1. Diagnosing common nutrient deficiencies in corn and grain sorghum

Some of the most common nutrient deficiencies in corn are showing up now, or soon will be, in fields around Kansas. Both corn and grain sorghum are especially prone to nutrient deficiencies in the 4- to 7-leaf growth stages as the permanent crown root systems begin to become established and the plant enters the rapid vegetative growth period. Most nutrient deficiency symptoms are similar in both corn and grain sorghum.

Below are some of the common nutrient deficiencies of corn and grain sorghum seen in Kansas. Keep in mind that most field nutrient deficiencies are not as severe as those pictured and may not appear exactly as “classic” deficiencies normally presented in photos.

* Nitrogen (N). Young plants with N deficiency will generally have pale, yellow-green foliage and be stunted and slower growing than corn grown with adequate N (first photo below). Nitrogen is a mobile nutrient in the plant, so when deficient the plant will take N from the older, lower leaves and translocate it to new developing tissues, creating the classic “firing” symptoms shown in the second picture below. The pattern of firing starts from the tip of the leaf and progresses back toward the stalk along the mid-rib of the leaf. Nitrogen-deficient stalks are often thin and spindly. Nitrogen deficiency delays maturity and often results in wet corn at harvest.
Nitrogen-deficient corn seedlings caused by plugged starter fertilizer units. (Photo by Stu Duncan, K-State Northeast Area Crops and Soils Specialist)

Nitrogen deficiency at mid-season, characterized by classic firing of the lower leaves on the plants on the left. (Photo taken at K-State Southwest Research-Extension Center, Tribune)

* Phosphorus (P). More than 50 percent of the soil samples sent to the K-State Soil Testing Lab each year are deficient in P. Severe deficiencies will result in stunted plants with purpling of the leaves (although many other factors may also result in purpling of leaves). Phosphorus deficiency delays maturity, commonly noted in delayed tasseling in corn or flowering in sorghum. Delayed maturity will often result in higher grain moisture at harvest.
* Potassium. Like N, potassium is a mobile nutrient in the plant, and is moved from the older leaves to the upper developing new leaves in response to deficient conditions. This creates the classic firing of leaf margins on the older, lower leaves shown below.

Soil compaction, or injury to the root system can also cause K deficiency in corn. The picture below shows K deficiencies at moderately high soil tests caused by a combination of compaction and corn root worm injury.
Potassium deficiency in corn.

*Sulfur (S). Sulfur deficiency resembles nitrogen deficiency, especially on young plants. Plants are stunted with pale, chlorotic leaves. The field photo below is from South Dakota, and shows yellow S deficient corn in the foreground and darker green corn in the lower portion of the field. Much of the S available to crops each year comes from decomposition of soil organic matter, so on hills and side-slopes where organic matter is lower, or has been lost through erosion, the deficiencies will be more common. Sulfur deficiency is most common on low organic matter sandy soils in Kansas, but is becoming more widespread as we reduce the amount of S emitted from industry and automobiles.

Sulfur deficiency in corn (foreground). Note that the symptoms are similar to N deficiency. Photo courtesy of South Dakota State University.
* Zinc. Zinc deficiency results in stunted plants with “bronzing” discoloration between leaf margins and midrib. Internodes of the stalk can also be shortened. Most of the plant-available zinc in soils is present in soil organic matter. Zinc deficiencies are commonly found on high pH soils, sandy soils, and soils which have lost organic matter through erosion or soil leveling.

Zinc deficiency in corn. Photo courtesy of University of Minnesota.

* Iron. Iron chlorosis often occurs in spots or patches in fields. Plants are stunted and display inter-veinal chlorosis on new leaves. Severely deficient plants can have completely yellow to almost white upper leaves. Most commonly found on high pH, calcareous soils.


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2. Chloride fertilization of grain sorghum in north central Kansas

There has been quite a bit of research in Kansas over the years on chloride (Cl) applications to wheat. There has also been research showing that grain sorghum responds to chloride fertilizer when soil Cl levels (0 to 24 in.) are below 20 to 30 lbs/acre.

Research at the North Central Experiment Field has helped confirm this. During 2004 to 2007, Cl rates (0, 20 and 40 lb/a Cl) and method of application were evaluated on grain sorghum.

Chloride was applied by using one of two methods: broadcast on the soil surface immediately after planting or applied as a starter placed 2 inches to the side and 2 inches below the seed at planting (2 × 2). The Cl source used was liquid ammonium chloride (NH₄Cl). The NH₄Cl was added to a starter fertilizer containing 30 lb/a N and 30 lb/a P₂O₅. Plots receiving broadcast NH₄Cl also received the same amount of starter fertilizer but without the NH₄Cl. Nitrogen was balanced on all plots so that plots received 150 lb/a N regardless of NH₄Cl treatment.

The experiment was conducted on a Crete silt loam soil in which soil test Cl was 14 to 18 lb/a Cl.

