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10/04/2019

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate 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 Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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1. Sorghum development and potential freeze injury

The latest USDA-NASS Crop Progress and Condition report for Kansas released September 30 stated that grain sorghum maturity was at 38%, behind 47% for last year and 49% for the average. More than 60% of the crop was rated as good or excellent condition. Wet conditions and mild temperatures could delay harvest in several regions across the state.

Will the remaining sorghum reach maturity before first freeze? The answer is, "it depends." There are two main factors involved: 1) weather conditions and how they affected the development of sorghum during the season, and 2) crop phenology -- when the crop was planted, hybrid maturity, and the date of half-bloom. Further details on sorghum growth and development can be found at: https://www.bookstore.ksre.ksu.edu/pubs/MF3234.pdf

Weather component

Wet conditions at planting time delayed sorghum planting in some areas of the state, delaying heading. During August, there was a split in the temperature patterns. The southeast saw cooler-than-normal temperatures with the greatest departure at 2 to 4 degrees below normal. The warmest conditions were in the western divisions. Departures in the southwest were at 1 to 2 degrees above normal temperatures (Figure 1, upper panel). In contrast, September mean temperatures were above normal across most of the state. Normal temperatures were concentrated in the northwest division with the coolest areas having a departure of 0.5 degrees above normal. In contrast, much of the remainder of the state had departures ranging from 5 to over 9 degrees warmer than normal (Figure 1, lower panel).

A delay in flowering time could jeopardize yields if the crop is exposed to heat around blooming or if low temperatures occur during grain fill. Recent K-State research published by Prasad, Djanaguiraman, Perumal, and Ciampitti found that high temperature stress around flowering time (5-days before and after flowering) could impact sorghum's final grain number. Also, K-State researcher Vara Prasad and others found that high temperature stress after growing point differentiation (approximately 30 days after emergence) delayed heading and decreased seed set (number and size), affecting final yields.

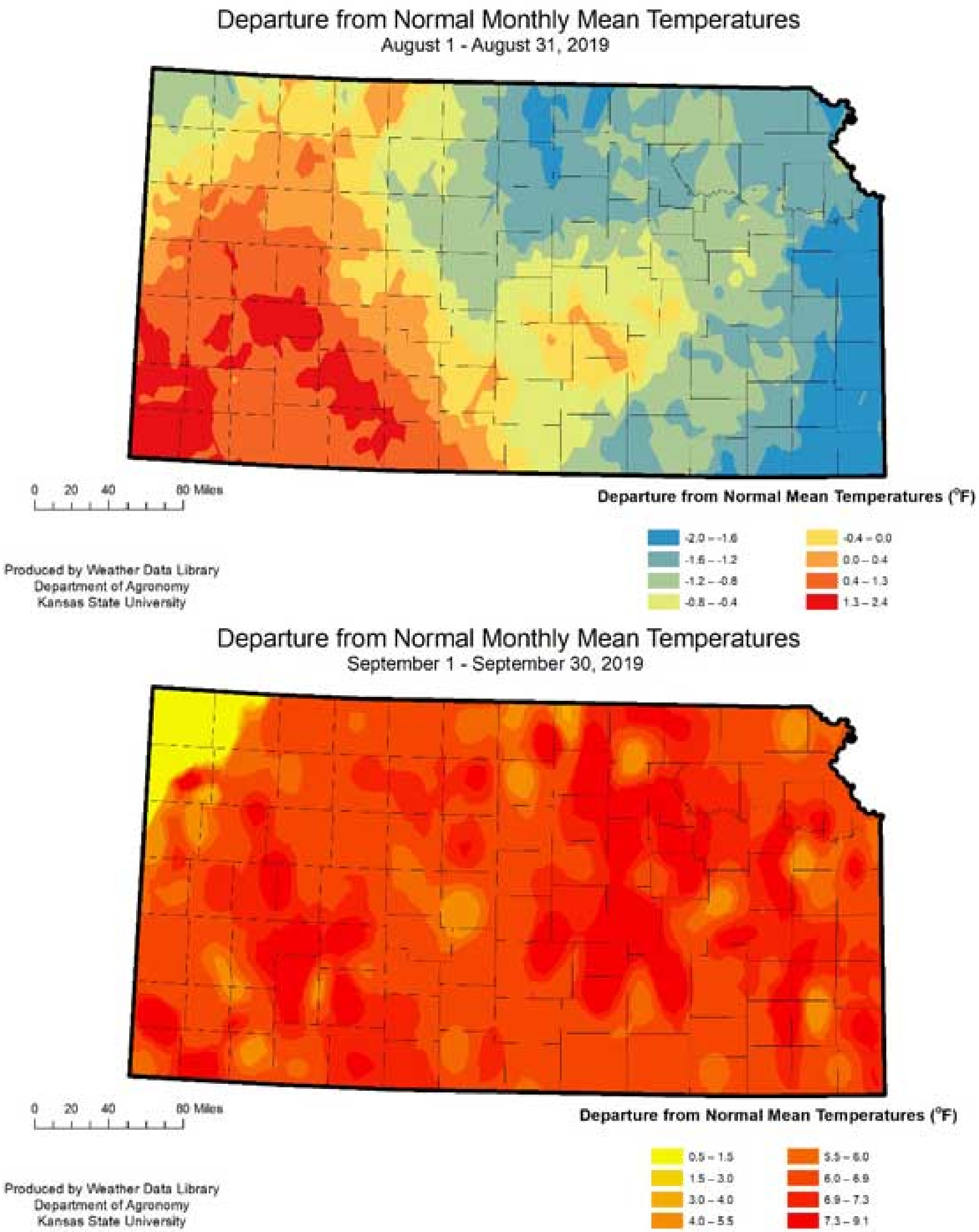


Figure 1. Departure from monthly mean temperature for the August and September 2018.

Sorghum is also sensitive to cold temperatures during most of its growth period. Temperatures below 40 degrees F will inhibit sorghum growth. Previous K-State research by Staggenborg and Vanderlip documented the impact on the grain weight early during the grain-filling period when temperatures were below 30 degrees F. The low temperatures at this time caused lower photosynthetic rates and the inability of the plant to translocate carbohydrates to the developing grains. From mid-August until this current week (Oct. 4, 2019), the lowest minimums reached 33 degrees F in a small area of the northwestern section of the state.

