



K-STATE
Research and Extension

Extension Agronomy

eUpdate

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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, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. New K-State wheat variety: Joe

“Joe” is a new hard white winter wheat variety released this summer by the Kansas Agricultural Experiment Station. This variety was developed at K-State’s Agricultural Research Center-Hays from a cross made by Joe Martin, retired wheat breeder at ARC-Hays. Joe was in the 2015 K-State Performance Tests as experimental number KS11HW39-5-4. Its pedigree includes two white experimental lines, KS04HW10-3 and KS04HW119-3.

- Yield record: Joe has yielded very well in western Kansas. It has shown a significant increase in yield potential over currently grown varieties. Averaged over three years (2013 to 2015) of dryland testing across western Kansas, yields of this variety were about 16% higher than Danby and about 33% higher than TAM 111. Danby and TAM 111 are two of the most adapted hard white and hard red wheat varieties, respectively, in western Kansas. In 2015 Kansas Wheat Performance Test, the average yield of Joe ranked No. 1 across dryland testing sites in western Kansas and was at least 5% higher than all other varieties in the trials. Joe has been tested under irrigation in Colby, Kansas, for the last three years. Yields averaged 103.7 bu/acre, which was about 19% higher than Danby and 27% higher than TAM 111. Joe was also tested in 2015 Colorado Dryland Wheat Performance Test and ranked No. 1 with an average yield of 81.3 bu/acre across the nine testing sites.
- Disease resistance: Joe has very good resistance to wheat streak mosaic virus, stripe rust, and leaf rust.
- Maturity: Medium late
- Straw strength: Above average
- Height: Medium tall
- Winterhardiness: Good
- Milling and baking quality: Good
- Pre-harvest sprouting tolerance: Moderately susceptible
- Area of adaptation: western Kansas and eastern Colorado

Registered seed of Joe will be available in the fall of 2016. It is an open-market hard white winter wheat, and like all white wheat varieties will need to be kept separate from hard red winter varieties through the production, harvesting, and marketing chain.

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2. Pre-harvest glyphosate treatment on sorghum in a no-till system

There are always questions about effective ways to manage grain sorghum to improve the performance of winter wheat planted into no-till sorghum residue following fall harvest. The technique most often asked about is applying glyphosate to the sorghum crop prior to harvest.

Most glyphosate labels require that applications be made to the sorghum crop when grain moisture is at 30% or less to minimize any possible yield reductions. Also, there is a required seven-day period between time of application and harvest.

K-State research results

In 2011 and 2012, former K-State agronomy graduate student Josh Jennings established six field trials to test the effect of pre-harvest glyphosate treatments on sorghum. In 2011 to 2012, field trials were conducted at Belleville, Manhattan, and Ottawa. In 2012 to 2013 field trials were located in Belleville, Manhattan, and Hutchinson.

Glyphosate was applied to the sorghum crop when grain moisture was approximately 18-21%. In 2011, applications of glyphosate, on average, were applied 22 days earlier than glyphosate treatments in 2012. The first freeze date was also 12 days later in 2011 than in 2012. As a result, the pre-harvest applications of glyphosate were applied, on average, 38 days prior to the first freeze in 2011 and only 6 days prior to the first freeze in 2012.

For grain sorghum, the glyphosate pre-harvest treatments had no significant effect on yield, grain moisture at harvest, test weight, or seed size when averaged over both years and all locations.

The effect on wheat yields was more variable.

For the 2011-12 wheat crop, when the pre-harvest glyphosate treatments were applied to sorghum 38 days prior to the first freeze in the fall of 2011, the wheat following sorghum that received the pre-harvest glyphosate treatment yielded 12-13% more on average than wheat following untreated sorghum.

On the other hand, for the 2012-13 wheat crop, when the pre-harvest glyphosate treatments were applied to sorghum only 6 days prior to the first freeze in the fall of 2012, wheat yields were about the same when following either treated or untreated grain sorghum.

Summary

Applications of glyphosate to grain sorghum prior to fall harvest can help improve the performance of the following wheat crop if applied early enough in the late summer/early fall. Wheat yields following glyphosate-treated grain sorghum, on average, were 6% greater than wheat yields following untreated grain sorghum – but only when glyphosate treatments were made at least 38 days prior to the first freeze date. When pre-harvest glyphosate is applied closer to the time of the first freeze, response of wheat yields following treated sorghum may be minimal.

It is important to follow the glyphosate label for application recommendations. Glyphosate applied

at low rates or when temperatures are not adequate may reduce the effectiveness of the product.

The sorghum field should also be inspected for stalk issues prior to applying the glyphosate. If stalk rots are present, applying glyphosate may increase the chance of plant lodging if it is not harvested in a timely manner.

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3. Early planting of wheat can lead to several problems

The general target date for planting wheat for optimum grain yields in Kansas is within a week of the best pest management planting date, or BPMP (formerly known as the “Hessian fly-free”) date. If forage production is the primary goal, wheat should be planted in early to mid-September. But if grain yields are the primary goal, then waiting until the fly-free date to start planting is the best approach.

This doesn’t always work according to plan, of course. Some years, the earlier-planted wheat does best and some years the later-planted wheat does best, depending on weather conditions and disease pressure during the growing season. If fields become too wet to plant by mid-October and stay that way through the remainder of the fall, then producers end up planting much later than they’d like, and this is an incentive to start planting earlier than the fly-free date if soil conditions are good.

But it’s a good idea not to go overboard and start planting too much earlier than the BPMP date (which can seem quite late to some, especially in south central Kansas). What’s wrong with planting a few weeks earlier than the BPMP date? There are several problems that can arise from planting too early:

1. Increased risk of **wheat streak mosaic** and related diseases. Wheat curl mites survive over the summer on living plant tissue of volunteer wheat and certain other grasses. As soon as those host plants die off, the wheat curl mites leave and start searching for a new source of living plant tissue. Wheat that is planted early is likely to become infested, and thus become infected with wheat streak mosaic, high plains virus, and Triticum mosaic virus. The wheat curl mites can normally move only about a half mile through the air before dying, so if wheat is planted early, make sure all volunteer wheat within a half-mile is completely dead at least two weeks before planting.
2. Increased risk of **Hessian fly**. Over the summer, Hessian fly pupae live in the old crowns of wheat residue. After the first good soaking rain in late summer or early fall, these pupae (or “flaxseed”) will hatch out as adult Hessian flies and start looking for live wheat plants to lay eggs on. They are most likely to find either volunteer wheat or early-planted wheat at that time. After the BPMP date, many of the adult Hessian fly in a given area will have laid their eggs, so there is generally less risk of Hessian fly infestation for wheat planted after that date. But Hessian fly adult activity has been noted through November or even early December in Kansas.
3. Increased risk of **barley yellow dwarf**. The vectors of barley yellow dwarf are greenbugs and bird cherry-oat aphids. These insects are more likely to infest wheat during warm weather early in the fall than during cooler weather.
4. Increased risk of **excessive fall growth and excessive fall tillering**. For optimum grain yields and winter survival, the goal is for wheat plants to head into winter with established crown roots and 2-4 tillers. Wheat that is planted early can grow much more than this, especially if moisture and nitrogen levels are good. If wheat gets too big in the fall, it can use up too much soil moisture in unproductive vegetative growth and become more susceptible to drought stress in the spring if conditions are dry.
5. Increased risk of **take-all, dryland foot rot, and common root rot**. Take-all is usually worse on early-planted wheat than on later-planted wheat. In addition, one of the ways to avoid dryland foot

rot (*Fusarium graminearum*, and other *Fusarium* species) is to avoid early seeding. This practice promotes large plants that more often become water stressed in the fall predisposing them to invasion by the fungi. Early planting of wheat also favors common root rot because this gives the root rot fungi more time to invade and colonize root and crown tissue.

6. **Grassy weed infestations** become more expensive to control. If cheatgrass, downy brome, Japanese brome, or annual rye come up before the wheat is planted, they can be controlled with glyphosate or tillage. If wheat is planted early and these grassy weeds come up after the wheat has emerged, producers will have to use an appropriate grass herbicide to control them.

7. Germination problems due to **high soil temperatures**. Early planted wheat is sown in hotter soils, which may become problematic as some wheat varieties have high-temperature germination sensitivity. In other words, some varieties won't germinate when soil temperatures are greater than 85°F. If planting early, it is important to select varieties that do not have high-temperature germination sensitivity and sow sensitive varieties later in the fall, when soil temperatures have cooled down.

8. Germination problems due to **shortened coleoptile length**. Hotter soils tend to decrease the coleoptile length of the germinating wheat. Therefore, deeply planted wheat may not have a long-enough coleoptile to break through the soil surface and may result in decreased emergence and poor stand establishment. Because of the shortened coleoptile length, it is preferable to dust the wheat in at a shallower depth (3/4 to 1 inch deep) when early planting wheat than trying to reach moisture in deeper layers if soil moisture is absent from the top inch of the soil profile.

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4. Hessian fly fall activity on wheat

Hessian fly activity was significant on wheat in parts of Kansas last season. Producers should be alert to the possibility of Hessian fly infestations again this fall.

One of the most critical times in the life cycle of Hessian fly, from the perspective of newly planted wheat, is late summer and early fall. The Hessian fly lives through the summer in residue of wheat, wheat-related species, rye, and barley as brown, 1/8-inch long capsule-like cases (puparia) commonly called flaxseeds.

Tiny, fragile flies emerge from the flaxseed on warm fall days from August through November, often after a rain. It does not take much moisture to get adult fly activity. We have had spikes in activity from just fog/heavy dew events.

The adult Hessian fly is a tiny, dark-colored insect about 1/8-inch long that resembles a gnat. These adults only live for one to three days, during which time they mate. After mating, females lay eggs in the leaf grooves of fall-seeded (preferably seedling) wheat. Though tiny, eggs can be seen with the unaided eye and resemble early stages of wheat leaf rust.

Only a portion of the population will emerge as adults at any one time. Some flaxseeds survive in a dormant stage for weeks, months, or even years. This makes the exact source of an infestation difficult to document and allows additional broods to develop. Under favorable weather conditions, volunteer wheat present in or adjacent to infested fields can support development of a summer brood. Injury to volunteer wheat is of little consequence, but the individuals arising from this brood may produce a secondary fall brood that is likely to injure the planted crop.

After the eggs are laid on wheat, they will hatch into tiny larvae within three to 10 days. These larvae migrate downward during the night when humidity is high. Larvae cannot survive exposed on the leaf surface. They move down the plant between the sheath and stem, stopping just above the crown, generally just below the soil surface. Larvae feed by withdrawing sap from the plant for eight to 30 days. Temperature influences development, and most larvae mature before the onset of cold weather. Mature larvae are shiny, whitish, legless and headless maggots about 3/16-inch long. Full-grown larvae gradually form flaxseed, and just as in the summer, the insects pass the winter in this flaxseed stage.

Fall infestations are not always conspicuous at first. Infested shoots are stunted and sometimes killed. The entire stand may be lost, especially if significant infestation occurs shortly after germination while plants are in the seedling stage. If tillering has begun at the time of infestation, only individual tillers may actually be killed. Examination of an infested tiller usually reveals an undeveloped central shoot with an unusually broad and thickened, bluish-green leaf. To confirm the diagnosis, carefully remove the plant and roots from the soil. Look closely for maggots or flaxseeds by gently pulling the leaf sheath away from the stem and inspecting all the way down to the base of the plant.



Figure 1. Wheat infested with Hessian fly (left) compared with non-infested wheat. Photos by Holly Schwarting, K-State Research and Extension.



Figure 2. Hessian fly puparia, or "flaxseed," on wheat.

For more information, see K-State publication MF-2866, "Hessian Fly," at:
<http://www.ksre.ksu.edu/bookstore/pubs/MF2866.pdf>

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5. Factors that influence Hessian fly fall infestations

Which wheat fields are most likely to be infested with Hessian fly in the fall? It depends on residue management, variety, planting date, the presence of nearby volunteer wheat, the use of insecticide seed treatments, and crop rotation.

Residue management. Undisturbed stubble favors survival. Experience has shown that, where soil management practices allow, thorough incorporation of the stubble can be a useful management technique. Thorough incorporation must be stressed, however. In one study, flaxseeds buried 1 inch below the surface of the soil allowed 26 percent of the population to emerge, at 2 inches only 6 percent emerged, and none emerged where stubble was buried to a depth of 4 inches. In another study, it was determined that double disking was five times more effective than single disking. What about burning and grazing? Studies have shown that burning destroys flaxseeds present on the above-ground portion of the stem. A slow-moving fire is best, but stubble fires are often fast moving and affect top growth instead of burning out the crowns at or below the soil line where the majority of flaxseeds exist.

Variety. Often the best practice is to consider planting a resistant variety, where practicable. Growers should consider this option carefully during times when fly populations appear to be increasing, especially when the intention is to plant early for fall pasture and where other options are limited. Consult with your local K-State Research and Extension agent for more information on performance of varieties in your area. Or see K-State Research and Extension publication MF-991 *Wheat Variety and Disease Insect Ratings*, available at: <http://www.ksre.ksu.edu/bookstore/pubs/MF991.pdf>

Planting date. In theory, waiting to plant until the best pest management planting date (BPMP) allows time for the main fall brood of adult Hessian flies to emerge and die before wheat is planted. Without live wheat plants, emerging females are deprived of a place to lay eggs, minimizing fall infestation. There is still some risk if a nearby infestation exists and a secondary fall brood develops. The BPMP used to be called the "Hessian fly-free date," but that older term is not accurate because it implies there will be no Hessian fly adults after that date – and that is not true.

The risk of fall infestation is almost always greater where wheat is planted before the BPMP date, especially during years favorable for fly development. Observance of the BPMP date also reduces the incidence of wheat streak mosaic and barley yellow dwarf viruses. The BPMP date strategy is based on studies conducted from 1918-1935, and BPMP dates are based on data collected more than 70 years ago, but are now being refined.

The relatively mild fall weather in recent years, along with a slight increase in average fall temperatures over the last 30 years, has reduced the effectiveness of using this date as a planting guide. In studies conducted in Sedgwick County, Kansas, during 2006 -2010 using a Hessian fly pheromone trap, adult flies were active until early December. It seemed that more adult flies were trapped after a rain. The impact of this extended Hessian fly activity on wheat or on fly population density is not known, but it is interesting to note that potential for Hessian fly infestation exists longer into the fall than historical data indicate. In addition, the BPMP date may not always present the best planting date for optimum yield, but on average, it correlates well. The BPMP date can be used on an individual-field basis but will be more effective when it is practiced area wide.

Planting too late is also risky. Growers may be surprised to learn that delaying planting too late in the fall can actually increase the risk of Hessian fly infestation. While late planting dates may protect the

field against fall infestation, the result is smaller plants in the spring. And when the spring brood of flies is active in March or April, those females prefer younger plants for egg laying. Thus, if a source of infestation is nearby, very-late-planted wheat of a susceptible variety may suffer extensive damage from spring infestations.

Volunteer wheat. Volunteer wheat that is allowed to grow for two to three weeks, especially in wet summers, can enable the fly to produce an extra brood and infest the planted crop in greater numbers. Volunteer wheat not only increases the population but also may render other practices, such as planting after the BPMP date, less effective. The adult fly is capable of dispersing to adjacent fields to lay eggs, so it is vital to destroy volunteer wheat in the area at least two weeks before the planted crop germinates. This practice also helps reduce the incidence of wheat streak mosaic virus.

Insecticide seed treatments. Studies have shown that systemic seed treatments may provide some control of Hessian fly larvae for up to 30 days. Depending on when the wheat is planted, this may protect plants through the egg-laying period in fall, or at least shorten the period of vulnerability before cold weather stops adult emergence and larval feeding. In either case, Hessian fly impact is reduced.

Crop rotation. The Hessian fly has a limited host range and is not a migratory pest, so populations can be reduced by not planting wheat directly back into infested stubble.

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The estimation of crop yields before harvest can be erratic, but producers often like to know about the potential yield of their crops. In previous K-State Agronomy eUpdates we discussed the calculation of the potential yield for soybean and corn. These articles are:

- Estimating soybean yields. ksu.ag/1WJNWaf (August 21, 2015 - eUpdate 525)
- Estimating corn yields. ksu.ag/1gux3t0 (July 31, 2015 - eUpdate 522)

This article will discuss how to get simple but fairly good estimates of sorghum yield potential. Similarly to soybean crop, sorghum can also compensate for abiotic or biotic stresses through changes in head sizes (grain number and weight) and number of tillers.

Before going into the procedure to estimate sorghum yields, we need to understand the main plant components of sorghum yield. The main yield-driving forces are:

- Number of plants
- Number of tillers per plant
- Total number of seeds per head
- Seeds per pound

The number of plants and the number of tillers per plant are two of the main components, which are determined well before the end of the crop growing season. Those two yield components are influenced by the initial plant density, planting date, and the environment, among other factors.

Those who want to get right to the formula can skip to the next paragraph, but it will help to know how sorghum yield components develop. Increasing the number of plants per acre potentially increases competition for resources, which can diminish the plant's capacity to produce tillers. In addition, the interaction of planting date with plant density can have a similar effect. As planting date is delayed, the capacity of the plant to produce tillers will be reduced; thus, plant population needs to be increased to compensate for the reduction in the number of tillers. Previous research at K-State showed sorghum produces more tillers when planted early (mid-to-late May) at lower plant populations as compared with late planting dates (mid-to-late June). The environment also plays an important role in the final number of heads per unit area. Heat and drought stress will reduce the plant's ability to produce more tillers, and also could severely reduce the tiller survival rate. The total number of seeds per head will be determined within the one- or two-week period before flowering until milk to soft dough stages (approximately two to three weeks after flowering). Kernel size will be determined close to the end of the season. In the 15 to 25 days after flowering, during the soft dough stage, sorghum grains have already accumulated about 50% of the final dry mass. Thus, the period around flowering is critical for defining not only the final number of grains per head but also the potential maximum kernel size. Final seed weight will be determined when the grains reach physiological maturity (visualized as a "black-layer" near the seed base). From this time until harvest the grains will dry down from approximately 35% to 20% moisture content.

The interaction among all four components will determine the actual yield, but a wide range of variation can be expected in all these main yield driving forces (Figure 1).

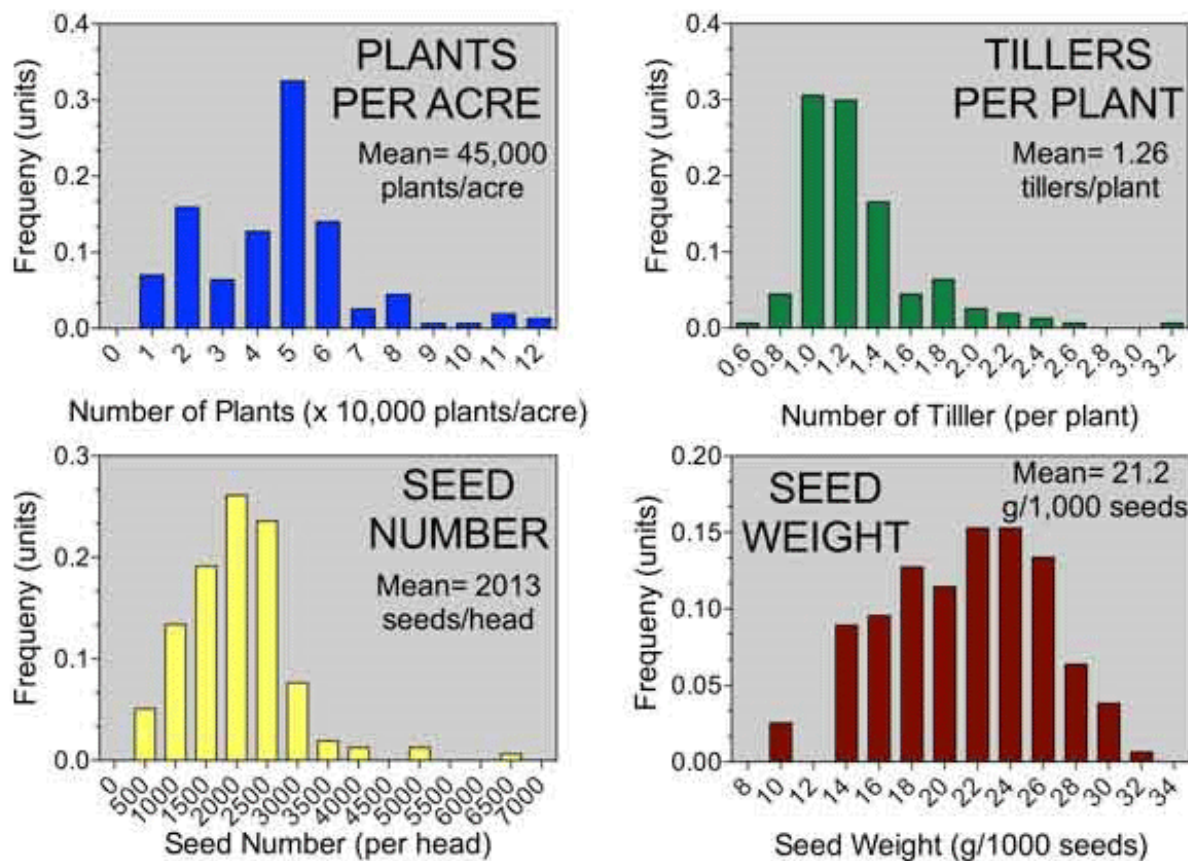


Figure 1. Example of the variation expected to be found in the main sorghum yield components. The number of tillers per plant can also be interpreted as the number of heads per plant, considering that all tillers have one fertile head.

When can I start making sorghum yield estimates?

As the sorghum crop gets closer to full maturity, yield estimates will be more accurate because the kernel weight will be closer to being set. Nonetheless, we can start taking yield estimations three to four weeks after flowering (from soft to hard dough stages). At these stages, the final seed number can still change. In addition to the seed number, the seed weight will be only partially determined -- approximately 50 to 75% of dry mass accumulation as compared to the final weight.

Variability within the field

Variability between plants needs to be properly accounted for when estimating sorghum yields using the on-farm approach (see next section). Another important factor is the variation between different areas in the field. In general, it is recommended to perform yield estimations in at least 5 to 10 sections of the field to account for field variability.

On-farm approach for estimating sorghum yields

The estimation of sorghum yields should consider the main driving forces:

Total number of heads per unit area [number of plants per acre x heads per plant] (1)

Total number of seeds per head (2)

Number of seeds per pound (3)

Pounds per bushel, or test weight, which for sorghum is 56 lbs/bushel (4)

The final equation for estimating sorghum yields:

$$[(1) \times (2) / (3)] / (4) = \text{Sorghum yield in bushels/acre}$$

The following steps should be taken for making sorghum yield estimates:

Step 1 -Number of Heads per Unit Area:

For this on-farm approach, start by counting the number of heads from a 17.4 foot length of row when the sorghum is in 30-inch rows. This sample area represents 1/1000th area of an acre. If the sorghum is in 15-inch rows, then the number of heads in 2 rows should be counted. For a 7.5-inch spacing, 4 rows will be measured. In each of these scenarios, the area counted will be equal to 1/1000th of an acre.

Head counts should be taken in several different areas of the field to properly account for the potential yield variability. If the proportion of smaller heads, less than 3 inches in height, is very low (less than 5%), these heads could be avoided due to the smaller proportion they will represent when determining the final yield.

Step 2 –Estimation of the Number of Seeds per Head:

The seed number is, by far, one of the most complicated yield components that need to be estimated. The total number of seeds per head can vary from 100 to 5,000 seeds per head (Figure 1), but almost $\frac{3}{4}$ of the seed number distribution is around 1,500 to 2,500 seeds per head. A previous report on sorghum yield estimation (Vogel, 1970), suggested as an alternative to estimate the number of nodes, and branches within nodes, for each sample of sorghum heads, and then to count the number of grains in a subsample of nodes and branches.

This approach is still very tedious. A simpler method of estimating the number grains per head would be very helpful.



Figure 2. To estimate the total number of heads per acre, count the number of heads in a sample area 17.4 feet in length, for 30-inch row spacings. Photo by Ignacio Ciampitti, K-State Research and Extension.



Figure 3. There is no easy shortcut yet for counting the number of seeds per head. Photo by Ignacio Ciampitti, K-State Research and Extension.

We are currently processing information from previous and current year to develop a method for making a quick estimation of the grain number.

Another quick method uses an estimate of seed counts per head based on determinations of general yield environment conditions. From previously published information from K-State (provided by K-State professors Richard Vanderlip, emeritus, and Kraig Roozeboom), we can utilize a very simple association between the yield level, conditions around pollination/grain set time, and the number of grains per heads (Figure 4). In their work, Vanderlip and Roozeboom counted the average number of seeds per head and average seed weight for different yield environments, after harvest.

We can use this relationship to give us a general idea of the kind of seed count per head we can expect based on the general yield environment, using primarily the environmental conditions during the period of first week before flowering to two to three weeks after flowering, when pollination and grain set are being determined. We can then use that estimated seed count per head, and multiply it by the number of heads per acre. The number of seeds per pounds, or seed weight, is also a factor we need to estimate, but the work by Vanderlip and Roozeboom found that to be much less of a factor in yield than seed count per head.

If conditions were very poor during pollination and grain set, around the first week before and two to three weeks after flowering, and the general yield environment is low then the total number of seeds per head will average around 500-1,000 seeds per head (900; Table 1). On the opposite extreme, if the conditions around flowering were very favorable for good pollination and grain set

development, and the general yield environment is very high, then the number of seeds per head could be around 1,500 to 3,500 (2,500; Table 1). Intermediate yield environment scenarios can occur if a portion of the three-to-four week period around flowering was favorable and part of it was unfavorable. In that case, the number of seeds per head could be between 1,000-3,500, with an overall average of around 1,745 seeds per head.

This information is provided only for general guidance on estimating sorghum yield potential using the on-farm approach. Different responses between yield and its components might be expected for the complexity of diverse genotypes, crop production practices, and environments.

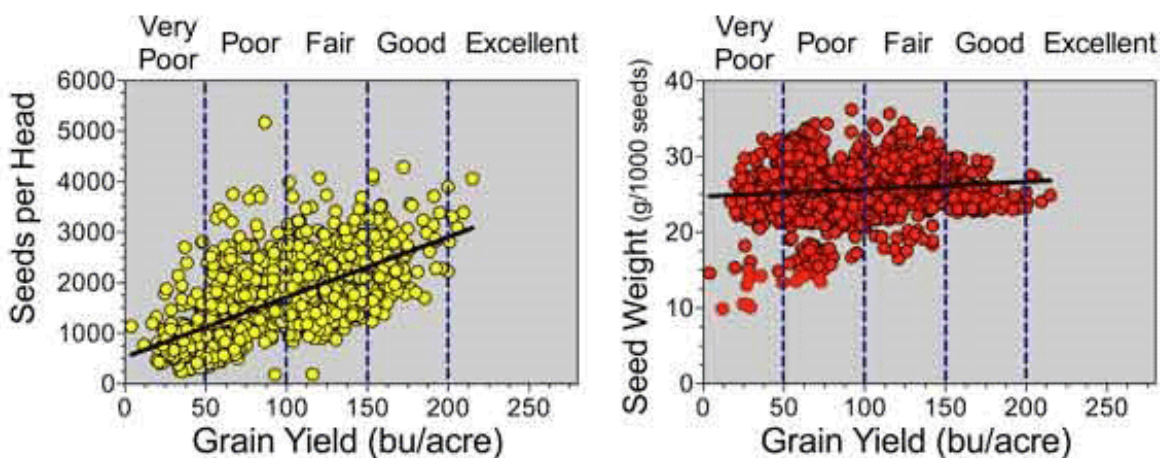


Figure 4. Relationship between grain yield and yield components, seeds per head (yellow points, left panel) and seed weight (red data points, right panel). The number of seeds per head has the most direct relationship with yield.