Application of Cl increased grain sorghum yield in all 3 years of the experiment. Averaged over years and methods of application, addition of 20 lb/a Cl increased yield by 11 bu/a over the untreated check. Applying Cl at a higher rate than 20 lb/a Cl did not significantly increase grain yield. Applying Cl as a 2 × 2 starter significantly increased grain yield in only 1 of the 3 years of the study. Averaged over years, there was no difference in application method.

| Grain Sorghum Yield Response to Chloride, NC Experiment Field, 2004-2006 | Grain sorghum yield (bu/acre) |
| --- | --- | --- | --- | --- |
| Application method | Chloride rate (lbs/acre) | 2004 | 2005 | 2006 | Average |
| None | 0 | 120.3 | 115.2 | 125.8 | 120.4 |
| Broadcast | 20 | 127.0 | 124.2 | 133.2 | 128.1 |
| | 40 | 132.8 | 128.1 | 136.2 | 132.4 |
| 2 x 2 | 20 | 130.0 | 131.5 | 140.5 | 134.0 |
| | 40 | 131.0 | 131.3 | 139.0 | 133.8 |
| Mean values | Rate | 0 | 120.3 | 115.2 | 125.8 | 120.4 |
| | 20 | 128.5 | 127.9 | 136.9 | 131.0 |
| | 40 | 131.9 | 129.7 | 137.6 | 133.1 |
| LSD (0.05) | 5.2 | 3.9 | 4.9 | 4.8 |
| Method | | Broadcast | 129.9 | 126.2 | 134.7 | 130.3 |
| | 2 x 2 | 130.5 | 131.4 | 139.7 | 133.9 |

Results of this experiment suggest that when soil test Cl levels are below the 20 lb/a level, consistent increases in yield can be obtained with application of fertilizer containing Cl.
3. Winter canola crop update

Winter canola is ripening across Kansas; however, the recent cool and damp weather pattern has slowed the impending harvest. Before I discuss canola harvest though, I want to provide a brief update on how the canola fared in spring 2009.

As in 2007, a hard April freeze affected the canola crop, primarily in central and southern Kansas and in Oklahoma. The canola was at or nearing initial bloom when the freeze occurred. Late maturing varieties had only minor leaf damage. On the other hand, some of the early maturing varieties had 90% of the flower stalks severely split, kinked, or broken over. While a few of the plants died, most that were severely affected lost all or part of the primary seed-bearing stalk. However, within 10 days, secondary branches and lower portions of the main stalk that were less damaged were flowering. Overall, the crop recovered extremely well from temperatures below 20 degrees F. It is important to remember that the effects of the April freeze do not relate to winterkill. Canola plants were well beyond dormancy and how the plants fared is not related to their winter hardiness.

Canola swathed the week of June 1 in southern and central Oklahoma was harvested mid-week and initial yield reports range from 1,200 to 2,250 lbs/a (24 to 45 bu/a). One producer in Barber County, Kansas reported a yield of 1,900 lbs/a (38 bu/a). A return to sunny days and warmer temperatures will hasten the ripening of canola and many swathed fields will be harvested next week. Most canola in Kansas is approaching the optimum growth stage for swathing. A few production fields near Nickerson, Kansas were swathed recently. Canola yield trials at the K-State Research and Extension Redd Foundation Field near Partridge reached the optimum swathing stage this week.

Swathing at the proper seed color change optimizes yield potential while reducing the potential for green seed and improving oil content. Canola seeds reach physiological maturity and complete grain fill at about 40% moisture. Seeds will turn green to light yellow, or reddish-brown to brown-black, depending on the variety. The ripening process starts from the bottom of the main stem. Color change progresses up the main stem as moisture content is decreased. Seeds change color an average of 10% every 2 to 3 days, but may occur more rapidly with hot temperatures. Canola may be swathed when the seeds are 30 to 60% “turned.” Swathed canola should be ready to harvest in 7 to 10 days under normal conditions, but producers should begin checking their fields 4 days after swathing.
Some producers in Kansas and Oklahoma are experimenting with a pre-harvest aid called “pushing” that may be an earlier, faster, and less expensive alternative to swathing. Canola is pushed when 10 to 50% seed color change is visible. A pusher is mounted on the front of a tractor and driven through the field at a high rate of speed to force lodging. By pushing the canola over, it is less susceptible to blowing in the wind and shattering losses. Canola that is pushed is then direct-harvested. A benefit to pushing is that the canola grain ripens naturally. Because the stems are not cut, the canola seed will have the full complement of grain fill and may provide higher quantity and quality oil. Pushing does not necessarily accelerate drydown.

Depending on the weather, canola to be direct harvested needs 1 to 2 additional weeks before it is ripe. Ideally, canola should be harvested when the average seed moisture is 8 to 10% and few green pods are visible. However, canola is an indeterminate crop and retains a few immature seeds at harvest. Waiting for smaller seed pods to mature will result in larger, higher yielding seed pods to shatter, reducing yield potential. Ripe canola must be harvested immediately and producers should not wait until wheat harvest is finished. The longer a mature crop stands in the field the greater the potential for shatter losses.

For more information on the advantages and disadvantages of each harvest method, read the newly updated Great Plains Canola Production Handbook, MF-2734, available through your county Extension agent or online at www.oznet.ksu.edu.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. 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 Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu