Testing Can Pinpoint Nutrient Deficiencies

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Micronutrient sampling can help farmers determine the need for and the right amount of a nutrient that's needed to raise a crop, according to Dr. Greg Schwab, University of Kentucky Extension Soil Specialist. Too often producers will just apply a fertilizer, and the result is they're wasting time and money.

"Most of the time when you try to correct 'just whatever,' you're spending a lot of money for nutrients that you don't need," he said. "The thrust of this message is to decide what you need and get that applied rather than just taking a broad spectrum and trying to cover everything possible."

Schwab says what you sample is the most important part of the micronutrient testing. On corn, the best time to sample is when its tasselling. The ear leaf that is connected to the ear is what you submit to the lab.
Photo by John LaRose, Jr.

He said that micronutrient deficiencies are not very common in grain crops grown in Kentucky. There are a few known deficiencies and there are some that are suspect. The one that happens most often is zinc deficiency in corn.

"I see a lot of guys blaming zinc for striped leaves, which you see early in the spring," Schwab noted. "Zinc deficiency does cause striped leaves, but the striping generally goes all the way across the veins. Even the veins in this area are white or very pale in color, you don't see light green, dark green, light green, dark green, every vein is standing out dark green.

"When you see the light green, dark green, light green, dark green, like we saw this spring, most likely that's not zinc deficiency. This pattern is generally caused by cold weather or lack of nitrogen or magnesium uptake, or something like that. If you have severe zinc deficiency, the corn plants are going to be stunted. I've seen corn that's tasselled and about waist high. It has a rosette appearance and is stunted, with shortened internodes."

Another one commonly seen is manganese deficiency in soybeans, Schwab explained. This occurs in river bottom ground on the wetter parts of the landscape. The wet soils occur through the winter months, the manganese is reduced during those wet conditions. There's no oxygen there and the manganese can leach out of profile and cause the soybeans growing in these wet areas in the field to look very light green.

"Those are the two common deficiency symptoms we see sometimes in Kentucky," he said.

Most of the time, zinc deficiency is caused by low soil test zinc, but sometimes by too much phosphorus or too high soil pH. Farmers who put on more phosphorus than needed to try to keep the soil tests up real high may be causing zinc deficiency to occur in corn.

"So the higher the phosphorus level is, the higher the soil test zinc level needs to be," he said. "These are common, we probably don't need tissue sampling to identify some of these kinds of deficiencies; but the question always is 'I got a crop that looks normal, am I missing something?' and that's where tissue sampling becomes important."

Schwab distributed a new publication entitled *Sampling Plant Tissue for Nutrient Analysis* that discusses tissue sampling and included tables to explain comparisons.

"Those are all micronutrients the plants need a lot of, and if you notice we have corn and we have different stages of corn," he pointed out. "What you sample is the most important part of the test. On corn, the best time to sample is when its tasselling. When the pollen is shedding that's the best time to be in the corn field. When you go out to the corn field the tassels have just emerged what you want to do is pick the ear leaf. The leaf that is connected to the ear, this is what you submit to the lab."

Since the nutrient content is different in every leaf of the plant, the particular ear leaf is the one preferred for testing. All of the data whether it's high, low, or medium, is calibrated to this leaf. That's why tasseling is the best time to sample because this leaf is easy to identify.

If the grain has already started to fill, the leaf would test low, because the plant has already started to move nutrients out of the leaf and into the ear.

"You want to catch it before any grain starts to form, right at tasselling," Schwab said. "That will give you a very accurate analysis of whether there's something that's deficient."

"On soybeans it's a little trickier," Schwab said. "You harvest the uppermost mature trifoliate for testing. To do that, you look at the plant, figure out the uppermost mature trifoliate, take that part and send it to the lab. You need 30 to 40 of these others," he said showing the soybean leaves. "You sample a field just like you would soil sample. If I take only one plant, that's going to tell me only the status of that plant; so I want to go out and get random samples. When I'm walking through a soybean field I'm just looking for the big leaves that are at the very top of the canopy, that's almost always the right leaf to take."

Nutrient content will change as you change position on the plant. A lot of micronutrient work has been done in Russell county and the soils in Russell are quite a bit different than in Western Kentucky. They can be very deficient, more like Alabama soils than Kentucky soils.

Schwab further explained a trial conducted in Russell county last year. Showing the soil test levels, he noted the only thing that really stands out is the zinc level is pretty low.

"Phosphorus levels are pretty high, we suspected this field might be suffering from zinc deficiency, so we put out some treatments," he said. "The farmer fully fertilized the field and then we added potassium, zinc, sulfur, boron and then we added a combination of all of those nutrients. All the fertilizer treatments were added shortly after planting, just when the corn was spiking. Later, we went back in and did tissue analysis at the ear leaf time, right at tasselling; and, low and behold, sulfur was deficient on the check plots, boron was deficient on every plot except the plot that needed boron, and zinc was deficient on several of the plots, so at this time I'm excited. I might find one of those illusive nutrient crop responsive sights to micronutrients, I thought."

At harvest time there were surprises. The primary ear on the treatments that didn't receive boron fertilizer were not well pollinated, but the secondary ear appeared normal. Yields were not statistically different between any of the treatments likely because of the severe drought. We're repeating this study again this year with a couple of other elements too. We have some copper treatments in that study as well."

There also were soybean trials at a site very close by and the soybean tissue nutrient levels were below the critical level for both boron and zinc in the plots not receiving those fertilizers.

"If we added boron, there was almost four times as much boron in the leaf tissue as what we had without adding boron," he said. "The rate of boron used was only one pound per acre. We do this as a pure chemical, so it's literally like shaking salt on the soil plot. One pound per acre of actual boron is not very much. Boron is one of those that you have to be very careful with because the difference between deficiency and toxicity, enough to kill the plant, is just a few pounds per acre."

On zinc there was good zinc tissue data response in the soybeans as well. The bottom line is it was too dry to make these differences show up in yields.

Schwab and his crew repeated the soybean study in 2009 and will repeat it again in the 2010 growing season.

The University of Kentucky does not offer plant analysis; producers wanting this test must choose a private lab.

Schwab showed a plant tissue analysis of a soybean sample which showed potassium to be very low.

"Does that mean I needed more potassium fertilizer?" he asked. "It needs more potassium uptake but it's your job to figure out why it didn't take it up. It could be low soil test levels, it could be compaction, it could be the plant drowned out; it could be a lot of things, so just because you see low levels doesn't necessarily mean that you needed more of that fertilizer.

"So my take home message is that the University of Kentucky is actively looking for ways to improve crop growth and yield including the possibility of using micronutrients. Because micronutrient deficiencies are relatively rare, foliar fertilizers that use the strategy of supplying a low rate of a wide number of micronutrients rarely are an economical way to improve yield. Using a combination of soil and tissue analysis, we can improve our odds of identifying the most limiting nutrient and then take steps to remedy the specific deficiency." Δ

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