



K-STATE
Research and Extension

Extension Agronomy

eUpdate

09/29/2017

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, 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 Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Forecasting 2017 Kansas corn yields

Precise and reliable yield forecast tools could play a foundational role in supporting policy formulation and decision-making processes in agriculture. For farmers, reliable yield forecasts might represent a source for considering changes in management practices during the reproductive phase of the field crops.

For this study, the final yield forecast tool was developed by utilizing satellite imagery of current corn growing conditions across the state. The main steps to forecast yields were:

1) Data collection (2009-2016 period)

a) USDA-National Agricultural Statistics Service (NASS) county-level data was collected to determine yield distributions at the district level.

b) MODIS (820-ft x 820-ft pixel size) satellite information with an image every 8 days until the beginning of August

c) [CropLand Data Layer](#) or spatial distribution of the different crops throughout the state

2) Building and Validation of Yield Forecasting Models (YFM)

a) For building the models, NDVI (Normalized Difference Vegetation Index) was utilized, collected from corn producing regions within a county.

b) Yields at the county-level were estimated before harvest from satellite information and compared against the final yields reported by USDA-NASS at the county-level.

3) Building and Validation Layer for Corn 2017

Information from the CropLand Data Layer is available for corn in Kansas from 2006 until 2016 – but current corn locations across the state are not available for the 2017 season until next year.

Therefore, a complex statistical technique was employed (random forest prediction) to predict corn geo-locations across the state for the current season. Final validation of this map was tested against “known” field locations (collected via field survey analysis), summing up a total of over 500 field locations across the state.

4) Validation of previous years

Forecasted yield at the state-level from previous years (2009-2016) was validated by comparing those yields with the August yield estimation and the final yield from USDA-NASS. The yield forecasted via the satellite model was quite precise in predicting the final yields (e.g., example for 2009, 2012, 2014, and 2015 seasons; Figure 1).

5) 2017 Kansas Corn Yield Forecast

As a last step on the yield estimation, the yield and crop map models previously built were utilized to forecast the 2017 corn yield for Kansas. Satellite information from planting until the beginning of

August was aggregated to provide a more reliable yield prediction.

Based on the satellite yield model developed by our team, the state-level yield prediction will be 125 bushels per acre, which is close to both the August and September yield estimations of 133 bushels per acre released by USDA-NASS.

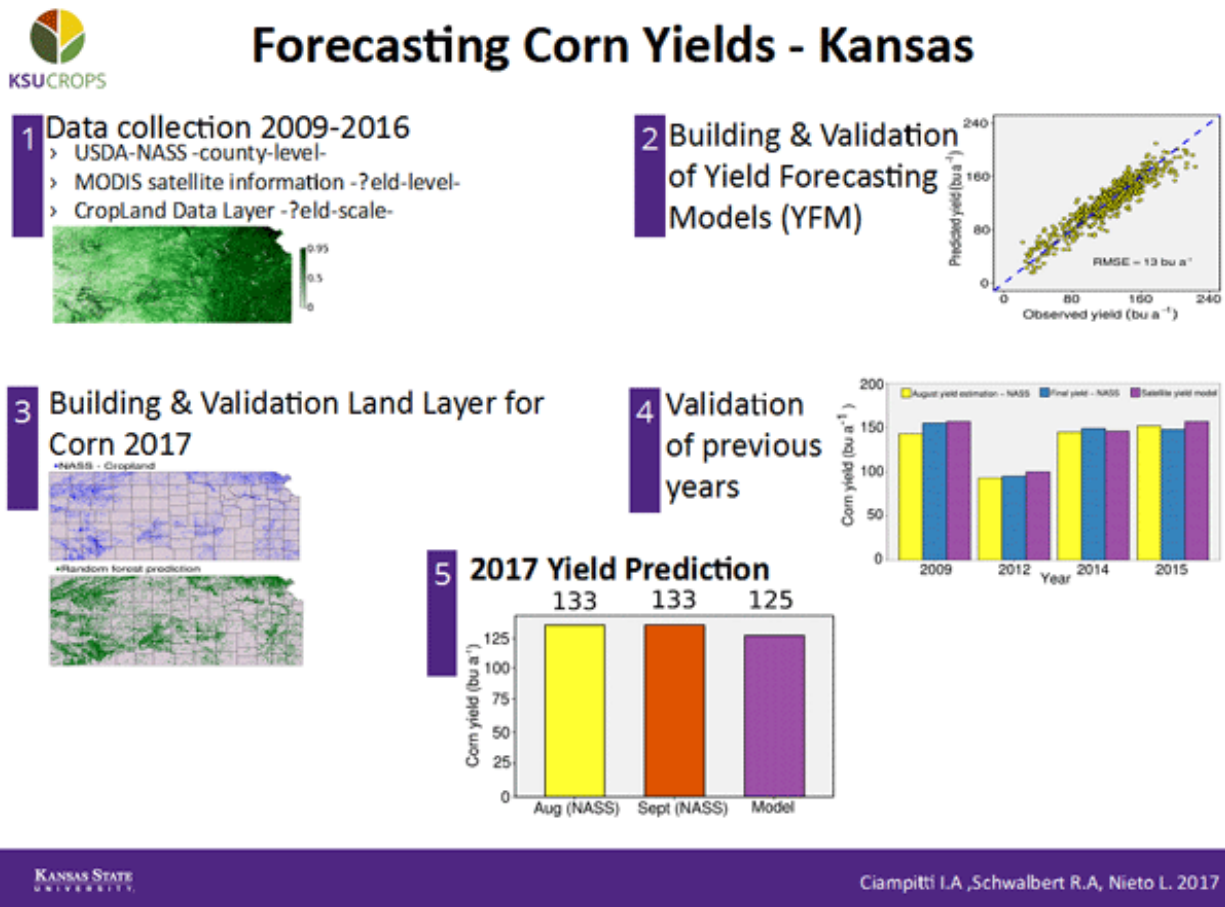


Figure 1. Forecasting corn yields derived from satellite data for the state of Kansas. Infographic developed by Ignacio Ciampitti, Rai Schwalbert, and Luciana Nieto, K-State Research and Extension.

A final prediction will be conducted in the first week of October that incorporates satellite information until the end of September to adjust and update the corn yield forecast value obtained from satellite data through the beginning of August. Stay tuned for the next update on the final 2017 corn yield prediction for the state of Kansas.

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2. Rate of dry down in corn before harvest

The latest USDA-National Agricultural Statistics Service crop progress and condition [report](#) classified more than 50% of the corn crop to in good or excellent condition. Overall, 75% of Kansas' corn is mature with only 29% harvested.

The weather conditions experienced from mid-August to mid-September were critical for corn as related to the grain filling rate and determining final grain weight. Temperatures and precipitation were split across the state, with warmer-than-normal conditions in the northwest and cooler conditions in the southeast. There was a small area of east central Kansas that had excessive moisture but much of the state had less than half of the normal precipitation for the period (Figure 1).

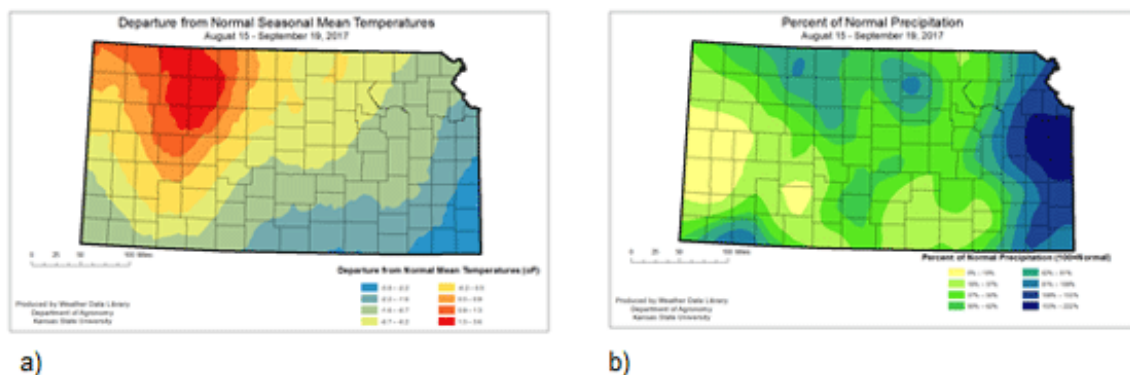


Figure 1. a) Departure from normal temperatures; b) percent of normal precipitation.

In recent years, a common question from producers is related to the dry down rate for corn when approaching the end of the season. Based on previous information, the average dry down rate depends on the weather, primarily temperature and moisture conditions – but it might range from 1% in late August to less than 0.5% per day in October. The weather outlook for October calls for an increase chance of warmer-than-normal temperatures with equal chances for above- or below-normal precipitation. This would favor a faster dry down rate than average.

According to a recent Extension article from Iowa State, "[Corn grain dry down in field from maturity to harvest](#)", grain water loss occurs at different rates but with two distinct phases: 1) before "black layer" or maturity (Figure 2), and 2) after black layer. For the first phase, Table 1 contains information on changes in grain moisture from dent until maturity of the corn.

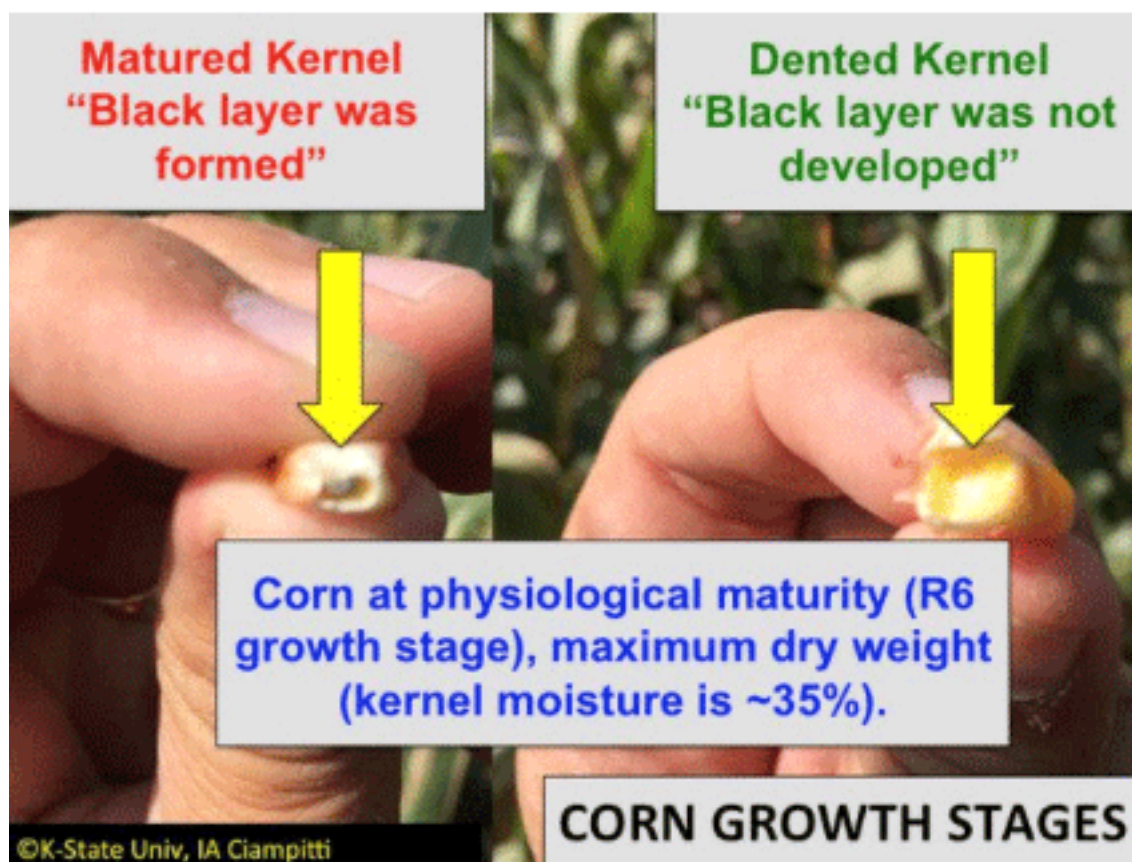


Figure 2. Corn at dent stage and at black layer growth stages. Photo and infographic prepared by Ignacio Ciampitti, K-State Research and Extension.

Table 1. Growth stages, moisture content, and total dry matter progression for corn from late to physiological maturity. Extracted from K-State Research and Extension publication MF3305 (Ciampitti, Elmore, Lauer, 2016).