Table 1. Total number of seeds per head and seed weight components.

Yield Range (bu/acre)	Crop Condition	Average Seeds per Head	Average Seed Weight (g/1,000)	Number of Observations
<50	Very Poor	900	24.5	154
50-100	Poor	1,500	25.5	391
100-150	Fair	2,000	26.2	495
150-200	Good	2,500	25.6	129
>200	Excellent	3,330	25.5	5

Step 3 –Estimation of the Seed Weight:

A similar procedure can be followed to estimate the seed weight (Table 1). For the seed weight component, the variation documented in the dataset showed a very narrow seed weight variation as

compared with the variability found in the seed number component. In general, it seems that lower seed weight is expected at low yield ranges, but the difference among yield levels is negligible. Table 2 shows the conversion from average seed weight to seeds per pound, and from seeds per pound to the seed size factor employed in the examples below for sorghum yield estimation.

Table 2. Seed weight, seeds per pound.

Yield Range (bu/acre)	Crop Condition	Average Seed Weight (g/1,000)	Seeds Per Pound
<50	Very Poor	24.5	18,520
50-100	Poor	25.5	17,793
100-150	Fair	26.2	17,318
150-200	Good	25.6	17,723
>200	Excellent	25.5	17,793

Step 4- Examples of “On-Farm” Yield Estimation Approach:

$[(\text{Heads} \times \text{Seeds per Head}) \times 1,000 \div \text{Seeds per Pound}] \div \text{Pounds per bushel}$

Examples:

A. Good Crop Condition:

Irrigated sorghum with adequate plant density (48,000 plants/acre), average number of tillers per plant of 1.3, and good yield environment with adequate flowering and grain filling periods:

$(48 \text{ plants in } 17.4 \text{ foot} - 1/1000^{\text{th}} \text{ of an acre} \times 1.3 \text{ fertile tillers per plant}) = 62 \text{ heads}$

Yield Estimation = $[(62 \times 2,500) \times 1,000 \div 17,723] \div 56 = \mathbf{156 \text{ bu/acre}}$

B. Poor to Fair Crop Condition:

Dryland sorghum with adequate plant density (40,000 plants/acre), average number of tillers per plant of 1.3, and poor flowering but fair grain filling period:

Yield Estimation = $[(52 \times 1,500) \times 1,000 \div 17,723] \div 56 = \mathbf{79 \text{ bu/acre}}$

C. Very Poor Crop Condition:

Dryland sorghum with adequate plant density (40,000 plants/acre), average number of tillers per plant of 1.0, and poor yield environment and growing season (poor flowering and grain filling period):

Yield Estimation = $[(40 * 900) * 1,000 \div 18,520] \div 56 = \mathbf{35 \text{ bu/acre}}$

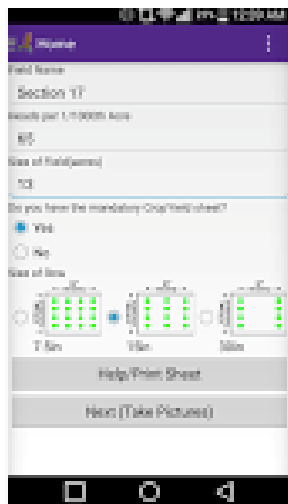
An app for predicting sorghum yields

An app is currently under development with the final goal of estimating sorghum yields before harvest. Both Android and iOS (Apple) versions are under development and evaluation at the field-scale (on-farm calibration). More information about this project and the release of the app will be included in upcoming issues of the Agronomy e-Update. Stay tuned for more information about this exciting project!



SorghumYield App





Summary

Seed number is the main driving force of sorghum yield. On-farm estimations can be roughly based on environmental conditions during the week before and the two- to three-week period after flowering, which is the critical period of pollination and grain set. Actual seed counts per head would make the estimates much more accurate, but requires considerable time and effort. Future work will focus on getting more exact, rapid estimates of the number of seeds per head through the use of pragmatic and simple techniques, which will simplify the “on-farm approach” described in this article, and on the release of the new sorghum yield predictor app.

Ignacio A. Ciampitti, Crop Production and Cropping Systems Specialist
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7. Calibration of yield monitors

Row crop harvest has begun, or will soon begin, in many areas of the state. While we are focused on harvesting grain, it's also important to remember the other harvest we have going on -- the harvest of yield data.

Why collect yield data?

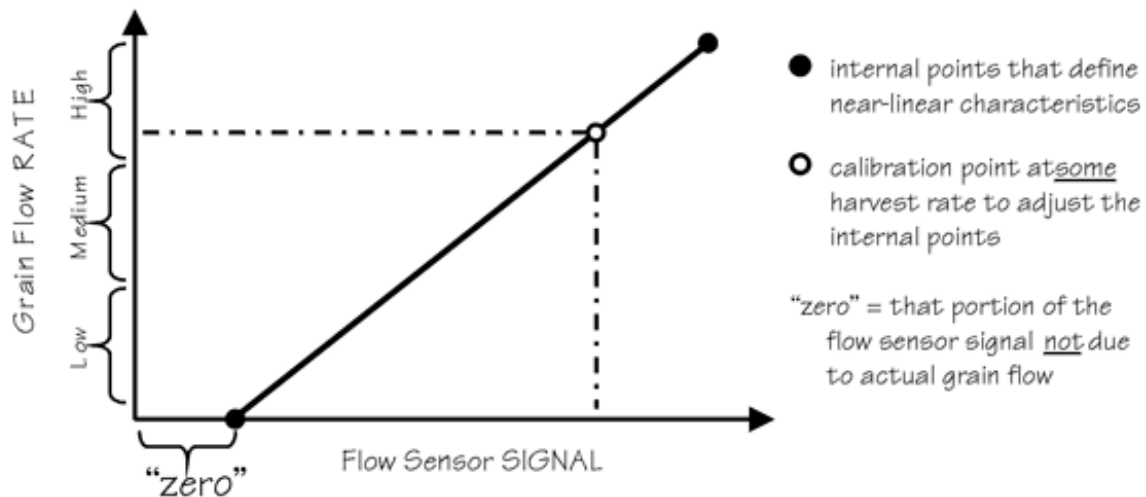
Crop yield, or yield potential, is the basis of almost all agronomic decision-making. Everything from nitrogen rates to seeding rates are tied to yield potential, either explicitly or implicitly. Yield varies spatially within a field, and yield monitor data is the only way to truly quantify spatial variability in crop yield within a field.

Yield monitoring systems and calibration

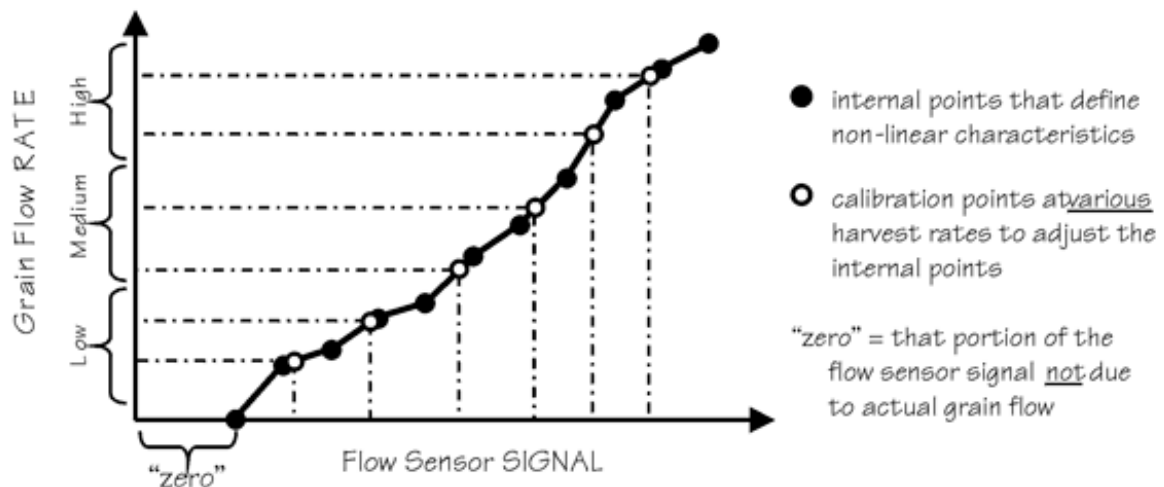
Most commercial yield monitoring systems work by measuring mass (weight) over a given area, and assigning that value to a geographic location via GPS. Grain mass is measured by a mass flow sensor located at the top of the clean grain elevator. Grain moisture is obtained by a capacitance-type sensor that is placed in the flow of clean grain somewhere on the combine. The grain moisture sensor is calibrated by adjusting the average moisture content of a yield monitor load to the moisture of a sample. Ideally this is conducted while harvesting an area of the field that is relatively uniform in moisture content.

It is important to keep the top of the clean grain elevator chain and paddles at the proper distance to the mass flow sensor, as this affects the trajectory of grain into the sensor's strike plate. Any change in this distance must be accompanied by recalibration of the monitor; distances outside of tolerance will result in reduced accuracy. It is important that proper calibration procedures are implemented so that the system can correlate a measured force to a known mass. The type of calibration to be performed depends on your yield monitoring system. A yield monitor can either be a single point (often 2 point) linear or a multi-point calibration. The differences between calibration methods are illustrated below:

(a) Example “near-straight” (near-linear) grain flow calibration curve.



(b) Example “not-straight” (non-linear) grain flow calibration curve.



Common single point systems on the market include Greenstar systems in John Deere combines prior to the S-series and Gleaner factory equipped combines. The multi-point method is used by Case-IH, AgLeader, and S series John Deere systems.

It is important to remember that a yield monitor is only as good as the calibration performed on it. A suggested flow calibration procedure for a multi-point type monitor is illustrated below. The full flow pass is done with full width and while “pushing” harvest speed. The resulting flows are then accomplished by traveling at a steady speed while using fractions of the available header width. For example, if running an 8-row head the operator would harvest 8, 6, 4, and 2 rows at the same ground speed to get the varying flow rates. Calibration loads should be between 3,000 and 6,000 lbs and taken from as uniform of an area in the field as possible. Using large calibration loads (i.e. truck loads) for a multi-point calibration will result in reduced accuracy.

	Full Flow	
--	-----------	--

Blank Area	¼ Full Flow	Blank Area
	½ Full Flow	
	¾ Full Flow	
	Additional Pass As Needed	

After completing calibration, errors should be in the range of 1.5 – 2.5% and must be less than 3% if the data is to be used for USDA Risk Management Agency (RMA) yield reporting purposes. Different calibrations are needed for each crop and multiple calibrations may be needed for extreme changes in crop type or condition (i.e. high moisture corn vs. drier corn).

In general, calibrations should be fairly stable across years unless changes are made to the clean grain elevator or yield monitor system components. Be aware that while some yield monitors will back-calculate and correct previous harvest data with the new calibration, not all will. For those yield monitors that cannot correct previous data it is important to perform calibration early in the harvest season.

Benefits of using properly calibrated yield monitors

Changes in RMA procedures regarding the use of precision agriculture technology have opened up many opportunities. Yield monitor data can be used to document production for APH (actual production history) reporting. Yield monitors data can also be used to report production separately for different practices in a given area even when the entire area is planted and harvested together (e.g. pivot corners and irrigated).

It is important to note than in order to meet RMA requirements the producer must have GPS technology integrated into the planter monitor, combine yield monitor, and yield mapping software. All three technologies are required if precision agriculture technology is to be used to provide information for RMA. Yield monitors used for RMA reporting must be calibrated to less than 3% error and the calibration procedure must be documented.

It is important to regularly transfer the data from your yield monitor to the datacard or flashdrive for transfer to your PC and to keep backup copies of the raw files on the card. It is best to evaluate yield data immediately after harvest while your observations from the operator's seat are fresh in your mind.

Summary

Many opportunities exist to make decisions such as site-specific agronomics based on yield monitor data. Although you may not be ready to make a move into site-specific agronomic management today, having multiple years of high-quality yield monitor data will be invaluable when making this step in the future. Just make sure the yield monitors are properly calibrated so that the data is reliable. It's better to have no data than bad data.

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8. Agronomy Field Day to feature sorghum production research, Oct. 9

Exciting advances in sorghum research will be featured at the 2015 Agronomy Field Day on October 9 at the Agronomy North Farm. Topics will range from increases in yield potential to the sugarcane aphid, cover crops, and more.

Higher yield potential remains the No. 1 priority for producers, and it's the top priority for K-State sorghum breeders as well. In theory, grain sorghum should yield just as much as corn in Kansas, given the same amount of fertilizer and with substantially less water, according to Tesfaye Tesso, K-State sorghum breeder in Manhattan and one of the featured speakers at the field day.

In practice, this has not yet happened consistently. New experimental lines in advanced testing at K-State are about to change that, however, Tesso said. These advancements are thanks in large part to funding from the Kansas Grain Sorghum Commission.

"Sorghum has high yield potential, much higher than what we're getting now. We know that," Tesso said. "We have been working to find new compatible parental lines that will be able to produce hybrids that can come closer to realizing sorghum's yield potential. At the same time, we need to make sure any new line has an acceptable maturity range, good standability, drought tolerance, good head exertion, and other necessary agronomic traits."

Tesso will talk about the most recent results of this research into higher-yielding sorghum lines at the field day.