Grain sorghum life cycle progression

The amount of time between emergence and half-bloom will depend on the planting date and the temperatures (cumulative growing degree days) during this period. There are also hybrid differences in the amount of time it takes to go from emergence to flowering. Short-season hybrids have a shorter time from emergence to blooming; while full-season hybrids will need more degree days to reach flowering. The overall cumulative GDD from flowering to maturity is about 800-1200 (based on 50 degrees F as base temperature), with the shortest requirement in GDD for short-season hybrids. Before maturity, from beginning of grain filling (soft dough until maturity), grain moisture content within a grain will go from 80-90% to 25-35% where black layer is usually formed (Figure 2). From maturity (seen as a "black-layer" near the seed base; Figure 3) to harvest time, sorghum grain will dry down from about 35 to 20 percent moisture, but the final maximum dry mass accumulation and final nutrient content will have already been attained at maturity.

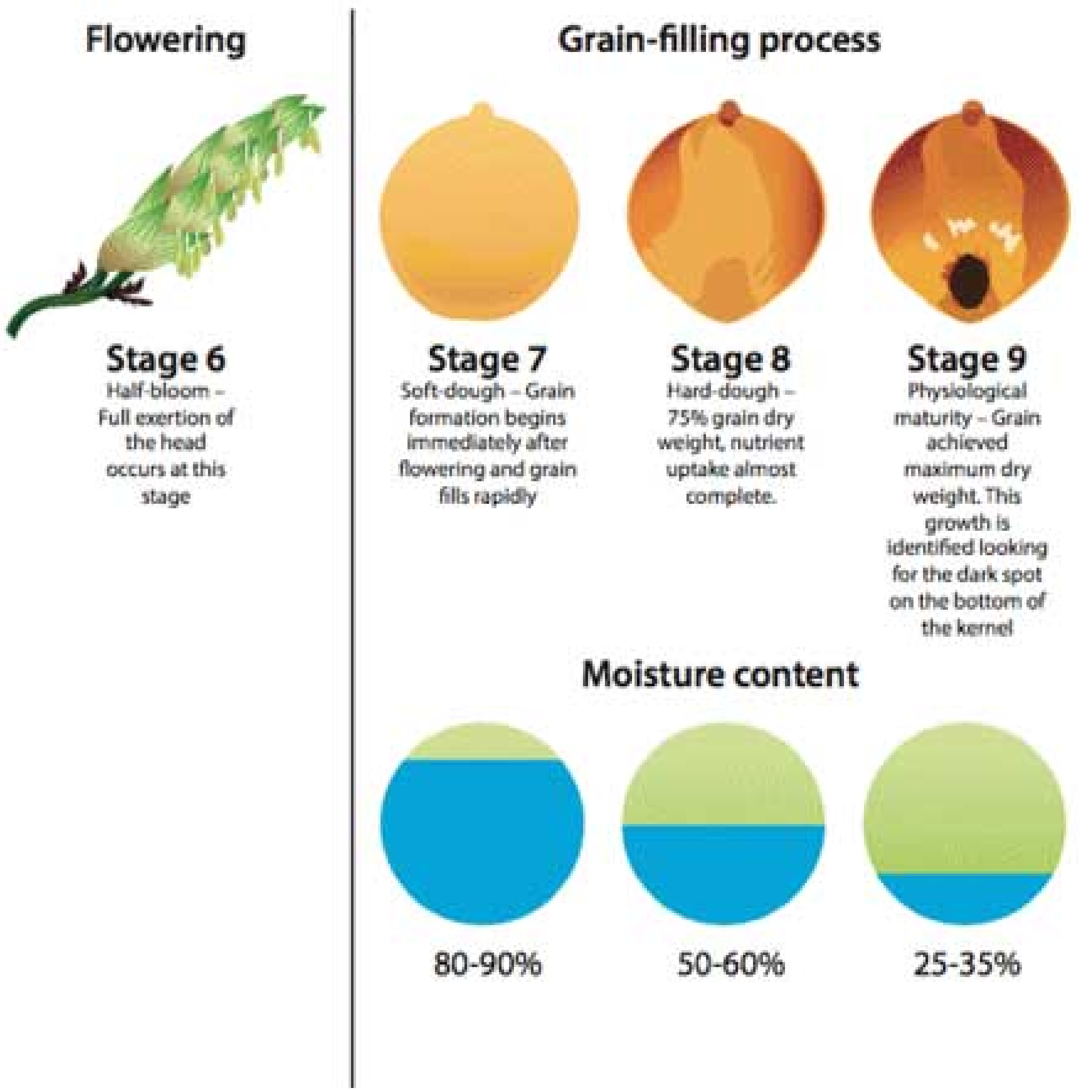


Figure 2. Sorghum growth stages from half-bloom and grain filling (including soft dough, hard dough, and physiological maturity). Infographic representing changes in grain coloration and moisture content during grain filling period until black layer formation, maturity. (K-State Research and Extension).

Figure 3. Black-layer identification in sorghum. Photo by Ignacio Ciampitti, K-State Research and Extension.

The likelihood of sorghum maturing before a freeze is related to all of these factors. When the crop flowers in late August or early September, it may not reach maturity before the first fall freeze in some parts of the state.