R Stage	Moisture %	Dry Matter (% of Total Dry Weight)	Average per Substage	
			Growing Degree Days, °F	Days
5.0	60	45	75	3
5.25 (¼ milk line)	52	65	120	6
5.5 (½ milk line)	40	90	175	10
5.75 (¾ milk line)	37	97	205	14
6.0 (Physiological maturity)	35	100		

¹Abendroth, L.J., R.W. Elmore, M.J. Boyer, and S. K. Marlay. 2011. *Corn Growth and Development*. PMR 1009. Iowa State Univ. Extension. Ames Iowa.

In order to properly address the rate of dry down question from many of our producers, a study was conducted to investigate the effect of the grain dry down rate from the moment of “black layer” until

commercial harvest grain moisture is reached. For the conditions experienced in 2017 (from late August until mid-September), the overall dry down rate was around 1% per day (from 35% to 13% grain moisture) – taking an overall period of 23 days.

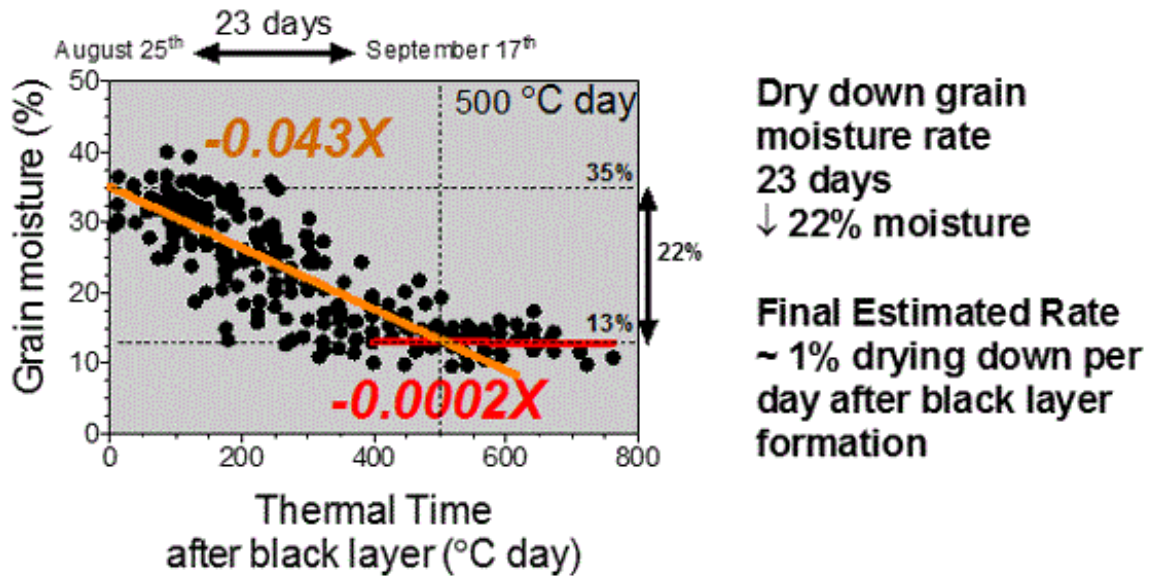


Figure 3. Grain moisture dry down (orange line) across three hybrids and different N rates near Manhattan, KS. Horizontal dashed lines marked the 35% grain moisture at black layer formation and 13% grain moisture around harvest time*. Graph prepared by Ignacio Ciampitti, K-State Research and Extension.

*Note: It is desired to reach harvest with 15.5% grain moisture to maximize the final grain volume to be sold, thus the importance of timing harvest with the right grain moisture content.

This dry down process can be delayed by:

- Low temperatures
- High humidity
- High grain moisture content at black layer (38-40%)

It is expected that the dry down rate will decrease to <0.5% per day for late-planted corn entering reproductive stages later in the growing season. A similar decrease is also expected for corn that was exposed to late-season stress conditions (e.g., drought, heat). Under these conditions, maturity may be reached with high grain water content and the last stages after black layer formation could face lower temperatures and higher humidity. These main factors should be considered when the time comes to schedule corn harvest.

This project is expected to be expanded in the coming years to include additional corn producing regions and to consider other factors such as planting date, hybrid maturity, and diverse weather environments across the state. If you are interested in participating, please contact the researchers listed below.

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3. Soybean dry down rate before harvest

Harvest may present some challenges when drought is a major factor. The last USDA-National Agricultural Statistics Service crop progress and condition [report](#) classified more than 40% of the soybean crop to be in good or excellent condition. Overall, 60% of all soybeans in Kansas are dropping leaves with a few areas of the state just entering into harvest (only 6% harvested).