The full list of topics and K-State speakers:

- Sorghum genetics and breeding – Tesfaye Tesso, Sorghum Breeder, and Geoffrey Morris, Sorghum Geneticist
- Inzen sorghum, a tool for postemergence grass control in sorghum– Curtis Thompson, Weed Management Specialist
- Heat and water stress sorghum physiology – Vara Prasad and Krishna Jagadish, Crop Physiologists
- Sorghum in Kansas cropping systems – Ignacio Ciampitti, Crop Production Specialist
- Sorghum response to cover crops in no-till systems – Kraig Roozeboom, Cropping Systems Agronomist
- Update on sugarcane aphid in Kansas – Brian McCornack, Entomologist

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.

In addition, there will be displays from commercial companies and K-State researchers in the shed near the registration area, along with the crop garden, forage garden, and weed garden for browsing. Extension specialists will be available to answer questions.

There is no charge to attend, and a complimentary lunch will be available. Preregistration is requested by October 6 so that a lunch count can be made. Those interested in attending can preregister by calling Troy Lynn Eckart at 785-532-5776. To preregister online, see:

<https://kstateagron2015.eventbrite.com>

On-site registration will also be available.

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

Research and new technologies for sorghum production



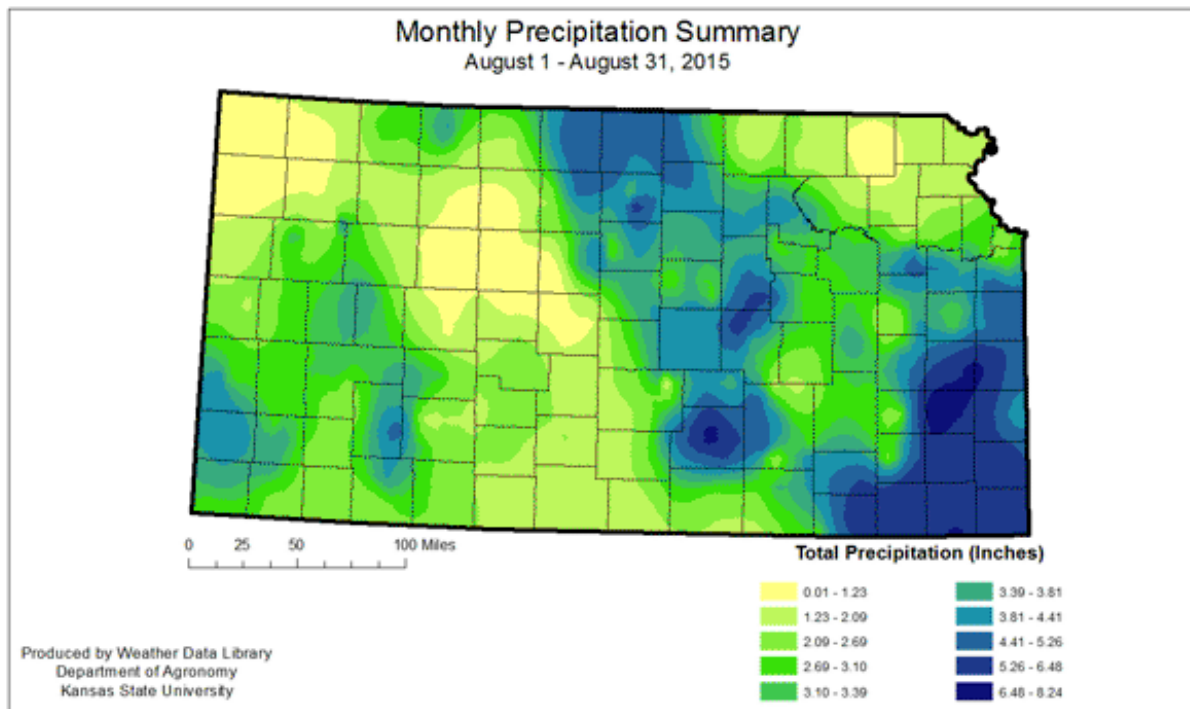
*Agronomy
Field Day 2015
Agronomy North Farm, Manhattan
Friday, October 9
9:00 a.m.- 1:00 pm*

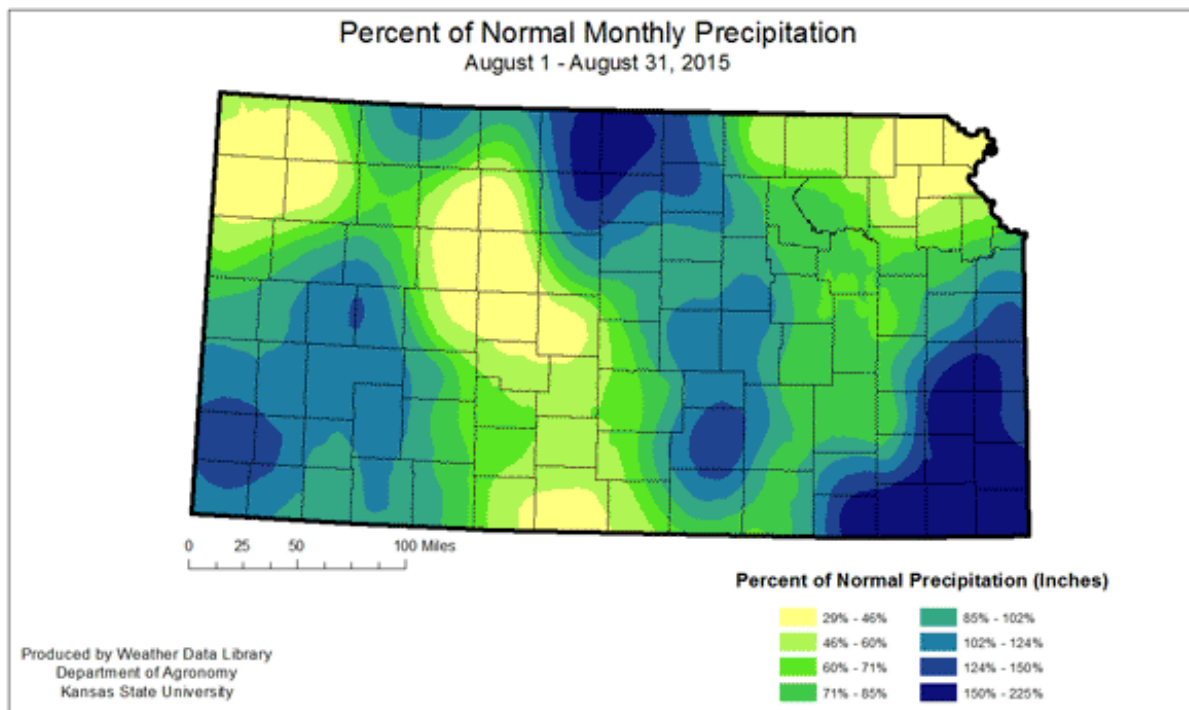
KANSAS STATE
UNIVERSITY

Department of Agronomy

9. August wheat summary for Kansas: Cool and dry

August was drier than normal in most of the state. Statewide average precipitation was 2.80 inches, or 85 percent of normal. The Northeast Division had the lowest percent of normal precipitation at 46 percent, or an average of 1.80 inches. The Northwest wasn't far ahead with 56 percent of normal, or an average of 1.55 inches. The two divisions with above-normal precipitation were the Southwest and Southeast. The Southwest Division had 101 percent of normal, or an average of 2.73 inches, while the North Central Division had 130 percent of normal, or an average of 4.74 inches. The statewide average ranks as the 55th driest August on record, placing it in the middle third of the 121-year distribution. The greatest monthly precipitation reports were 8.42 inches at Iola (NWS) and 8.78 inches at Wichita (CoCoRaHS). While 73 new daily precipitation records were set, none of these were new records for August.

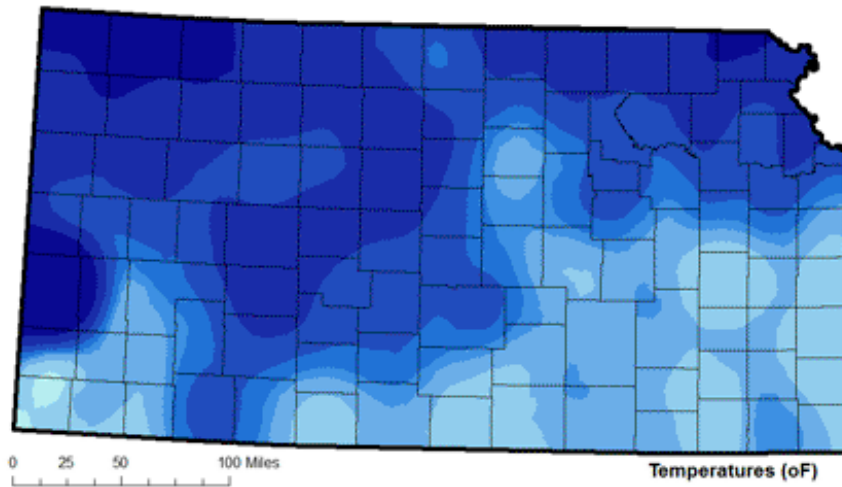




Temperatures were cooler-than-normal across the state. The statewide average temperature was 75.0 degrees F, 2.1 degree cooler than normal for the month. There were no new record high temperatures set during the month. In contrast, there were 9 new record cold high temperatures, and 3 records that tied. On the low temperature side, the same trend prevailed with 15 new record low minimum temperatures and 11 records tied. There were 3 new record daily warm minimum temperatures for the month, but no new monthly record lows set. The western divisions were the closest to normal, averaging between 0.7 and 0.9 degrees cooler than normal. The Southeast and the South Central Divisions were the coldest, with both averaging 3.5 degrees cooler than normal. The warmest reading was 108 degrees F on the 9th at Hays (NWS). The coolest reading for the state was 42 degrees F at Oberlin (NWS) on the 25th. While the temperatures weren't particularly outside of the normal range, late-planted spring crops such as corn and soybeans are still behind in development, with rising concerns that an early frost will have a negative impact on yields.

Lowest Minimum Temperature

August 1 - August 31, 2015

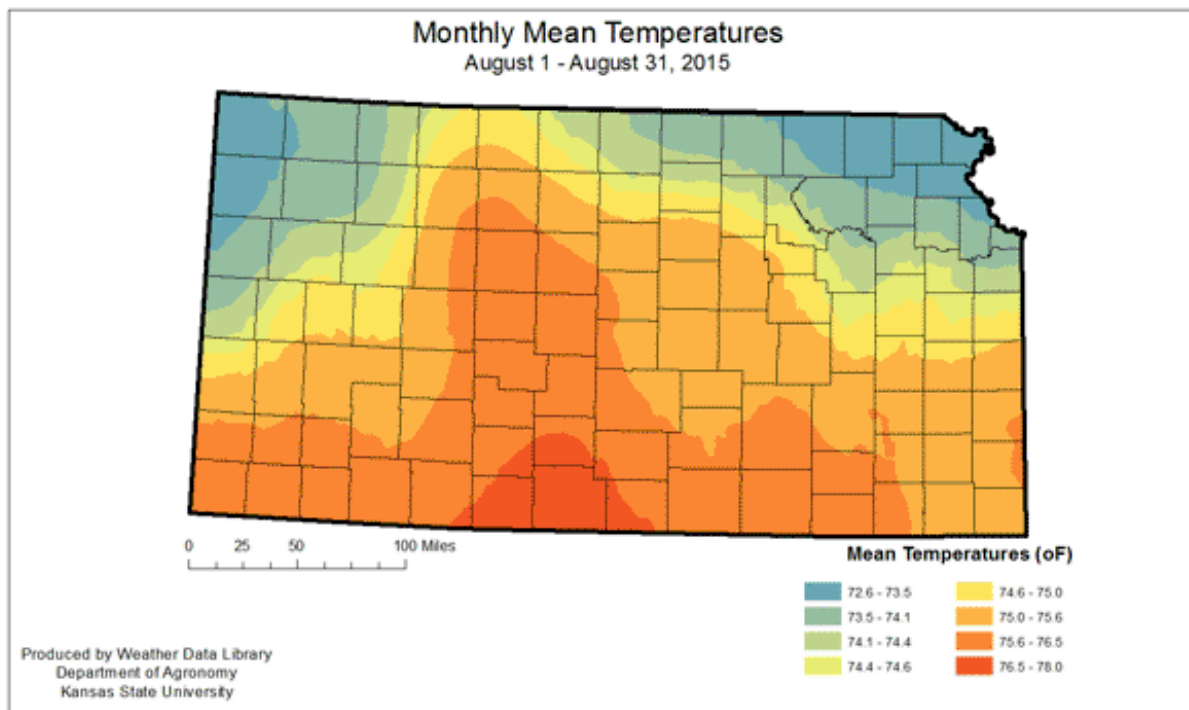


Produced by Weather Data Library
Department of Agronomy
Kansas State University

Kansas State University Department of Agronomy

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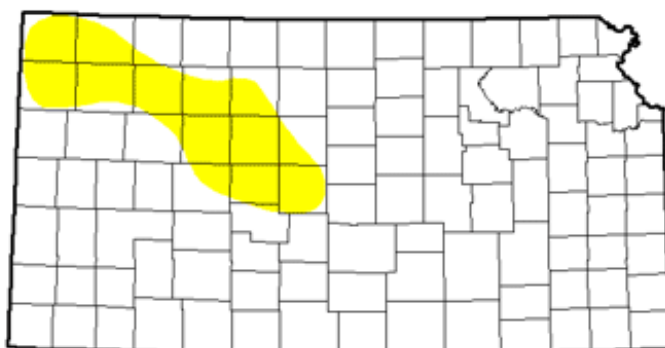


Severe weather was limited in August. Preliminary data indicates there were 2 tornadoes reported, compared to 7 in July, 15 during June, and 99 in May. Hail reports were also fewer with 45 reports this month versus 55 reports in July, 83 in June, and 108 in May. Damaging winds were also less common. There were 65 reports in August, 114 reports in July, 65 reports in June, and only 52 reports last May.

