k-state extension AGRONOMY e-Updates

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## 1. Manganese deficiency in Roundup Ready soybeans

Roundup Ready soybean varieties seem to be more susceptible to manganese (Mn) deficiency than conventional soybeans, in preliminary tests. The problem lies with the gene that was inserted into soybeans to give them resistance to glyphosate. This gene also changed the composition of root exudates from Roundup Ready soybean varieties so that these varieties are less able to solubilize Mn in the soil than conventional varieties. This has led to an increased susceptibility to Mn deficiency in Roundup Ready soybeans.

Manganese is especially important to legumes, such as soybeans. Manganese is essential in the activation of enzymes that stimulate the formation of flavonoids – which are proteins that stimulate the genes for nodulation. Legumes also need Mn to help metabolize nitrogen that is fixed by the bacteria in nodules into forms that can be effectively utilized within the foliage and seed coats.

Because Mn is involved in nitrogen metabolism within soybean plants, Mn deficiency results in a pale green appearance and reduced growth, similar to sulfur deficiency. More severe Mn deficiency will cause interveinal areas to be yellow, with the veins of the leaves still being green. This is similar to iron chlorosis. Leaves of Mn deficient plants will be cupped.

Manganese deficiency is most common on sandy or poorly drained soils. Manganese availability is also greatly decreased with increased soil pH. Roundup Ready soybean varieties are more sensitive than conventional varieties on any given soil. Soil test analysis for Mn is not a very reliable method of predicting Mn deficiency in soybeans at this time, although work is being done to determine critical levels of tissue and soil Mn for soybeans.

If soil test Mn levels are low, producers are very likely to get a yield response to applied Mn on soybeans. But even if soil test levels are adequate, producers may still get a response to Mn with Roundup Ready varieties. That's one reason more work needs to be done on correlating soil Mn levels with yield response on Roundup Ready varieties.

If soybean plants show Mn deficiency symptoms early in the season (pale yellow leaves, interveinal chlorosis, and/or leaf cupping), producers will probably get a yield response by applying Mn to Roundup Ready soybeans. Roundup Ready soybeans on bottomlands, sandier soils, and soils with a pH of 6.5 or higher are more likely to have Mn deficiency and respond to applied Mn than soybeans grown on upland soils with a pH less than 6.0.

In addition to the problem of not being able to solubilize enough soil Mn to meet their needs in some cases, Roundup Ready soybeans have another potential problem with Mn. The application of glyphosate to Roundup Ready beans also may directly retard Mn metabolism in the plant.

A supplemental application of Mn to Roundup Ready soybeans can result in greater yields. In one test on irrigated soybeans in northcentral Kansas, a Roundup Ready soybean variety had yield increases of up to 10 bushels per acre when 7.5 lbs Mn per acre was banded preplant, while a conventional variety of similar maturity showed no yield response to the applied Mn. Another test on irrigated soybeans in northcentral Kansas tested a Roundup Ready variety and its related conventional variety. Results were the same – a 10-bushel increase on the Roundup Ready variety from an application of 5.0 to 7.5 lbs Mn per acre, and no yield response by the conventional variety.

Research in Indiana and other states has also shown a response to Mn by Roundup Ready soybeans. Some work in Arkansas suggests that foliar application of Mn on Roundup Ready soybeans that have been under drought stress may improve yields.

Research on this will continue at K-State's North Central Experiment Field, through funding from the Kansas Soybean Commission.

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2. Winterkill of wheat

Most of the northern half of Kansas had adequate snow cover to protect against the record-breaking cold temperatures during the week of Dec. 5-9. Parts of the southern half of Kansas, however, had very little, if any, snow cover.

Will there be any winterkill of wheat in those areas? There are always two main questions to consider when evaluating the potential for winterkill:

* How well has the wheat hardened off, and how well developed is the root system?

In general, temperatures were well above normal into mid-November, but then started gradually getting colder until about December 10-11. That gradual decline in temperatures should have helped the wheat develop winterhardiness, which works in favor of the wheat. But where the wheat was planted late or conditions have been dry, the wheat may not have developed a good secondary root system. Wheat that is small, has not tillered, or has not developed secondary roots is much more susceptible to winterkill.

* How cold did the soil get at the crown level?