The weather conditions expected for mid-September to mid-October will be critical for soybean as related to the seed filling and determining final seed weight.

While current conditions have been cooler-than-average, temperatures are expected to trend towards warmer-than-normal during the next 8 to 14 day period. This pattern is expected to continue for October. There is a slight chance for wetter-than-normal conditions in the short term (6-10 days), but the outlook for October favors drier-than-normal conditions in the eastern third of the state, and equal chances for the rest of the state. Note that there is a significant drop in normal rainfall amounts from September to October as we move into what is typically the drier part of the year.

Soybean will reach final maturity with high seed water content, moving from 90% to around 60% from seed filling until final maturity. Final maturity is defined as the formation of the black layer in the seeds. According to a recent Extension article from Iowa State, "[How fast do soybeans dry down in the field?](#)", the average seed dry down rate was 3.2% per day. Still, the dry down rate will depend on the maturity group selection (affecting the length of the season), planting date, and weather conditions experienced during the latter part of the reproductive phase.

Changes in the water content during the seed-filling process (Figure 1) were previously described in our "[Soybean Growth and Development](#)" poster. As described for corn, seed water loss for soybeans can also be divided in two phases: 1) before "black layer" or maturity, and 2) after black layer.

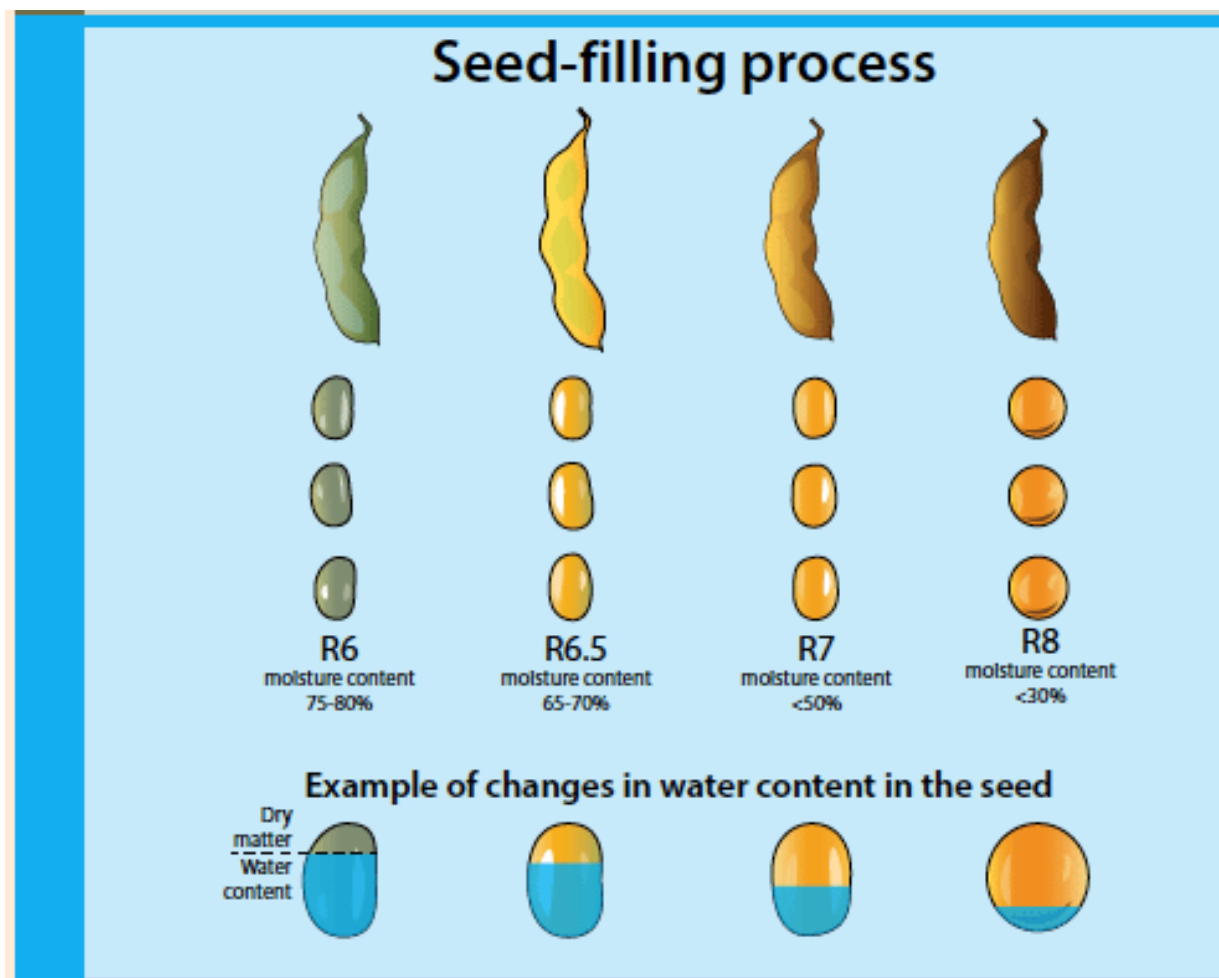


Figure 1. Soybean seed filling process from full seed to full maturity. Photo and infographic prepared by Ignacio Ciampitti, K-State Research and Extension.

In order to properly address the question related to the dry down rate for soybeans, a study was conducted to investigate the changes in water content from black layer formation (maturity) until harvest time (Figure 2). During the last days of September and mid-October 2016, the overall dry down rate was around 3% per day (from 58% to 12% seed moisture) – taking an overall period of 15 days.

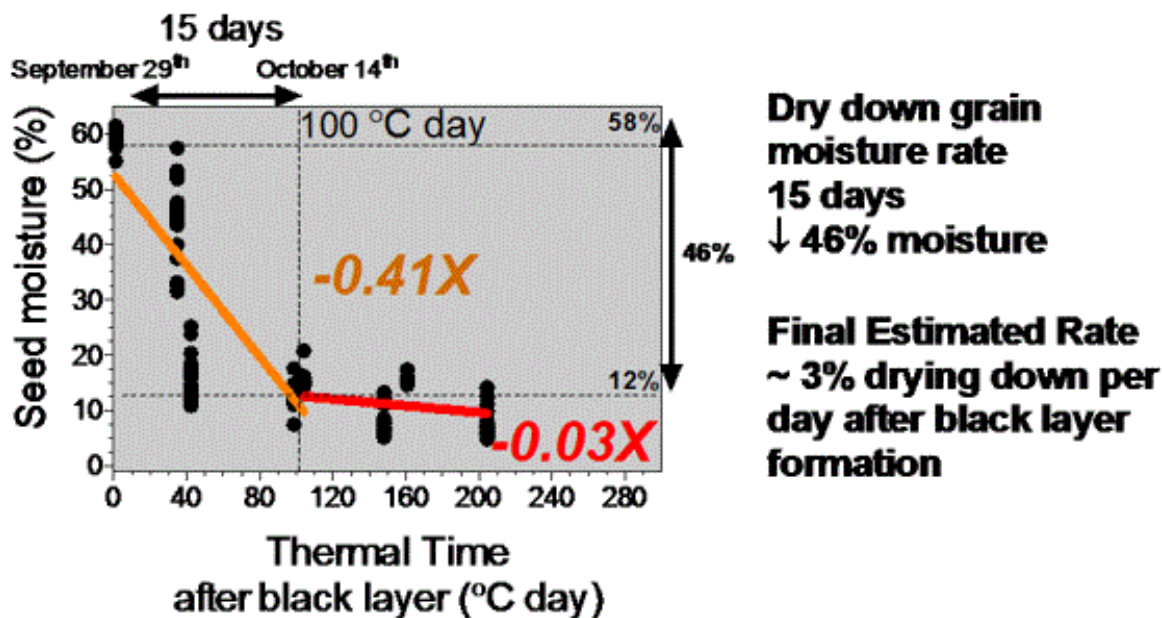


Figure 2. Grain moisture dry down (orange line) across three hybrids and different N rates near Manhattan, KS. Horizontal dashed lines marked the 58% seed moisture at black layer formation.* Graph prepared by Ignacio Ciampitti, K-State Research and Extension.

*Note: It is desired to reach harvest with 13% seed moisture to maximize the final seed volume to be sold, thus the importance of timing harvest with the right seed moisture content.

Soybean dry down rate was three-time faster, 3% per day, relative to corn at 1% per day. These dry down rates for corn and soybeans are primarily affected by temperature, humidity, and overall water content at the point of black layer formation (maturity). These main factors should be considered when the time comes to schedule soybean harvest.