Drought conditions deteriorated slightly, which was not unexpected, given the lower-than-average precipitation. Greater expansion of drought areas was limited due to the wetter-than-normal conditions in June and the cooler-than-normal temperatures this month. Only one area of abnormally dry conditions remains on the latest U.S. Drought Monitor map. This area is in portions of the Northwest, North Central, and Central divisions, where rainfall for growing season is less than normal. Thirty-seven counties in western Kansas remain in drought watch status according to the latest advisory from the Kansas Water Office. A return to normal or above-normal precipitation is needed to sustain improvements. Some long-term hydrological deficits are in place affecting some water supplies and reservoirs.

U.S. Drought Monitor Kansas

September 1, 2015
(Released Thursday, Sep. 3, 2015)
Valid 8 a.m. EDT



Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	88.23	11.77	0.00	0.00	0.00	0.00
Last Week 8/25/2015	93.12	6.88	0.00	0.00	0.00	0.00
3 Months Ago 6/2/2015	76.35	18.97	4.68	0.00	0.00	0.00
Start of Calendar Year 1/1/2015	19.49	43.02	19.18	16.05	2.25	0.00
Start of Water Year 9/1/2014	18.51	35.36	26.63	17.13	2.37	0.00
One Year Ago 9/2/2014	5.91	22.00	53.73	12.91	5.46	0.00

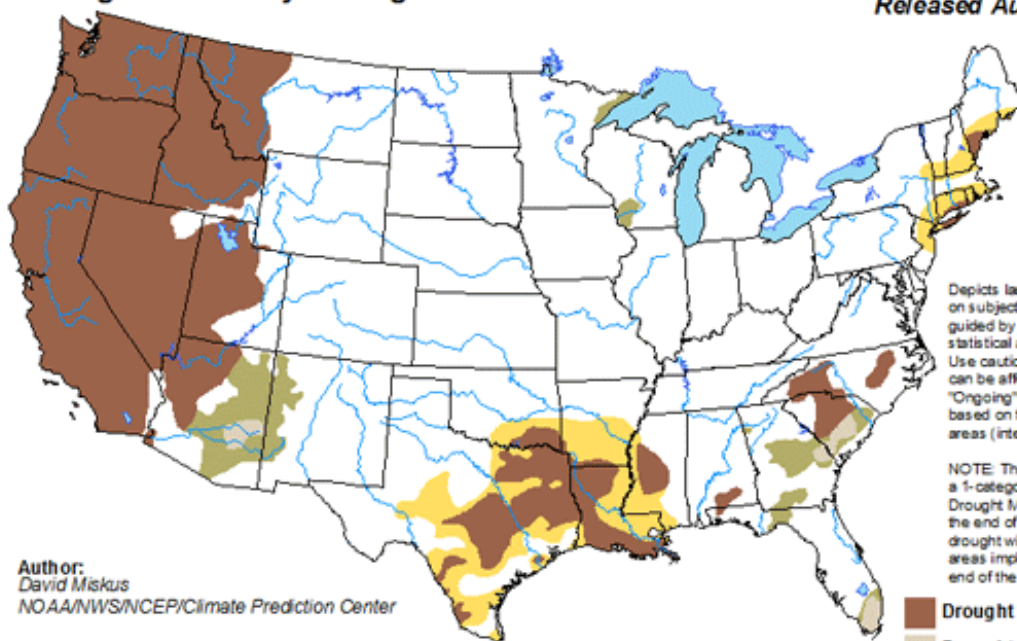
Intensity:

D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought
D2 Severe Drought	

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

U.S. Monthly Drought Outlook Drought Tendency During the Valid Period

Valid for September 2015
Released August 31, 2015



Author:
David Miskus
NOAA/NWS/NCEP/Climate Prediction Center

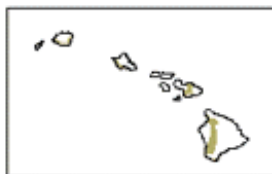
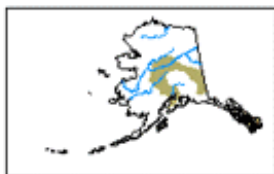
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists/intensifies
- Drought remains but improves
- Drought removal likely
- Drought development likely



<http://go.usa.gov/h6jh>



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August 2015

Kansas Climate Division Summary

Precipitation (inches)			Temperature (°F)							
August 2015			2015 Jan - August				Monthly Extremes			
Division	Total	Dep. ¹	% Normal	Total	Dep. ¹	% Normal	Ave	Dep. ¹	Max	Min
Northwest	1.55	-1.18	56	15.46	-1.43	91	74.1	-0.7	105	42
West Central	1.69	-0.92	64	16.31	0.02	100	74.8	-0.8	103	44
Southwest	2.73	0.02	101	21.15	5.71	136	76.3	-0.9	106	49
North Central	2.92	-0.36	89	20.47	-0.82	94	74.6	-2.5	101	43
Central	3.23	-0.34	87	20.75	-1.73	91	75.5	-2.6	108	45
South Central	2.54	-0.90	73	25.51	2.04	108	75.7	-3.5	101	50
Northeast	1.80	-2.10	46	28.13	2.47	109	74.2	-2.1	95	45
East Central	3.20	-0.89	78	26.87	-0.74	96	74.5	-2.6	96	47
Southeast	4.74	1.00	130	28.89	-0.52	98	75.0	-3.5	98	50
STATE	2.80	-0.52	83	22.73	0.73	103	75.0	-2.1	108	42

1. Departure from 1981-2010 normal value

Source: KSU Weather Data Library

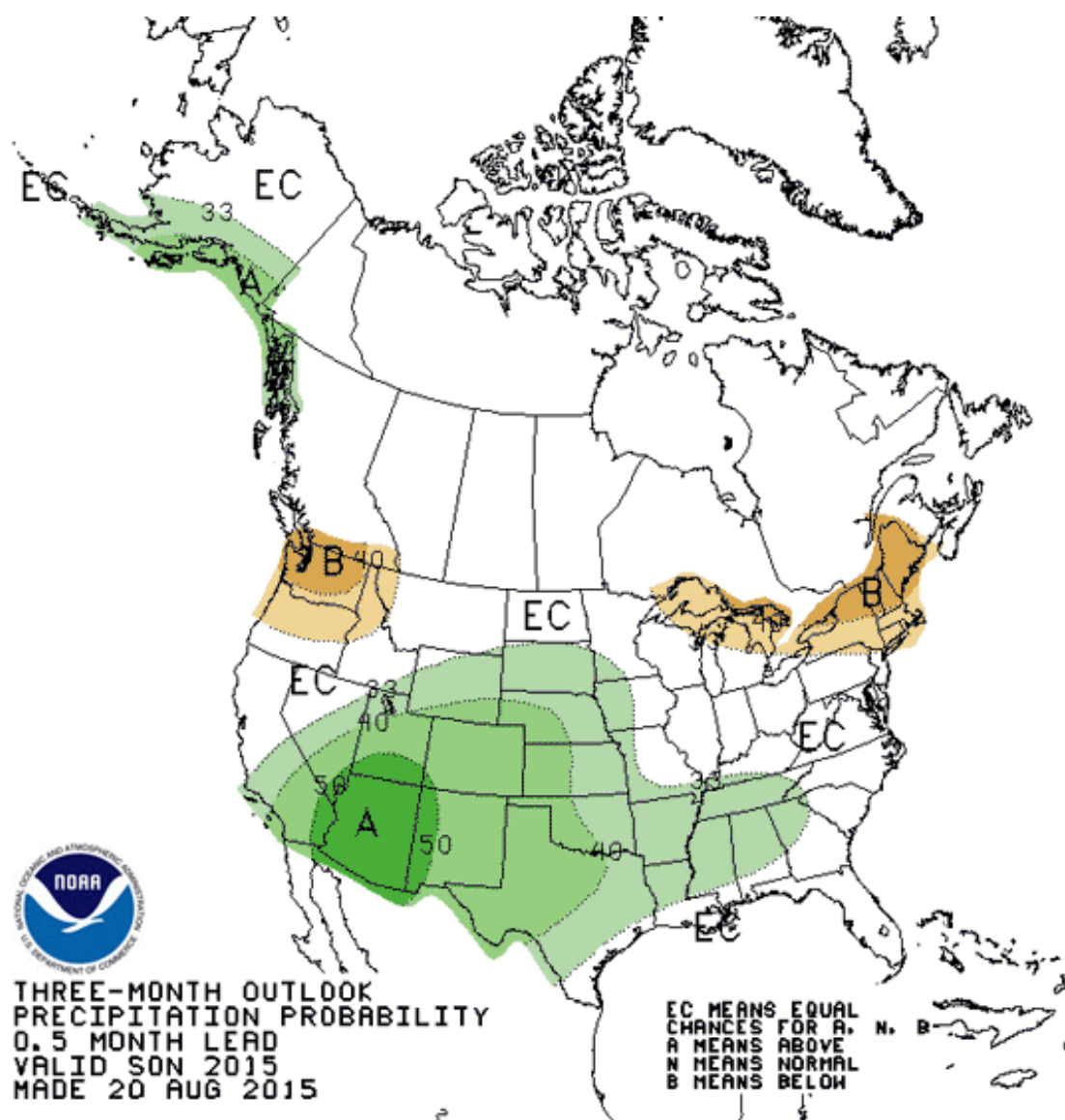
Mary Knapp, Weather Data Library
mknapp@ksu.edu

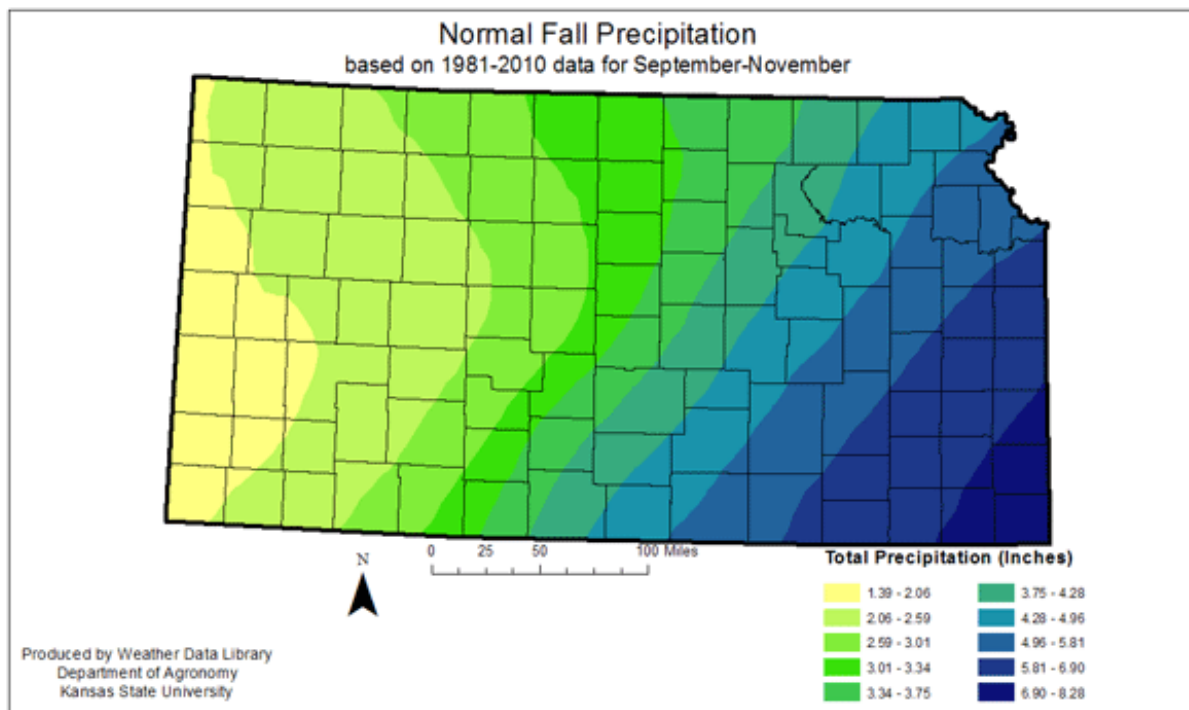
10. Fall weather outlook for Kansas

Warm weather recently has allowed for increased accumulation of growing degree units in summer crops. However, because of delayed spring planting and cool temperatures in July and August, there are concerns about weather conditions this autumn -- and what adverse fall weather could mean for crops in Kansas. Cool fall temperatures will delay crop maturity, while the recent dry weather increases concern of available water for planting winter crops such as winter wheat and canola.