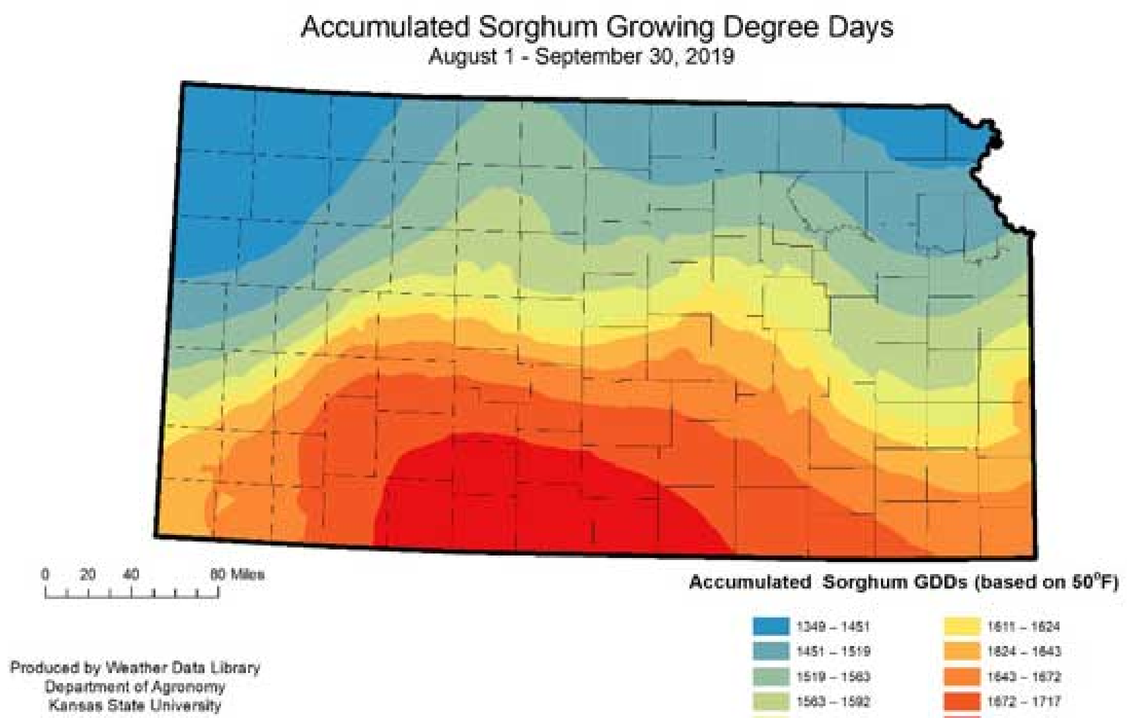
Probability of sorghum maturing before freeze for different flowering dates

The maps in Figure 4 show accumulated GDDs up to September 30 for the current growing season, starting at two different points: August 1 and September 1. Lower GDDs are depicted with blue colors, while higher GDDs are represented in red colors.

If blooming occurred during mid-August, the likelihood for maturing before freeze is high in most of the areas of the state that have accumulated 1100 GDDs (Figure 4). There are some areas of the state where sorghum GDDs accumulation was below 1100 (primarily related to light blue colors in Figure 4). Those areas will have a slight lower chance of maturing (having accumulated less than 1200

GDDs) before the first freeze. A worse picture is projected for the extreme northwestern area of the state (dark blue colors in Figure 4). In this case, there is a lower probability of maturing before the first freeze (low GDDs, <1000) but it will depend also on the hybrid maturity.

If blooming occurred during early-September, the likelihood for sorghum maturing before freeze is low for the southern part of the state (red color in Figure 4), presenting a cumulative GDD from early-September to early-October over 800 units; while the probability is extremely reduced for the northwestern section of the state, with a cumulative GDD below 650 units.



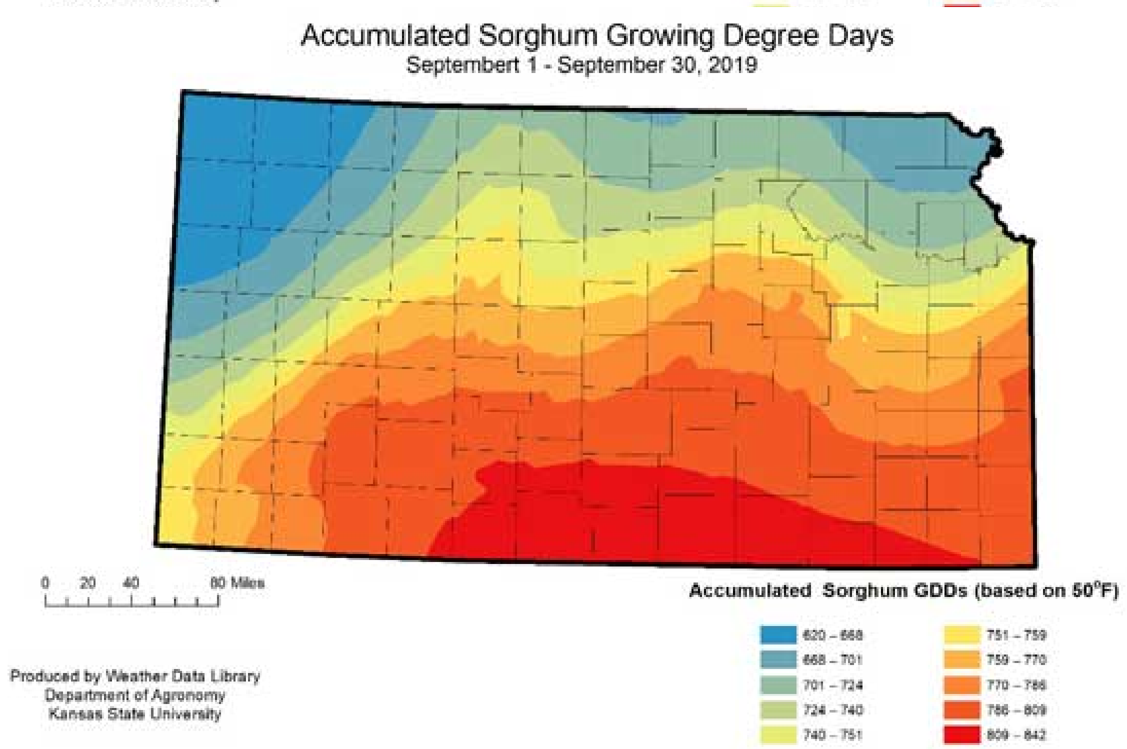


Figure 4. Accumulated Growing Degree Days (expressed in degrees F) for August 1-September 30 and September 1- September 30. The maps show that for sorghum that reached half-bloom on September 1, prospects are less certain especially in northwest Kansas. The darker the red, the higher the number of accumulated GDDs.

Management considerations

From a management perspective, the best way to mitigate this issue is to plan in advance. Recommended practices are just related to improve the use of different hybrid maturity and a different planting date:

- Use early planting dates for full-season hybrids, or
- When planting later, use medium- to short-season hybrids

If the sorghum is killed by a freeze before maturity, producers should first analyze the crop for the test weight and yield potential before deciding whether to graze or harvest the grain sorghum for silage.