This depends on snow cover and moisture levels in the soil. Winterkill is possible if soil temperatures at the crown level (about one inch deep) get down into the single digits. If there was at least an inch of snow on the ground, the wheat was protected and soil temperatures will have remained above the critical level. Also, if the soil had good moisture, it's possible that soil temperatures at the crown level may not have reached the critical level even in the absence of snow cover. But if the soil was dry and there was no snow cover, there may be the potential for winterkill, especially on exposed slopes or in low-lying areas. Air temperatures below -10 degrees can certainly reduce soil temperatures below critical levels when the soil is dry and there is no snow cover.

To test for winterkill damage, producers can dig up a few plants, put them in pots, and bring them inside to warm up. If the plants do not respond to the warmer conditions, they may have suffered winterkill injury.

If plants are killed outright, they won't green up. But if they are only damaged, it might take them a while to die. They will green up and then slowly go "backwards" and eventually die. There are enough nutrients in the crown to allow the plants to green up, but the winter injury causes vascular damage so that the nutrients that are left cannot move, or root rot diseases move in and kill the plants. This slow death is probably the most common result of winter injury on wheat.

Direct cold injury is not the only source of winter injury. Under dry conditions, wheat plants may suffer from desiccation. This can kill or weaken plants, and is actually a more common problem than direct cold injury.

-- Jim Shroyer, Extension Agronomy state leader and crop production specialist
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3. Dryland strip-till research, Part 1: Western Kansas

Strip-till has become a popular alternative to conventional tillage under pivot irrigation in western and central Kansas. Strip-till is also a dryland alternative to both conventional tillage and no-till, although its advantages are less certain under dryland conditions.

Strip-tillage is a tillage process by which a 6- to 10-inch strip of ground is tilled before planting, either in the fall or early spring. All strip-till machines consist of a coulter and a sub-surface knife, usually a mole knife, for injecting fertilizer and ripping the soil. Beyond this basic configuration, different manufacturers have various options, including discs, trash whippers, or rolling baskets behind the knife.

Fertilizer is placed approximately 4 to 8 inches deep. Seeding is normally done right in the strips, so the fertilizer is placed directly below the seed but separated by several inches of soil.

There are several potential advantages of strip-till under dryland conditions:

* Better drying and warming of the ground in the spring
* Can provide ideal environment for seedlings
* Places fertilizer in the soil for better efficiency
* Leaves a majority of the field undisturbed, similar to no-till
* Breaks up shallow compaction zones

There are also some potential disadvantages of strip-till under dryland conditions:

* High cost of strip-till machine
* Under dry conditions, strip may consist of large clods and poor seedbed conditions
* Also under dry conditions, strip-till will result in more soil water loss than no-till
* On dry soils, the action of the strip-till machine can leave the soil rough for spraying operations
* Under wet conditions, fertilizer knife can smear soil and cause sidewall compaction. The soil may not fill in the slot created by the fertilizer knife.
* If heavy rains fall between the time of the strip-till operation and seeding, the strips can sink in and result in depressions in the field
* Strip-till uses more fuel than no-till

Whether the potential benefits outweigh the potential drawbacks depends on whether it results in increased yields, seedling survival, and root growth. We have tested strip-till on corn, grain sorghum, and sunflower under dryland conditions in northwest Kansas for the past two years.

The results can be summarized as follows:

* Strip-till had higher or equivalent yields to no-till for sunflower in 2004 and 2005, and for corn in 2004. There was slightly higher-than-normal rainfall in 2004 and average rainfall in 2005 during the growing season.

* With grain sorghum, strip-till and no-till had comparable yields.

* Under strip-tillage, sunflower roots will develop similarly regardless of the environment. Corn and grain sorghum root development is influenced more by the

environment. Sunflower has a tap root system, while corn and grain sorghum have fibrous root system.

Remember, these are limited results for western Kansas at this point. There have not yet been any test results under below-normal precipitation in western Kansas.

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Editor's Note: There has also been K-State research on strip-till in northcentral and east central Kansas. Next week's Agronomy e-Update will include a summary of results at the North Central Experiment Field. In two weeks, the Agronomy e-Update will include a summary of results at the East Central Experiment Field. – Steve Watson
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These e-Updates are a regular weekly item from K-State Extension Agronomy. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader
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