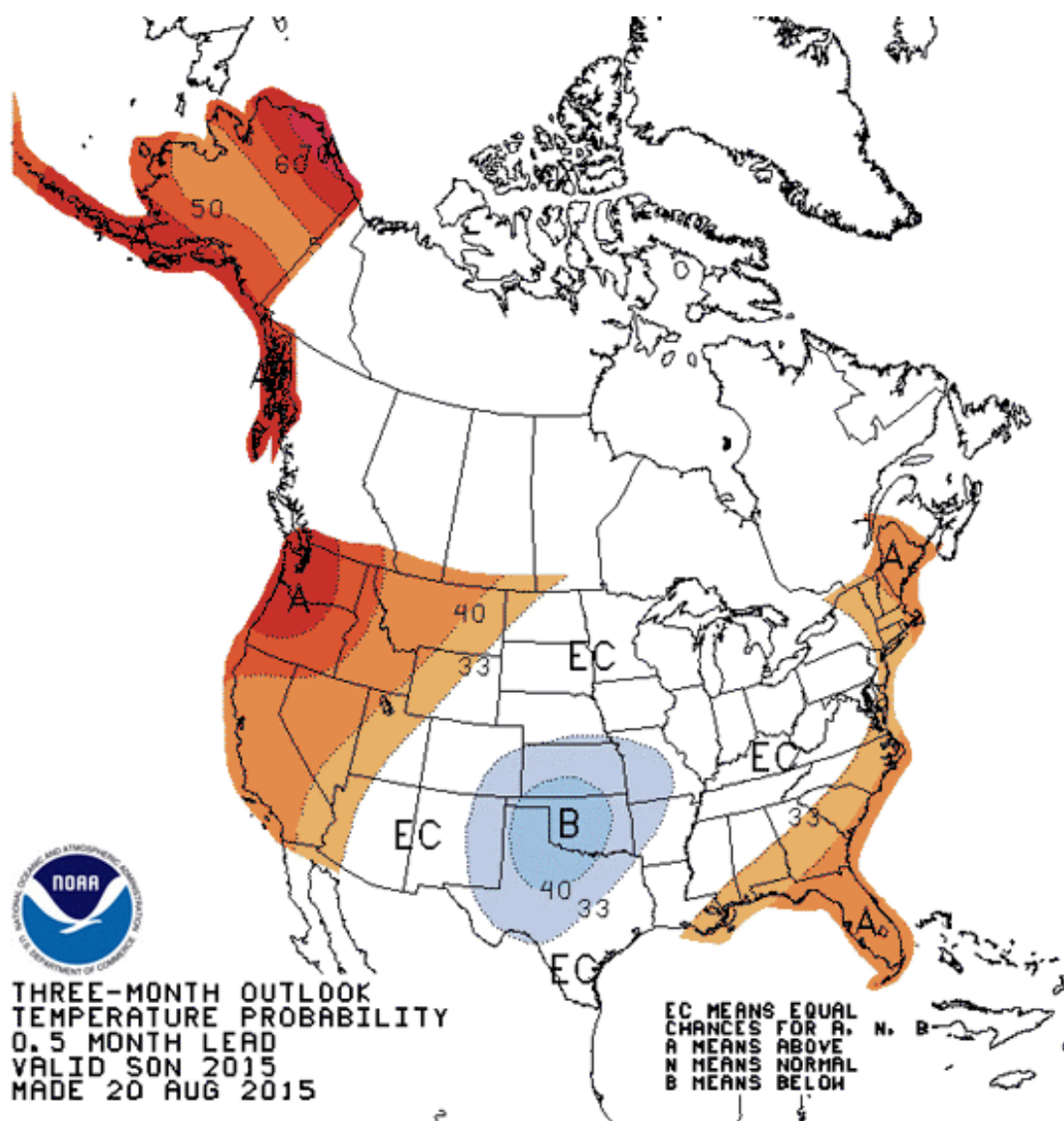
The outlook for September calls for cooler- and wetter-than-normal conditions for Kansas, despite the warm start to the month. This pattern is expected to continue in the September-November period.

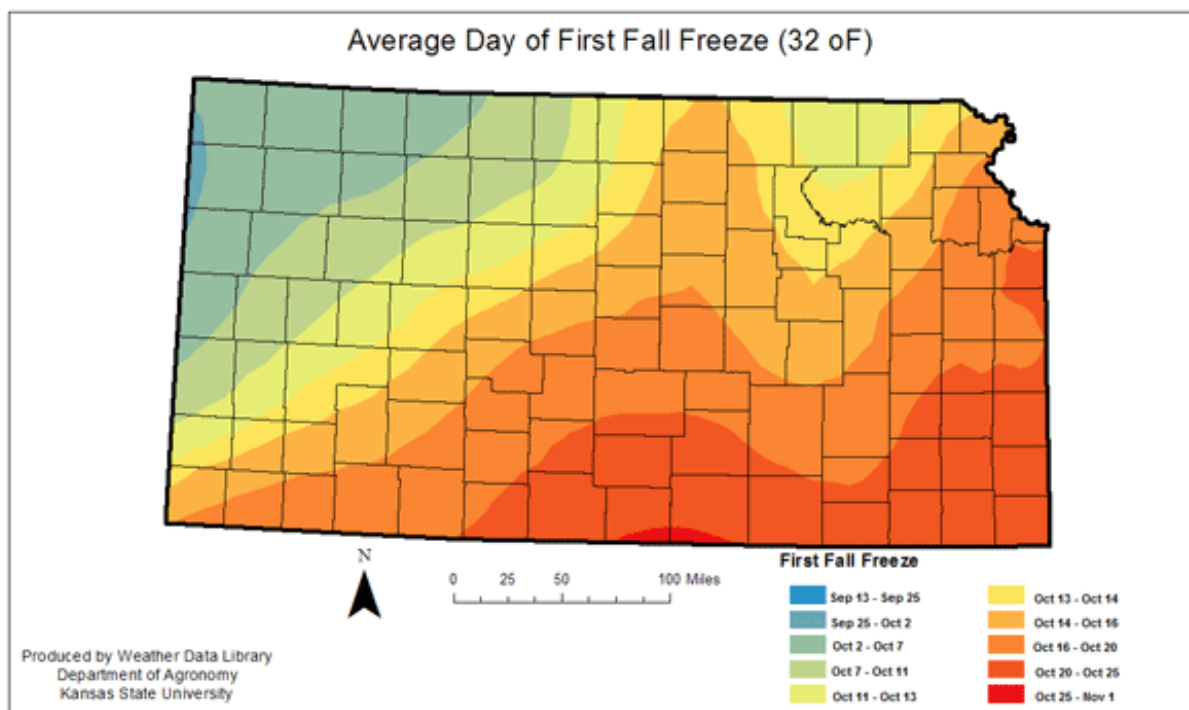
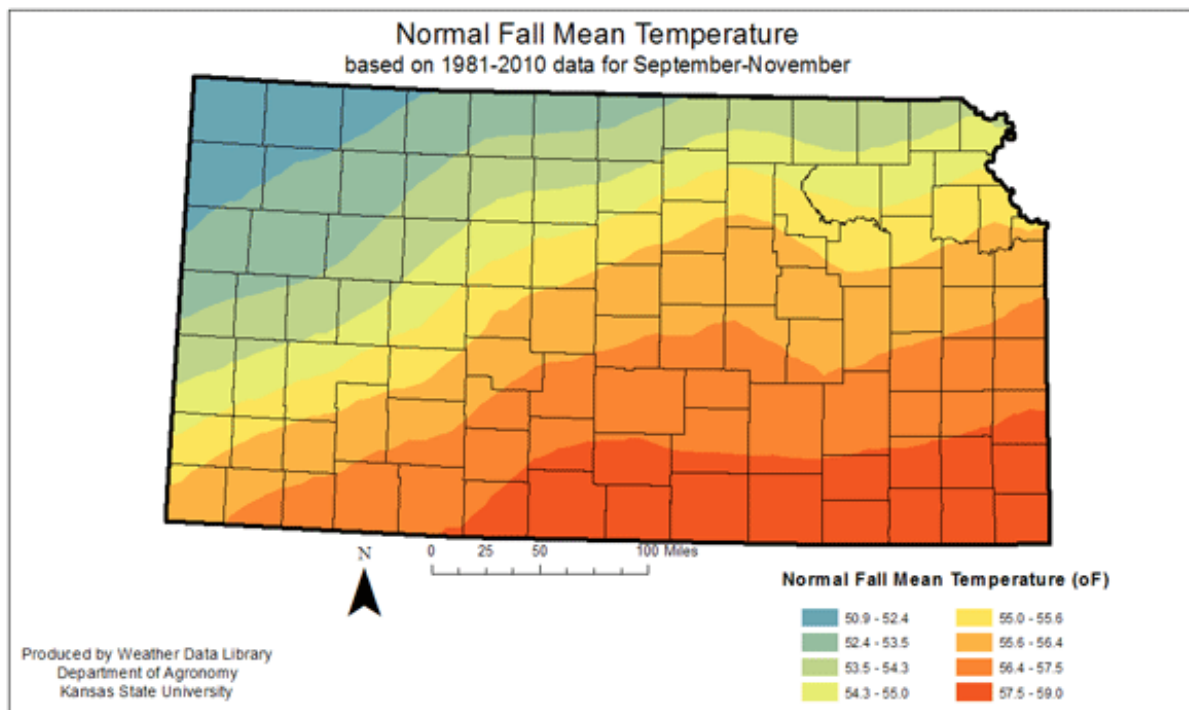
The precipitation outlook shows Kansas at the north end of a wetter-than-average area centered to the southwest. A wet pattern in the Southern Plains and the desert Southwest makes it less likely that we will have drier-than-normal conditions in Kansas. The average precipitation for the September-November period ranges from 6-8 inches in southeastern Kansas to less than 2 inches in western Kansas. Note that this is the total for the 3-month period. The outlook doesn't indicate how that might be distributed, although the September outlook is encouraging.





The temperature outlook calls for cooler-than-normal conditions to continue to dominate the country west of the Rockies. Temperatures are expected to be cooler-than-normal in west Texas and into the Oklahoma Panhandle. During the fall season, cooler-than-normal temperatures don't necessarily mean an early freeze. With cooler-than-normal temperatures expected in September, even an average freeze date could result in problems. The average temperatures for the period range from over 58 degrees F in the South Central Division to around 50 degrees F in extreme northwest Kansas.





An El Niño has been declared. It continues to be strong, but it is uncertain how much impact will result from that pattern. An El Niño generally favors wetter-than-normal conditions in the Central Plains. The ridging pattern along the western Rockies is also expected to continue. This has resulted in a split pattern, with the Central Plains as the dividing line. Warmer-than-normal conditions are to the west, while cooler-than-normal conditions are in place to the east.

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11. Comparative Vegetation Condition Report: August 18 - 31

K-State's Ecology and Agriculture Spatial Analysis Laboratory (EASAL) produces weekly Vegetation Condition Report maps. These maps can be a valuable tool for making crop selection and marketing decisions.

Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:

<http://www.youtube.com/watch?v=CRP3Y5Nlggw>

<http://www.youtube.com/watch?v=tUdOK94efxc>

The objective of these reports is to provide users with a means of assessing the relative condition of crops and grassland. The maps can be used to assess current plant growth rates, as well as comparisons to the previous year and relative to the 26-year average. The report is used by individual farmers and ranchers, the commodities market, and political leaders for assessing factors such as production potential and drought impact across their state.

NOTE TO READERS: The maps below represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact Nan An at nanan@ksu.edu and we can place you on our email list to receive the entire dataset each week as they are produced. The maps are normally first available on Wednesday of each week, unless there is a delay in the posting of the data by EROS Data Center where we obtain the raw data used to make the maps. These maps are provided for free as a service of the Department of Agronomy and K-State Research and Extension.

The maps in this issue of the newsletter show the current state of photosynthetic activity in Kansas, the Corn Belt, and the continental U.S., with comments from Mary Knapp, assistant state climatologist:

Kansas Vegetation Condition

Period 35: 08/18/2015 - 08/31/2015

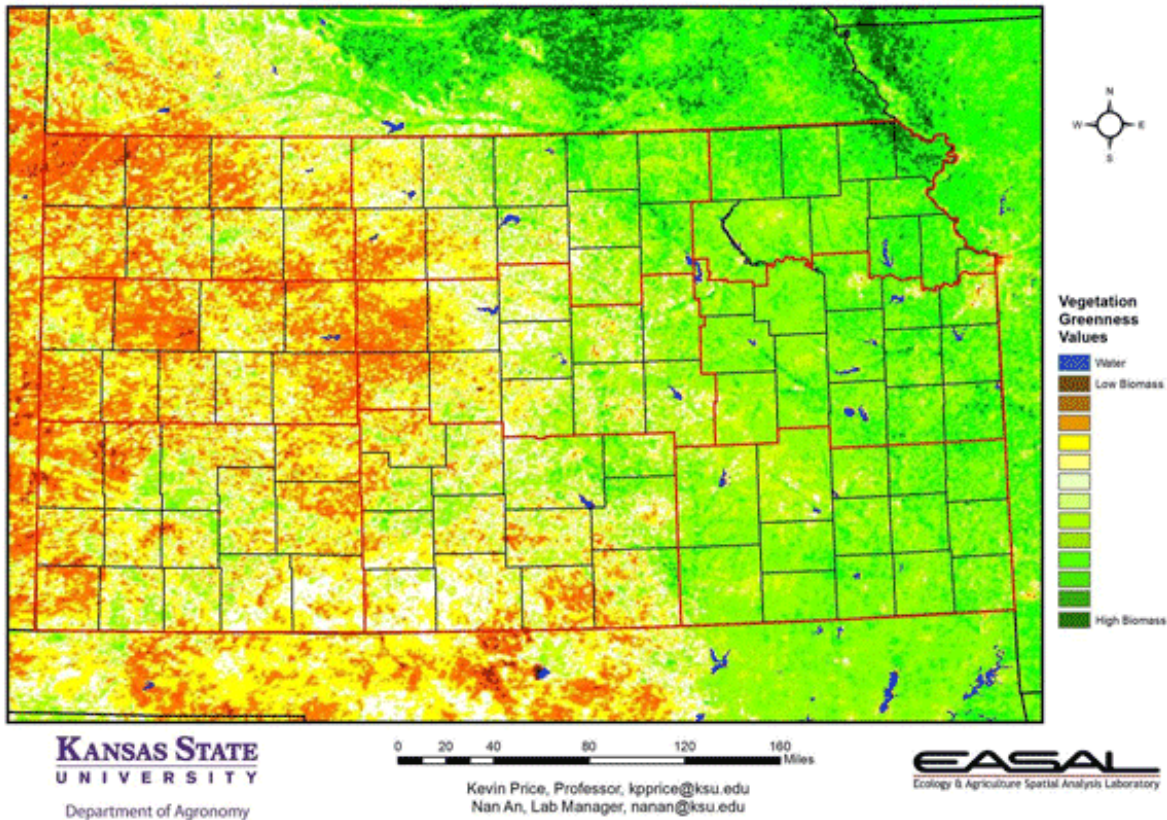


Figure 1. The Vegetation Condition Report for Kansas for August 18 - 31 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the highest biomass production is, as typical, in eastern Kansas. The highest NDVI values are in Brown and Doniphan counties along the Missouri River Valley. Favorable soil moisture and moderate temperatures have favored biomass production in these areas. Lower NDVI values are visible in western Kansas, where warmer temperatures have prevailed in the last two weeks.