For more information, see:

"Harvesting Grain from Freeze-damaged Sorghum," K-State publication MF-1081: http://www.ksre.ksu.edu/bookstore/pubs/mf1081.pdf

"Fall freeze damage in summer grain crops", K-State publication MF-2234: https://www.bookstore.ksre.ksu.edu/pubs/MF2234.pdf

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2. Stalk rots in grain sorghum

Considerable levels of stalk rot have been occurring in corn in 2019 and these same weather conditions are also favorable for stalk rot development in grain sorghum. Even in fields where lodging is not yet occurring, producers should be ready to deal with it before lodging does occur. Stalk rot is an even larger problem in sorghum than it is in corn due to a generally thinner stalk in sorghum.

Figure 1. Sorghum lodging caused by Fusarium stalk rot. Photo by Kim Larson, Agronomist.

Annual losses are difficult to determine because unless lodging occurs, the disease mostly goes unnoticed. The best estimates are that at least 5% of the sorghum crop is lost each year to stalk rot. The incidence of stalk rot in individual fields may reach 90 to 100% with yield losses of 50%. The most obvious losses occur when plants lodge. More important may be the yield losses that go unnoticed.

In sorghum, yield losses are caused by reduced head size, poor filling of grain, and early head lodging as plants mature early.

The two most common types of stalk rot in grain sorghum are charcoal rot and Fusarium stalk rot. Although caused by different organisms, the symptoms of the various stalk rots are somewhat similar.

Symptoms generally appear several weeks after pollination when the plant appears to prematurely ripen. The leaves become dry, taking on a grayish-green appearance similar to frost injury. The stalk usually dies a few weeks later. Diseased stalks can be easily crushed when squeezed between the thumb and finger and are more susceptible to lodging during wind or rainstorms. The most characteristic symptom of stalk rot is the shredding of the internal tissue in the lowest internodes of the stalk, which can be observed when the stalk is split. This shredded tissue may be tan colored (Fusarium stalk rots); red or salmon, (Fusarium and Gibberella stalk rots); or grayish-black (charcoal rot).

Summary of sorghum stalk rots

Disease	Symptoms	Weather
Charcoal rot stalk rot	Internal shredding of lower nodes; black sclerotia attached to the vascular tissue	High soil temperatures (98 degrees F) and low soil moisture during grain fill
Fusarium stalk rot	Internal shredding of lower nodes; tan or pink-to-purple internal discoloration	Dry conditions early and warm (82-86 degrees F) wet weather 2 to 3 weeks after pollination

Charcoal rot

Hot, droughty weather with soil temperatures in the range of 90 degrees or more are ideal for the development of charcoal rot. Drought does not cause the problem, but it weakens the plants' defenses to the disease. Charcoal rot is usually less severe if drought stress is not a factor.

While it is difficult to separate the effects of charcoal rot from simple drought stress, a good rule of thumb is that plants infected with charcoal rot will die about two weeks earlier from dry weather than plants that do not have charcoal rot. Grain fill that would have occurred during this period is the amount of yield loss that can be attributed to charcoal rot.

The plants will die prematurely. When stalks are split, the typical shredded appearance in the lower stalk associated with all stalk rots will be present. Additionally, there will be a gray to black discoloration of the inner stalk caused by numerous sclerotia (small, black reproductive structures of the fungus) forming on the vascular bundles and decaying tissue.

Figure 2. Close-up of charcoal rot in grain sorghum. Photo by Doug Jardine, K-State Research and Extension.

Fusarium stalk rot

Fusarium root and stalk rot is generally found in the same areas where charcoal rot develops. The pith of Fusarium stalk rot infected plants will have a shredded appearance and is typically tan in color, but in some hybrids the pith in the lower stalk may be pink to red in color. Plants may die prematurely or lodge.

Fusarium stalk rot is favored by wet conditions early in the season when denitrification or nitrogen loss from leaching may occur Research has shown that mid-season dry weather may predispose plants to later season problems. Later in the season, following pollination, warm (82 to 86 degrees F), wet weather can leach remaining nutrients from the soil resulting in late-season nitrogen stress and an increase in stalk rot.

Figure 3. Fusarium stalk rot in grain sorghum. Source: Stalk Rots of Corn and Sorghum**, K-State publication L-741.**

The most recent drought monitor index map for Kansas (Figure 4) provides clues as to where stalk rot problems may occur. In the areas of the state currently under drought stress, charcoal rot may be more common. In other parts of the state where there have been alternating wet and dry periods throughout the growing season, Fusarium stalk rot may be more common.