For more information on dry down rates for corn, see the companion article, “Rate of dry down in corn before harvest”, located in this eUpdate issue.

This project is expected to be expanded in the coming years to include additional soybean producing regions and to consider other factors such as planting date, soybean maturity group, and diverse weather environments across the state. If you are interested in participating in this project, please contact the researchers listed below.

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4. Stalk rots in grain sorghum

Weather conditions have been favorable for stalk rot development in grain sorghum, and although not yet occurring, producers should be ready to deal with it before lodging occurs. While stalk rot occurs in both sorghum and corn, it can be an even bigger problem in grain sorghum than in corn due to a generally thinner stalk in sorghum.



Figure 1. Sorghum lodging in 2015 caused by Fusarium stalk rot. Photo by Kim Larson, K-State Research and Extension.

Annual losses are difficult to determine, because unless lodging occurs, the disease goes mostly 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.

In grain sorghum, the two most common types of stalk rot are charcoal rot and Fusarium stalk rot. Although caused by many 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 dry conditions early in the season, which decreases nutrient solubility, making the nutrients unavailable to the plant. 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.

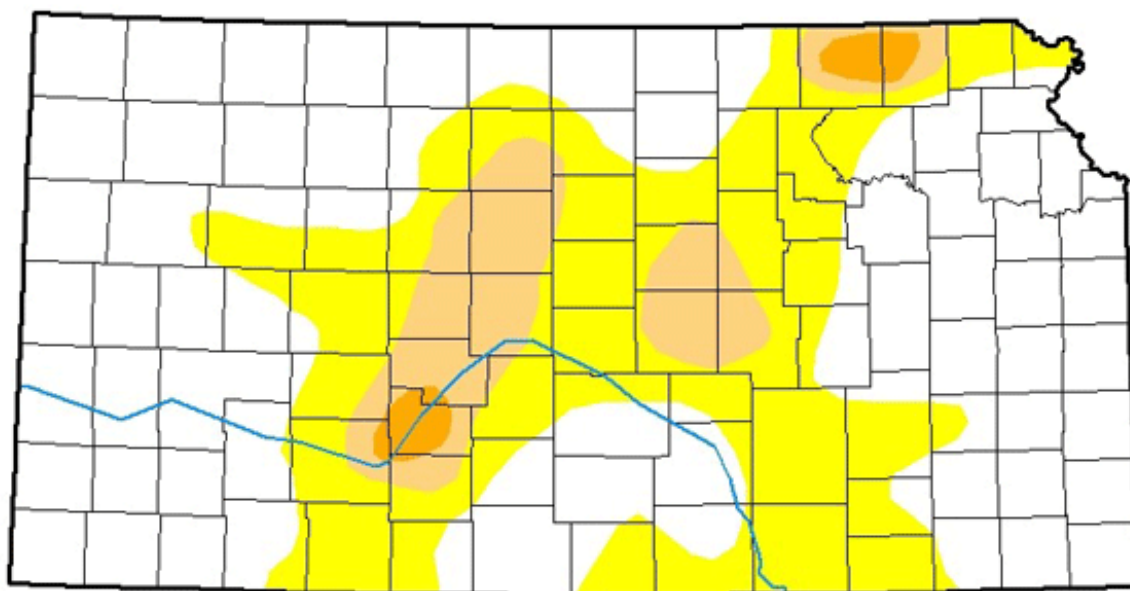


Figure 4. U.S. Drought Monitor Index map for September 28, 2017. <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?KS>

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. Where sugarcane aphids pressure was heavy this year, that will likely increase 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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5. Best options for controlling pigweeds in soybeans

Pigweed control in soybeans used to be easy before the development and increase in glyphosate resistance, but those days are now in the past. Many fields have been overgrown with pigweed in recent years, however the pigweeds weren't quite as bad in 2017 as in previous years. Grower adoption of new management strategies and technologies (with maybe a little luck from weather) has probably helped with pigweed management, but control continues to be a challenge.



Figure 1. Glyphosate-resistant Palmer amaranth in soybeans. Photo by Dallas Peterson, K-State Research and Extension.

Part of the difficulty in achieving season-long pigweed control is their biological characteristics. Waterhemp and Palmer amaranth are both prolific seed producers, so many fields have extremely high seedbanks due to past control failures. The pigweeds also have a fair amount of seed dormancy and will start to germinate in April, but continue to germinate through the entire growing season. Once emerged, plants can grow rapidly, so the window of opportunity for effective postemergence control can be very short.

