digested using acids and heat. This breaks down all the plant structures and releases the individual nutrients into solution.

Then, the sample is analyzed on instruments to determine the concentrations of each element in the plant tissue. These results are expressed as a percent or in parts-per-million (ppm). One percent (1%) is equal to 10,000 ppm.

In addition, our plant tissue reports will show you a graphical representation of your sample's nutrient rating levels. These ratings vary by crop and by growth stage, and show how your crop's levels compare to published optimum ratings. If one or more elements are shown to be low, the crop is somehow unable to access enough of that nutrient. In most cases this is due to under-fertilization of the soil, but other factors such as compaction, root damage, diseases, or insects can cause below-normal nutrient levels. Low ratings will help you identify a problem and potentially plan a solution (discussed below). But good ratings are also valuable. They can confirm that your management plan is performing properly, or if your crop still has a visible problem, it eliminates nutrition from the list of potential issues.

HOW CAN I CORRECT ISSUES?

There are several ways to potentially fix a nutrient issue in an actively-growing crop. Macronutrients, which are needed in larger quantities, typically require an application to the soil. Exceptions to this are if the crop is irrigated and the macronutrients can be injected in the pivot or drip irrigation system throughout the season. Micronutrients, which are needed in small quantities, can often be sprayed directly onto the leaf foliage when making a pesticide application.

Crops must take up the majority of their nutrient requirements through the root system. However, some nutrients are required in small



enough amounts that they can be supplemented through a foliar application. Plants are able to take in nutrients in small quantities either through the leaf epidermis or through leaf stomata. Once inside the plant, they can be used directly at the source in the leaves, or sometimes transported throughout the plant via its vascular system. Because micronutrients are typically required in small amounts, a deficiency can often be corrected with a foliar application. While some macronutrients can be applied this way, they are often required in amounts too large to fix the problem permanently.

SUMMARY

Tissue sampling is a valuable tool for monitoring a crop's nutrient supply during the growing season. Proper nutrient supply is critical for producing high yields, and there are several products available to help correct issues in-season. When used in combination with soil testing, it can give growers a better overall picture of their agronomic program. Growth stage, plant part, location within a field, and sample handling all play a part in generating a valuable result from the laboratory that will help you make the right decisions for your fields.

Example reports can be found on our website at www.waypointanalytical.com. If you have additional questions about starting a tissue sampling program, sample submittal, or result interpretation, contact your nearest Waypoint lab today. We are here to help!