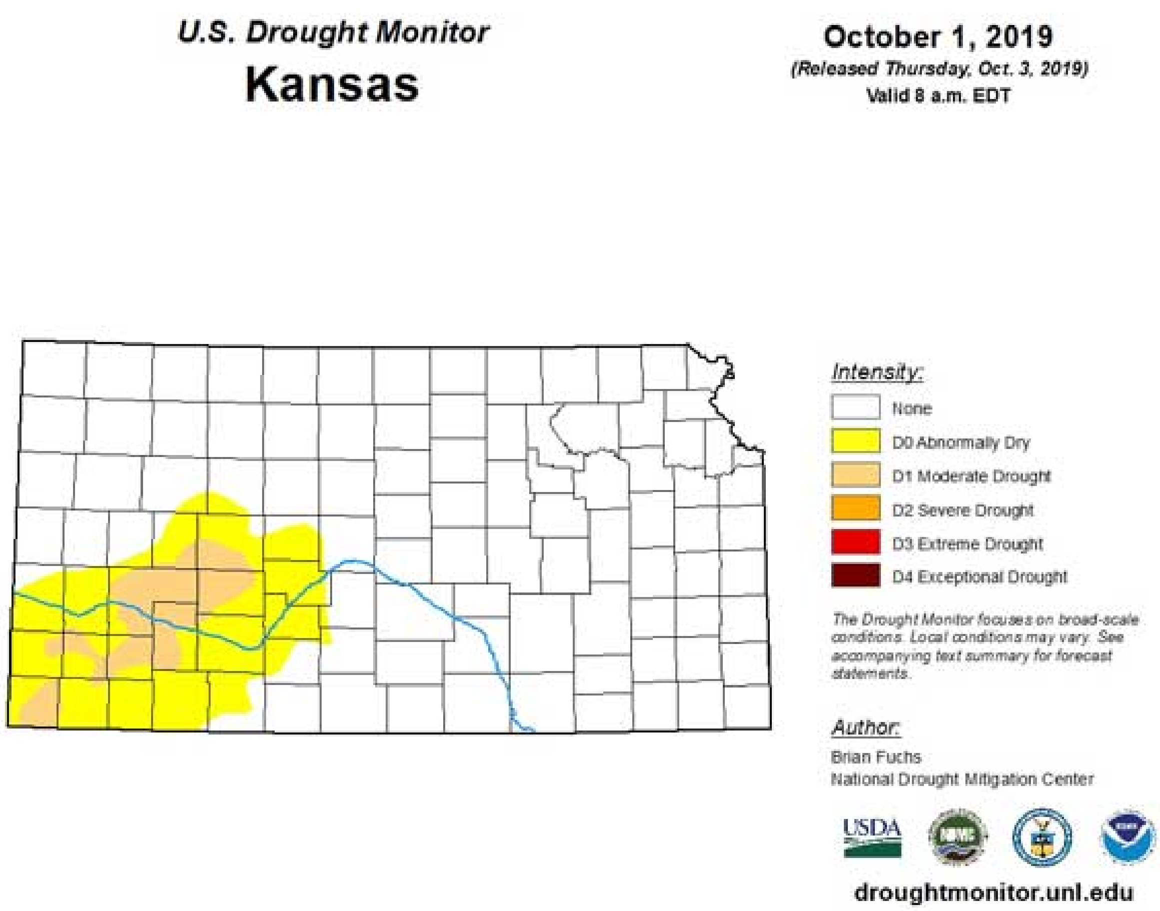

Figure 4. U.S. Drought Monitor Index map for September 26, 2019. https://droughtmonitor.unl.edu/

General considerations

Stalk rot is a stress-related disease. Any stress on a crop can increase both the incidence and severity of stalk rot. Research has indicated that when the carbohydrates used to fill the grain become unavailable due to nutrient shortage, drought stress, leaf damage from insects, hail, disease or reduced sunlight, the plant uses nitrogen and carbohydrate reserves stored in the stalk to complete grain fill. When sugarcane aphid pressure is heavy, there will likely be an increase in the incidence of stalk rot and producers should be prepared to harvest as soon as the grain is ready.

The loss of nitrogen and carbohydrate reserves resulting from leaf damage weakens stalk tissues and results in increased stalk rot susceptibility. Early maturing hybrids are generally more susceptible than full-season hybrids.

Other than irrigation or rain, there is little that can be done to prevent stalk rot by late summer. No hybrid has complete immunity to the stalk rotting pathogens. When choosing a hybrid, a grower should select a hybrid that is not only a high yielder, but one that has good standability and "stay-green" characteristics. This will help assure that if stalk rot does occur, losses due to lodging will be minimal. A balanced nutrition program based on soil tests should be used. Overall fertility levels should be adjusted to fit the hybrid, plant population, soil type, environmental conditions and management program. An excess, as well as a shortage, of nitrogen can lead to increased stalk rot problems.

Producers can check their sorghum for stalk rots by squeezing the lower stem with their thumb and fingers. If the stalks crush easily, they are probably infected with one of the stalk rot organisms and may lodge at any time. Check 100 plants across the field to determine the percent of affected plants. If the percentage of stalk-rot-infected plants is high, sorghum should be harvested as soon as possible, even if it hasn't dried down adequately in the field. If the stalks are firm, the plants will probably be able to stand just fine in the field for several more weeks if necessary.

Rotation with non-susceptible crops, such as small grains and alfalfa, will reduce the severity of stalk rot but will not eliminate it. A good insect control program is a must in limiting losses to stalk rot. In addition to the effect of leaf damage on stalk integrity, pathogens may enter stalks or roots through wounds created by insects. Hail damage will generally increase the amount of stalk rot damage.

For more information, see "Stalk Rots of Corn and Sorghum," K-State publication L-741, at: http://www.plantpath.k-state.edu/extension/publications/L741.pdf

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3. Green stem syndrome in soybeans

Soybean harvest is slowly starting across the state (2% complete, according to the USDA Kansas Agricultural Statistics report from September 30), slightly below the 5-year average. Soybean seed filling conditions were quite variable across the state and greenness remains in some fields.

Green stem syndrome in soybean is a condition by which the stem remains green while the seeds are mature and ready to harvest. In parts of the state, there are many fields of soybeans with brown pods but green stems (Figures 1, 2, and 3). A hard freeze will kill the leaves and stems, but it still may take a while for the leaves to drop if leaves are still green.

Producers can either harvest these soybeans now if the seed moisture is dry enough, or wait until the leaves have dropped and the stems have dried down. In most cases, it would be best to harvest sooner rather than later to reduce losses from shattering and lower seed quality. Harvesting beans before the leaves have dropped can be messy and gum up the combine, but at least the yield level will be maintained. Harvesting soybeans with green stems can be challenging. Make sure harvesting equipment is sharp and in top condition, and take it slow in the field.

Figure 1. Green stems and brown pods (seeds are mature) characterize green stem syndrome in soybean. Infographic developed by Ignacio Ciampitti, K-State Research and Extension.