Kansas Vegetation Condition Comparison
Late-August 2015 compared to the Late-August 2014

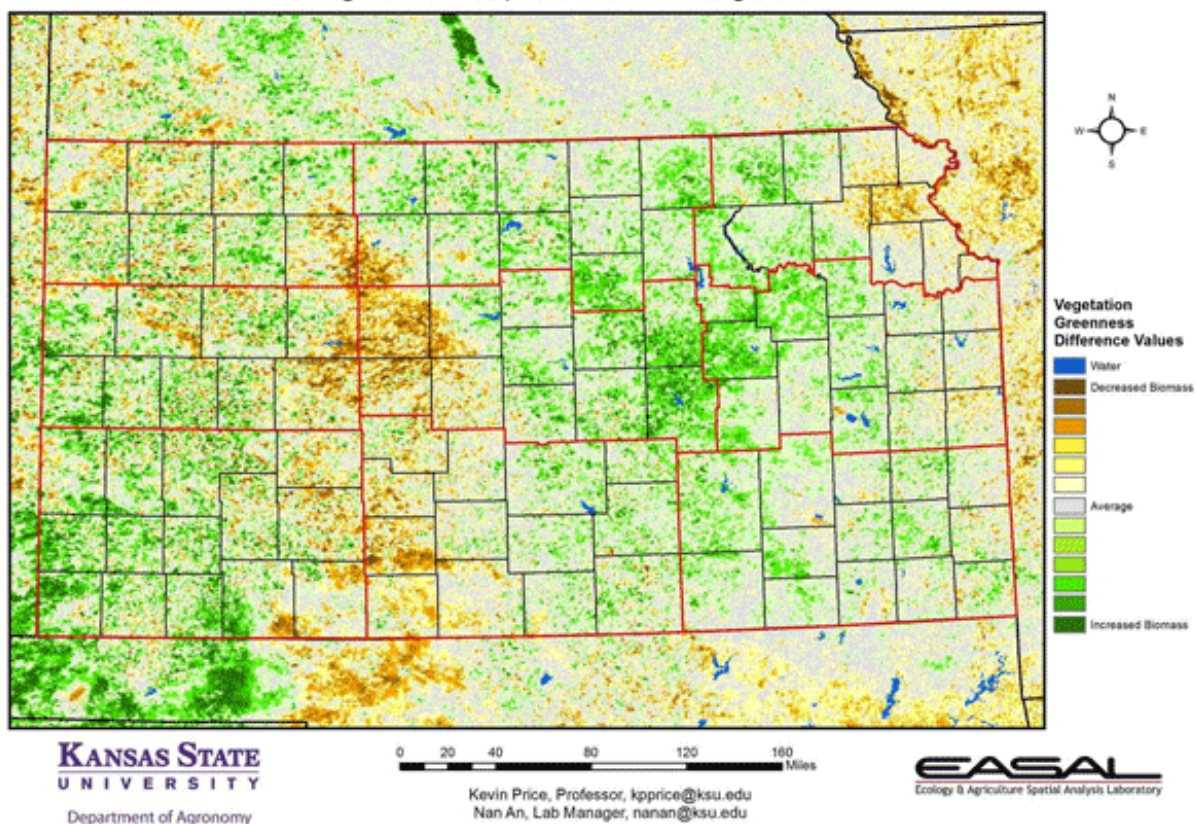


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for August 18 - 31 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows parts of central and south central Kansas have lower photosynthetic activity. These areas did not have as much moisture in recent weeks as counties farther west, and abnormally dry conditions persist. In contrast the North Central Division has had more favorable conditions this year. Moderate temperatures and favorable moisture have resulted in high photosynthetic activity.

Kansas Vegetation Condition Comparison

Late-August 2015 compared to the 26-Year Average for Late-August

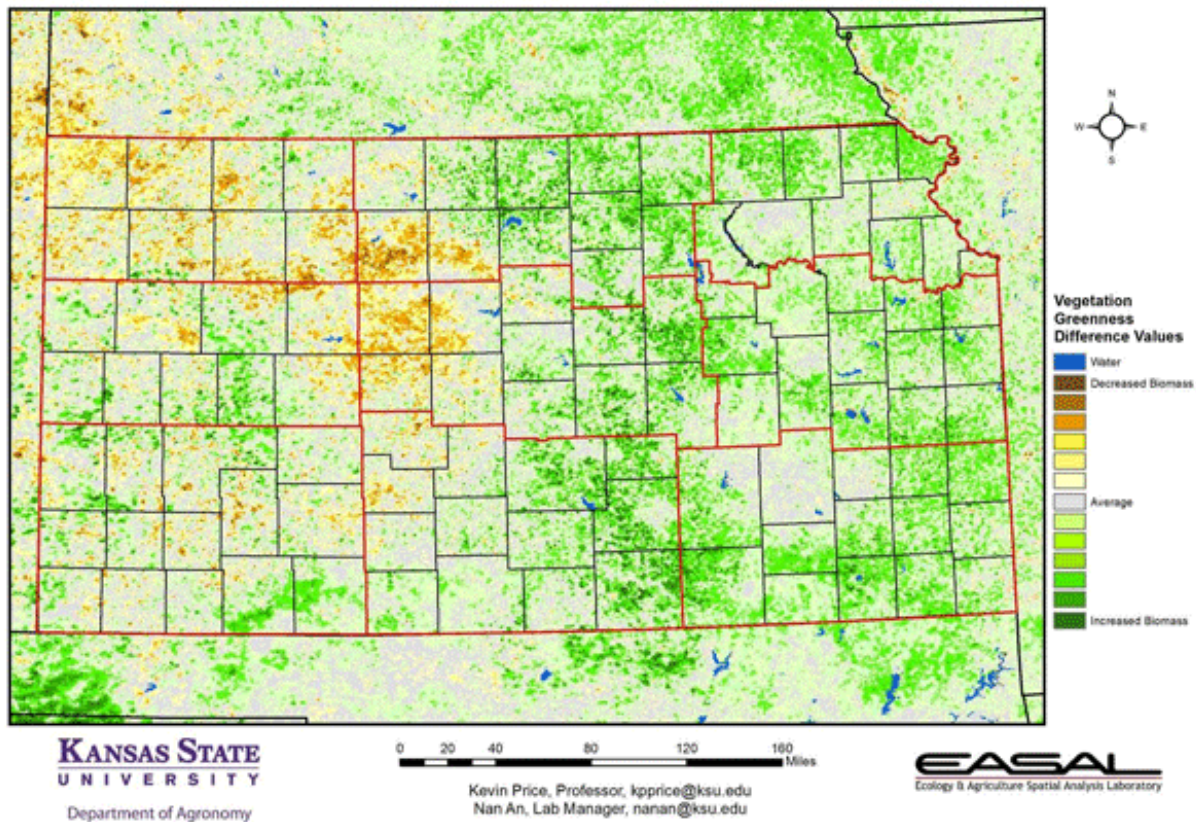


Figure 3. Compared to the 26-year average at this time for Kansas, this year's Vegetation Condition Report for August 18 – 31 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that most of the state has at or above-average photosynthetic activity. The North Central and Northeastern Divisions have the greatest levels of above-average activity. This continues to be due to a combination of favorable growing conditions and delayed crop development. This delay means more of the vegetation is in the most active growth period, rather than the reduced activity that comes as the crop matures. An area of abnormally dry conditions continues in the Northwest Division edging into North Central and Central Divisions. This is reflected in lower-than-average biomass production in the region.

U.S. Corn Belt Vegetation Condition

Period 35: 08/18/2015 - 08/31/2015

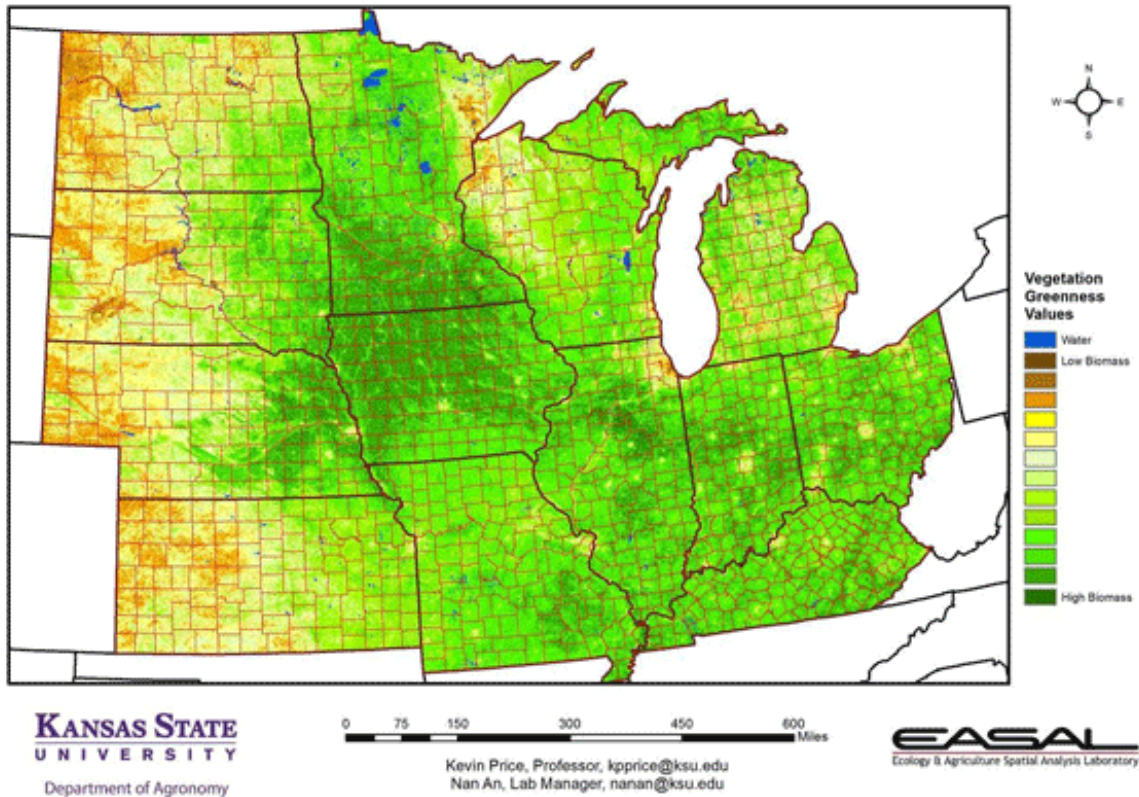


Figure 4. The Vegetation Condition Report for the Corn Belt for August 18 – 31 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that greatest level of photosynthetic activity is concentrated from northeastern Nebraska through Iowa, southern Minnesota, and into Illinois. Favorable moisture conditions have resulted in high photosynthetic activity. In Iowa, corn is rated as 81 percent good to excellent, while soybeans are 76 percent good to excellent.

U.S. Corn Belt Vegetation Condition Comparison
Late-August 2015 Compared to Late-August 2014

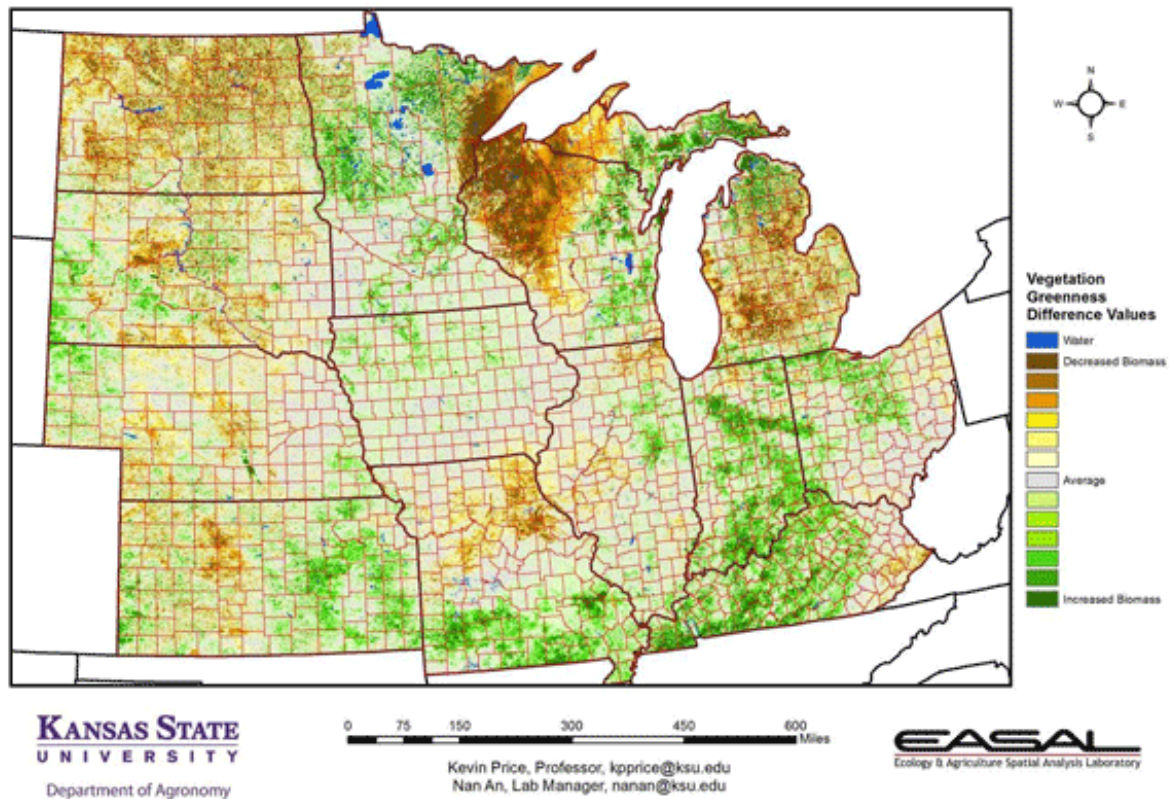


Figure 5. The comparison to last year in the Corn Belt for the period for August 18 – 31 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows lower photosynthetic activity concentrated in the northern parts of the region, particularly in Wisconsin. Despite recent cool weather, both corn and soybeans are ahead of last year.