The most successful and consistent pigweed management programs in soybeans will be an integrated approach that utilizes a diversity of herbicides and timely applications, along with good cultural practices. One of the keys to managing pigweeds is to stay ahead of them. There are a number of good residual soybean herbicides for preplant and preemergence pigweed control. However, they require good rainfall for activation and rarely provide complete season-long control. In a no-till situation, you may want to consider a split application of residual herbicides, with a preplant application in mid- to late-April followed by another application at planting time. This approach provides a better chance for activation and control of early emerging pigweed, along with extended residual control later into the season.

Postemergence treatments need to be applied before pigweeds exceed 3 to 4 inches tall. Whereas, glyphosate used to control large pigweeds, no other postemergence herbicide is consistently effective once pigweeds exceed 3 inches. An overlapping residual also can be included in the postemergence treatment, especially if a split application wasn't used before and at planting time. Sequential postemergence treatments also may be an option depending on product guidelines.

There are many different herbicide options that can be fit into the program. In addition, several different herbicide resistant traits are currently available, or likely will be available in soybeans in the future. Each trait has its unique strengths and weaknesses, but a multiple pronged approach utilizing a diversity of herbicides and timely applications will be critical for success regardless of trait technology. A program approach utilizing different herbicide modes of action will also help sustain the effectiveness of the new technologies further into the future.

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6. The spotlight is on cover crops at the 2017 Agronomy Field Day, November 3

Exciting advances in cover crop research will be featured at the 2017 Agronomy Field Day on November 3 at the Ashland Bottoms Research Farm in Manhattan. Topics will focus on understanding the role cover crops play in weed control, soil quality, nutrient management, and more.

The full list of topics and K-State speakers:

- Using cover crops for weed suppression – Anita Dille, Weed Ecology
- Improving soil quality with cover crops – DeAnn Presley, Soil Management Specialist
- Protecting surface water with healthy soils, cover crops, and fertilizer management – Nathan Nelson, Soil Fertility and Nutrient Management
- Soybean Yields and Cover Crops – Ignacio Ciampitti and Doug Shoup, Crop Production Specialist and South East Area Agronomist.
- Ten years of cover crops in a no-till wheat-sorghum-soybean rotation – Kraig Roozeboom, Cropping Systems Agronomist
- Cover crops and the nitrogen cycle in the rotation – Peter Tomlinson, Environmental Quality Specialist

The field day will begin with registration at 9 a.m. and wrap up at 1 p.m. Sessions include two concurrent one-hour tours in the morning, starting at 9:30, followed by a poster session during and after lunch.

Stay tuned for more information concerning registration and other Field Day news in upcoming eUpdate articles.

For more information, interested persons can contact Dorivar Ruiz Diaz at 785-532-6183 or ruizdiaz@ksu.edu

Cover crop research update



Agronomy Field Day 2017

Ashland Bottoms Farm, Manhattan

Friday, November 3

9:00 am – 1:00 pm

KANSAS STATE
UNIVERSITY

Department of Agronomy

Kansas State University Department of Agronomy

2004 Throckmorton Plant Sciences Center | Manhattan, KS 66506

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7. Kansas Bankers Association Awards nominations due by November 3

Nominations for the 2017 Kansas Bankers Association Conservation Awards Program are now being accepted. This year the Kansas Bankers Association, K-State Research and Extension, and the Kansas Department of Wildlife, Parks, and Tourism have announced six award categories:

- Energy Conservation
- Water Quality
- Water Conservation
- Soil Conservation
- Windbreaks
- Wildlife Habitat

The purpose of this program is to stimulate a greater interest in the conservation of Kansas' agricultural and natural resources by giving recognition to those farmers and landowners who have made outstanding progress in practicing conservation on their farms.

Each year over 200 Kansas producers and landowners are recognized through this program. Nominations can be made by any person in the county. They should be sent to the County Extension Agricultural Agent or the Kansas Department of Wildlife, Parks, and Tourism District Biologist by November 3, 2017.

The K-State Extension agent for Agriculture and Natural Resources, or the Extension Coordinator, is the designated Chairperson of the committee to select persons to receive awards.

For more information, see:

<http://www.agronomy.k-state.edu/extension/kansasbankersaward/kansas-bankers-awards.html>

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