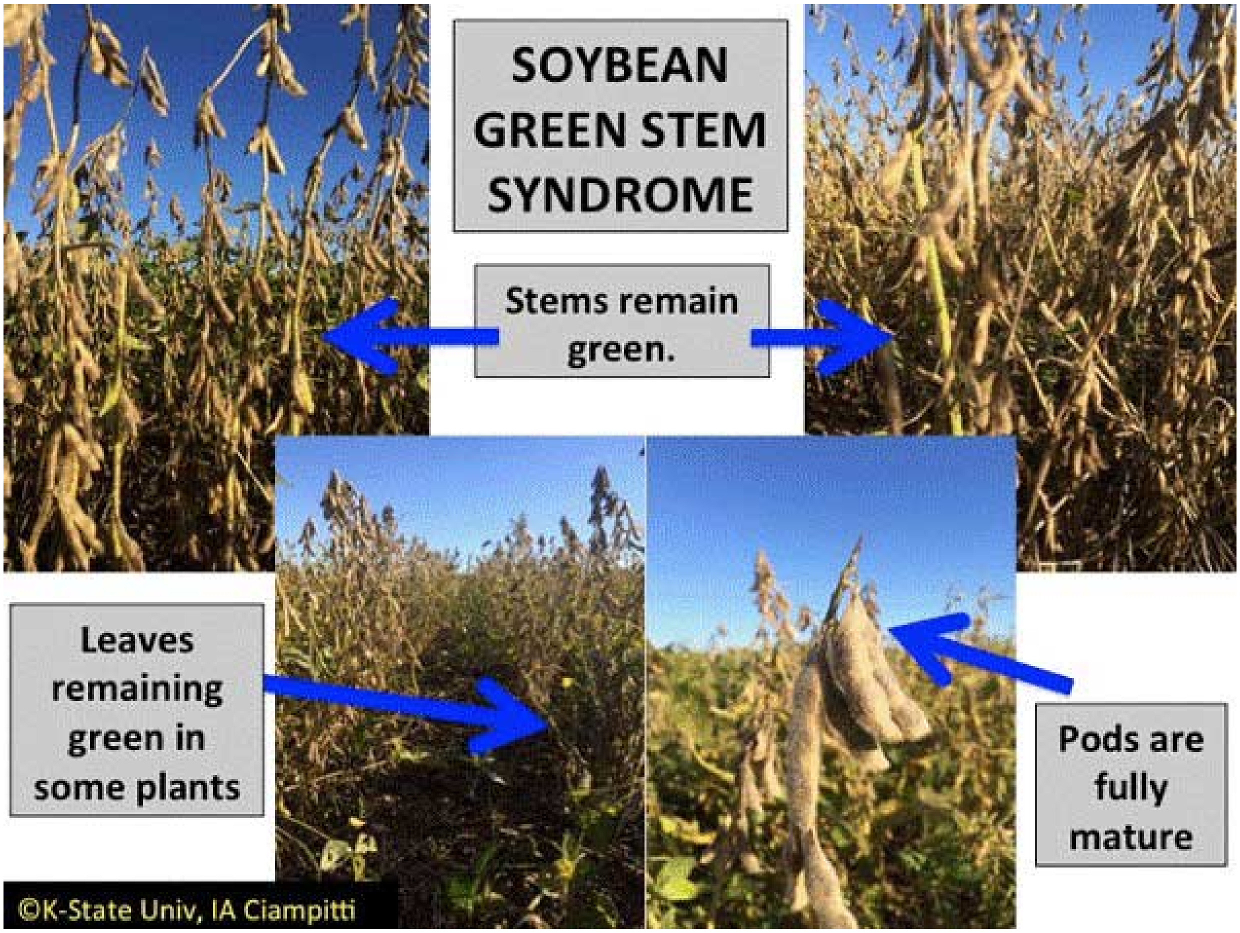

Figure 2. Green stem syndrome in soybeans. Infographic developed by Ignacio Ciampitti, K-State Research and Extension.

Causes of green stem syndrome

What causes this unusual situation? It is most likely due to a combination of early-season stress, low pod counts, and improved late-season growing conditions.

In a normal situation, soybeans will accumulate carbohydrates and proteins in the leaves and stems up until seeds begin to form (R5). The leaves provide the photosynthates needed by the newly formed seeds as they begin filling. As the seeds continue to get bigger, their need for photosynthates will eventually become greater than what the leaves can provide through photosynthesis. As this occurs, the plants will move carbohydrates and nutrients from the leaves and stems into the seeds. This can be referred to as "cannibalization" of the vegetative tissue (rapid senescence and defoliation), but it is a normal process. This eventually causes leaves to turn yellow and drop, and stems to turn brown and die.

The fewer the number of seeds, due to abiotic or biotic stresses, the lower the demand for photosynthates produced by leaves and stems. If demand is low enough, the leaves and stems are never "cannibalized" for their carbohydrates and protein. As a result, the leaves and stems will remain green longer than normal, even up through physiological maturity of the beans. Late-season rainfall can make the problem worse by keeping the plants alive after the seeds have dried down. It will take either a frost or chemical desiccant to kill the leaves and stems in this situation. If the leaves are still green and intact when pods have turned brown and have reached 13-14% moisture, it is usually an indication of mid-season stress around flowering/pod set and low yield potential – at least relative to the amount of foliage produced.