U.S. Corn Belt Vegetation Condition Comparison
Late-August 2015 Compared to the 26-Year Average for Late-August

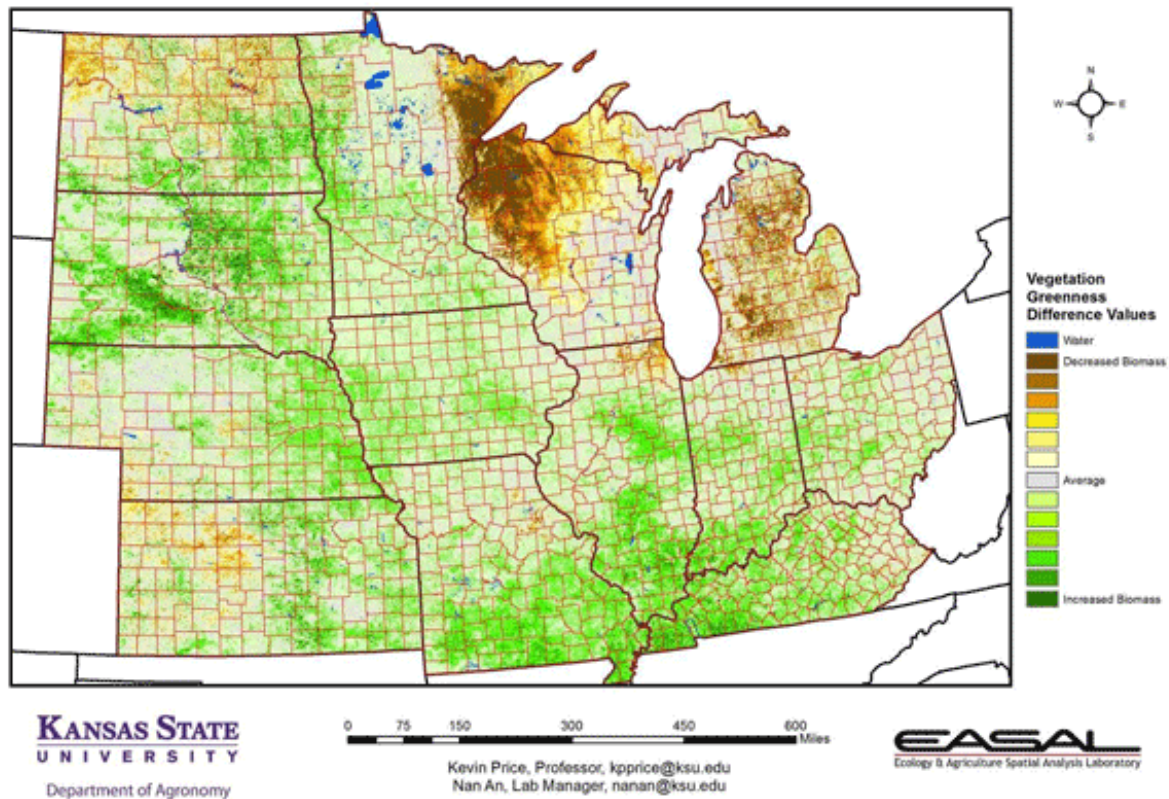


Figure 6. Compared to the 26-year average at this time for the Corn Belt, this year's Vegetation Condition Report for August 18 – 31 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows most of the region has average biomass production. Wisconsin stands out with below-average NDVI values, although crop conditions are rated favorably.

Continental U.S. Vegetation Condition

Period 35: 08/18/2015 - 08/31/2015

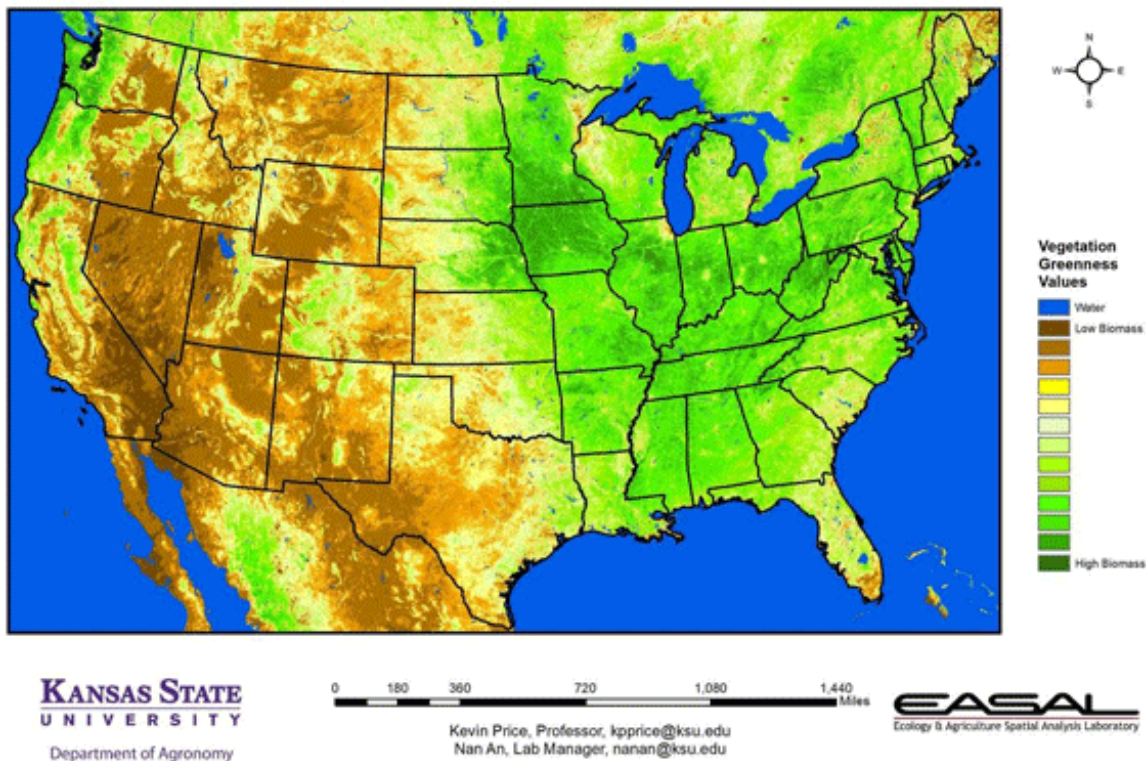


Figure 7. The Vegetation Condition Report for the U.S for August 18 – 31 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that the highest photosynthetic activity is centered in the Upper Midwest. Lower NDVI values are noticeable in the Southeastern U.S., particularly in Georgia and South Carolina and the tip of Florida, where drought conditions continue to intensify. Rains from the recent tropical systems were less productive than anticipated. Low NDVI values are also notable along the western Cascades in Oregon.

Continental U.S. Vegetation Condition Comparison

Mid-August 2015 Compared to Mid-August 2014

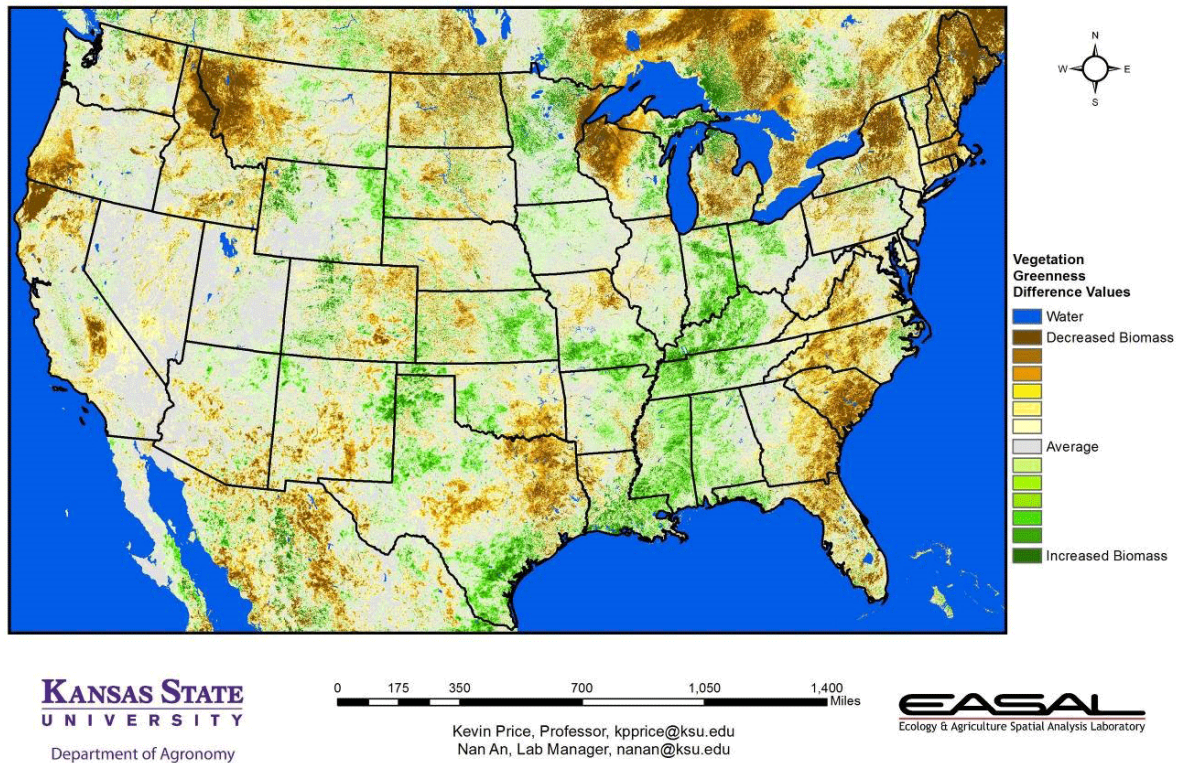


Figure 8. The U.S. comparison to last year at this time for the period August 18 – 31 from K-State’s Ecology and Agriculture Spatial Analysis Laboratory shows that lower NDVI values are most evident along the East Coast. In the West Coast region, lower NDVI values are visible in Northern California and especially into Oregon. Rains in the early summer were heavier on the California side of the border. Decreased photosynthetic activity is also evident in western Montana, as extreme drought expands in the area.

Continental U.S. Vegetation Condition Comparison
Late-August 2015 Compared to 26-year Average for Late-August

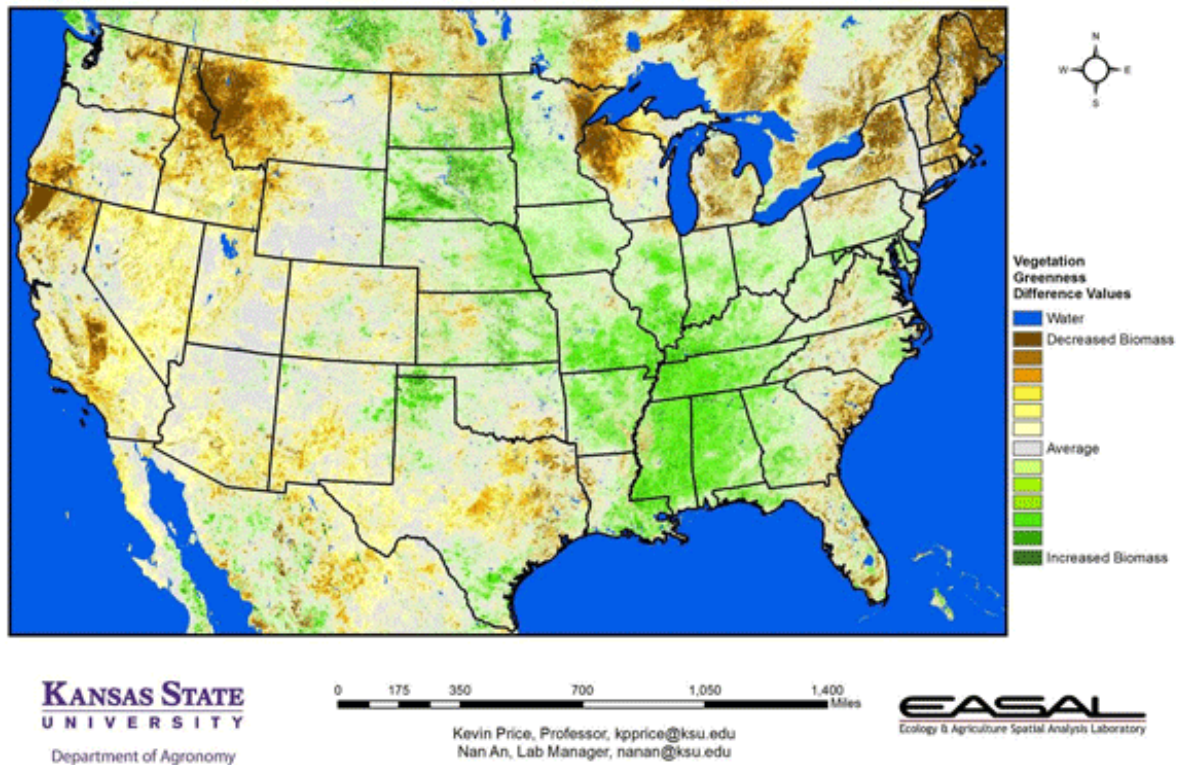


Figure 9. The U.S. comparison to the 26-year average for the period August 18 – 31 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the West continues to have lower-than-normal photosynthetic activity, while the greatest increase in NDVI values is in the Central Plains. There is also an area of below-average NDVI values along the lower Great Lakes to Upstate New York and into New England. This marks an area of expanding moisture stress.

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