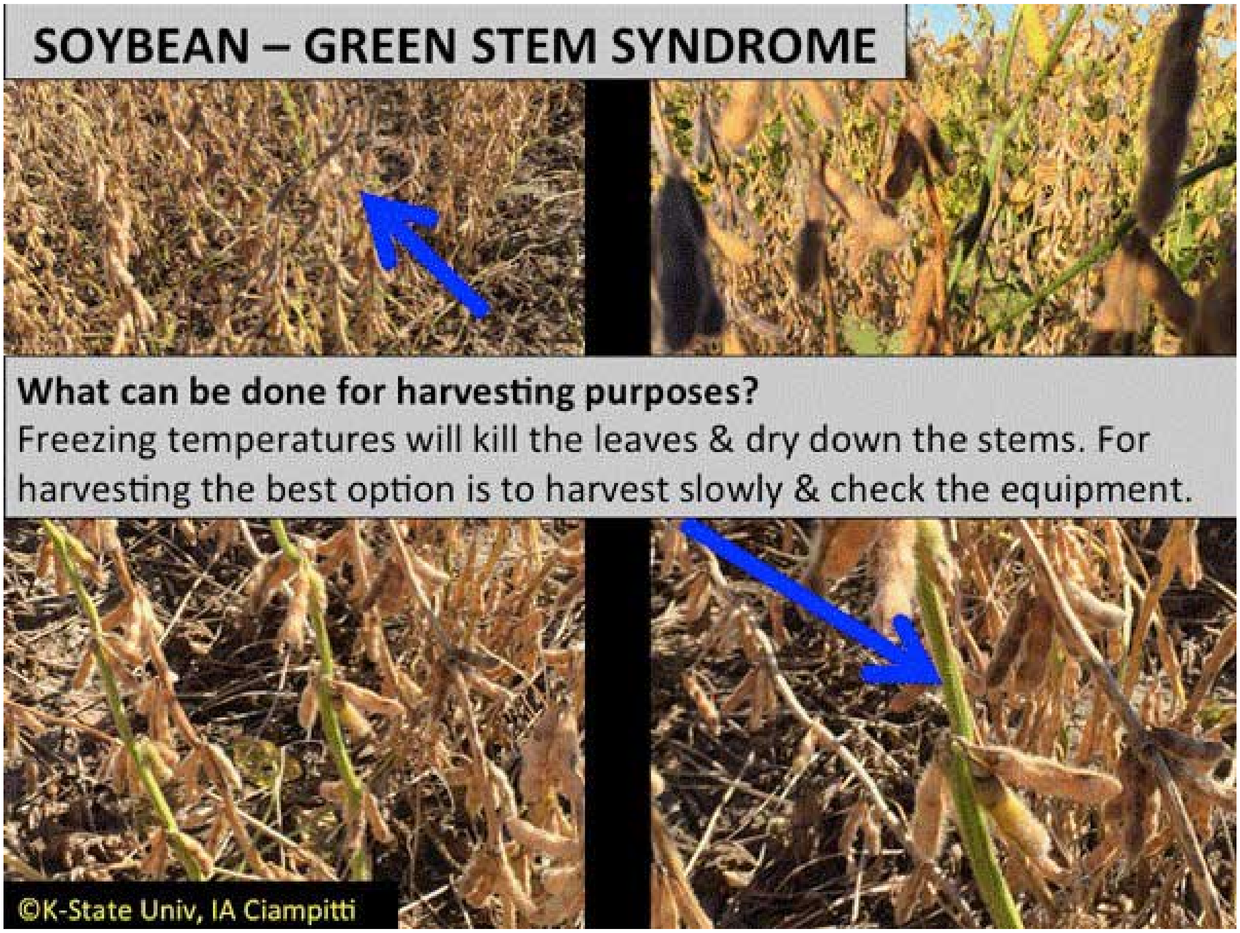

Figure 3. Green stem syndrome in soybeans and suggested harvesting operations. Infographic developed by Ignacio Ciampitti, K-State Research and Extension.

What can be done for harvesting purposes?

Eventually, freezing temperatures will kill the leaves and dry down the stems. Otherwise, the utilization of desiccants to kill leaves and drop the stem moisture down is a viable option, but only if the producer wants to harvest the field soon, before a freeze is likely to occur. If the stems and/or leaves are still green when the field is harvested, the best option is to harvest slowly and make sure the harvesting equipment is sharp and in excellent condition.

We recommend scouting your field right before harvest to better understand what environmental conditions led to the green stems. As always, make sure to time your harvest for the optimum seed moisture content in order to maximize the final grain volume to be sold. More information on soybean dry down rate can be found in eUpdate Issue 767, September 27, 2019 at http://bit.ly/2nfhAWe

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4. Consider sampling now for soybean cyst nematode

After harvest is an excellent time to soil sample for the soybean cyst nematode (SCN). Currently, 58 of Kansas's 105 counties are known to be infested (Figure 1).

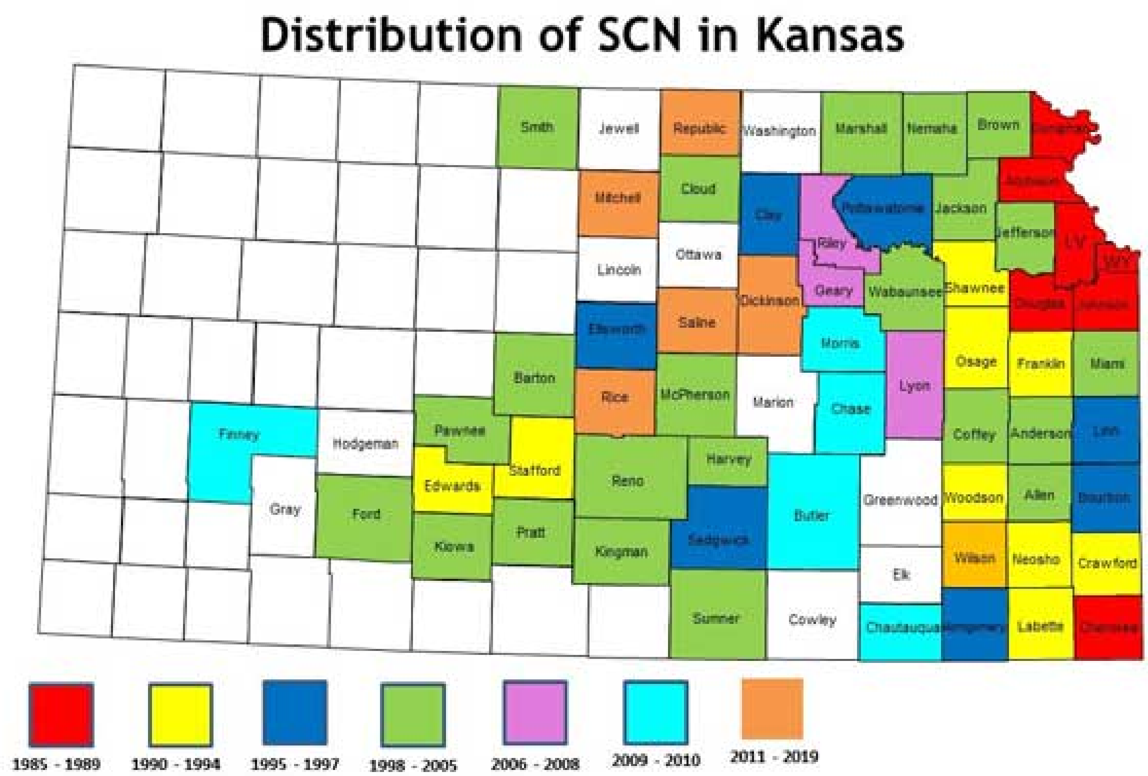

Figure 1. Current map of Kansas counties with known soybean cyst nematode infestations. Map created by Doug Jardine, K-State Research and Extension.

In fields currently infested, knowing your nematode population numbers is an excellent way to determine if your management plan is working. If numbers are going up, you know that the population of nematodes in your field have overcome the resistance in the most recently planted soybean variety and that use of that variety should be discontinued in infested fields.

Sampling the soil in a known infested field is very similar to collecting a soil fertility sample. You will need a soil probe, a bucket, and a little elbow grease (Figure 2). Walk a "Z" or "W" pattern across the field. If the field was in soybeans in 2019, collect the cores from directly in the row, since that is where the nematodes are most likely to be found. One difference from fertility sampling is that the probe should be inserted to a depth of 6 – 8 inches. Collect 18 - 24 cores in the bucket. Mix the soil thoroughly, and then remove about a pint for the actual sample. Soil can be placed into the same type of white sampling bag used for fertility samples or into a re-sealable, gallon-size plastic bag.

Avoid freezing the soil or exposing it to excessive heat after collection.

Figure 2. Tools needed for nematode sampling. Photo by K-State Research and Extension.

For fields with no history of SCN, you should concentrate on areas of the field that might be hot spots (Figure 3). Other than targeting potential hot spots, the sampling procedure is the same as outlined above.

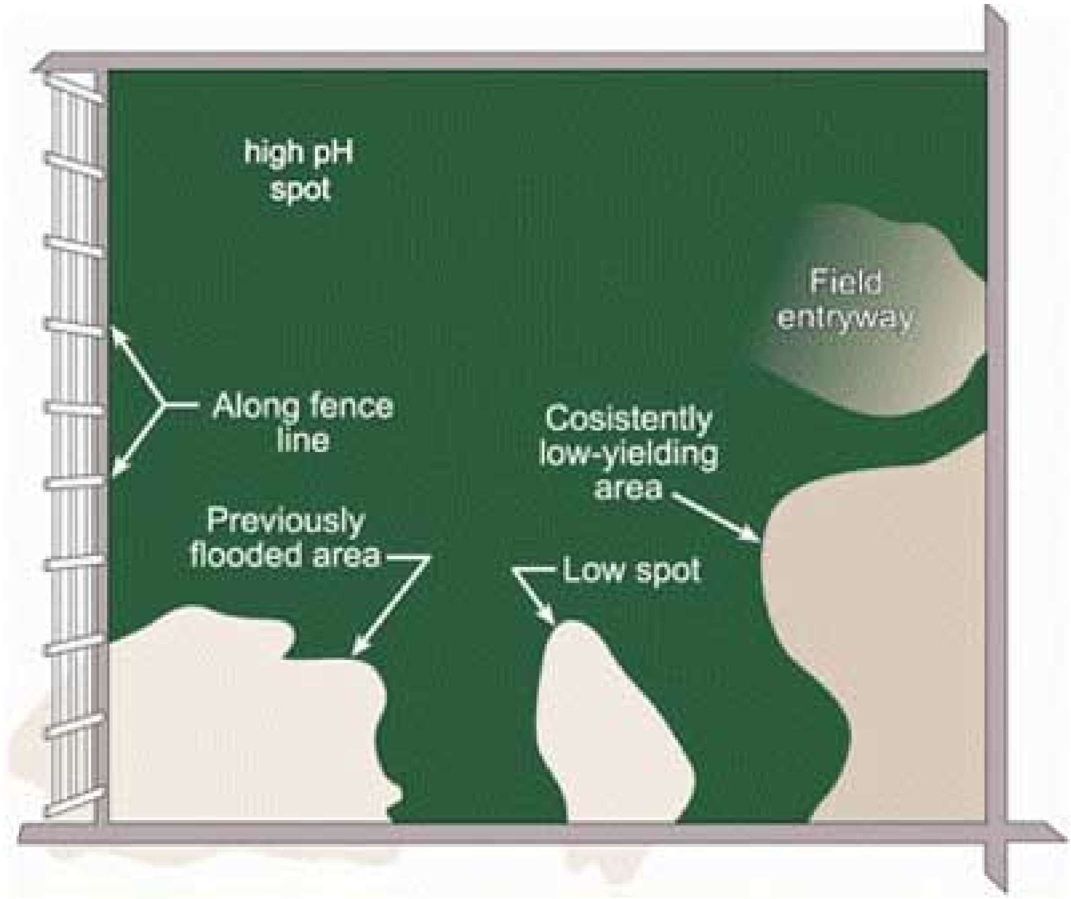

Figure 3. Hot spots in fields where soybean cyst nematodes are likely to be found. Photo courtesy of the Soybean Cyst Nematode Coalition.

Samples can be taken to any K-State Research and Extension county office for shipping. They can also be sent directly to the K-State Plant Disease Diagnostic Laboratory:

1712 Claflin Rd
4024 Throckmorton PSC
Manhattan, KS 66506

The Plant Disease Diagnostic Lab currently has a grant from the Soybean Cyst Nematode Coalition that allows us to provide free testing for SCN soil samples. Keep in mind that if you are too busy to sample this fall, any time is a good time to sample for SCN. Unlike other nematodes that move up and down in the soil profile depending on the season, the cysts are always there and move only with tillage.

For more information, visit the SCN Coalition website at https://www.thescncoalition.com.

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5. KS Dallas: New hard red wheat variety from K-State

The Kansas Agricultural Experiment Station has released a new hard red winter wheat variety named KS Dallas. This variety was developed by the K-State wheat breeding program at Hays and named after Dr. Dallas Seifers, a K-State retired plant pathologist who has made great contributions on wheat streak mosaic virus resistance. KS Dallas is adapted to western Kansas and other neighboring semi-arid regions.

Figure 1. New K-State hard red winter wheat variety KS Dallas. Photo by Dr. Guorong Zhang, K-State Research and Extension.

The experimental number of KS Dallas was KS15H116-6-1. KS Dallas was selected from a three-way cross of "KS08HW112-6//TX03A0148/Danby TR" using a modified bulk breeding method. In the pedigree, KS08HW112-6 is a hard white breeding line developed by the Kansas State University wheat breeding program at Hays. This parent has wheat streak mosaic virus resistance from the *Wsm2* gene. TX03A0148 is a hard red breeding line developed by Texas A&M University. Danby TR is a mutation line derived from Danby, a hard white variety released by the Kansas State University wheat breeding program at Hays.

KS Dallas has very competitive yields in western Kansas. Averaged over three years (2017 to 2019) of dryland testing, yield of this line was 79.8 bu/a, which was similar to Joe (80.4 bu/a). KS Dallas has good resistances to wheat streak mosaic virus, leaf rust, and stem rust. Its wheat streak mosaic virus resistance can hold up to ~70 ^{o}F (21^{o}C), which is about five Fahrenheit degrees higher than those resistant varieties with *Wsm2*, such as RonL, Joe, Clara CL, and Oakley CL. It is intermediate to stripe rust, barley yellow dwarf virus, and *Triticum* mosaic virus. It is moderately susceptible to powdery mildew and Hessian fly, and susceptible to soilborne mosaic virus and acid soil.

In general, KS Dallas has average test weight (~60 lb/bu), good flour yield, and very good mixing tolerance.

KS Dallas has medium maturity and medium height. It has medium-long coleoptile length and large kernels. It has good grain shattering resistance and average straw strength.

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