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eUpdate

07/08/2016

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.

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1. Corn harvest efficiency

Harvest time is payday!

While much of Kansas is in the pollination stage of corn, southern Kansas is in the midst of grain fill, so harvest is not far off (Figure 1). Producers spend considerable resources and effort to protect their corn yield. However, they often don't realize some of the biggest yield losses can occur during harvest operations.

Figure 1. Corn in the grain fill stage picked the first week of July from Coffeyville. Photo by Doug Shoup, K-State Research and Extension.

Harvest inefficiencies often result in a reduction in overall yield and can cause future problems in the form of volunteer corn (Figure 2). While volunteer corn may have some value by increasing soil organic matter, providing a cover to reduce potential soil erosion, or even providing potential forage for livestock, several negative effects can also result.

Volunteer corn can cause problems for wheat planting following corn harvest, or in a wheat-corn-fallow cropping system, by using up valuable soil moisture and nutrients needed to promote fall tillering in wheat (see "Managing glyphosate-tolerant volunteer corn in summer fallow" in this issue, No. 579, of the Agronomy eUpdate). In addition, volunteer corn can provide a green bridge for the wheat curl mite and several aphid species that can vector viral diseases such as High Plains virus, wheat streak mosaic virus, and barley yellow dwarf virus to wheat. While yield loss is expected any time these viral diseases infect wheat, fall infections often have the most significant negative impact on yield.

The biggest problem with having a dense stand of volunteer corn is that it indicates a significant loss of corn grain during the harvest operation. While capturing 100% of the grain at harvest is unrealistic, producers should take steps to improve the efficiency of harvest and reduce grain loss as much as possible.

Figure 2. Extremely thick stand of volunteer corn, resulting from grain lost during harvest operations. Photo by Gretchen Sassenrath, K-State Research and Extension.

Several factors may contribute to poor harvest efficiency in corn.

Diseases

Diseases that infect the ear can contribute to grain loss at or prior to harvest. Diseases such as *Diplodia* or *Gibberella* can cause light kernels that can be lost during threshing. These diseases can also weaken the ear shank. A weak ear shank can often result in ears dropping off the plant prior to entering the combine and can account for significant grain losses.

Combine settings

Most of the kernel loss at harvest time is due to mechanical limitations with combine settings. A combine has three major actions that are performed in the harvest operation: picking, threshing, and cleaning. The potential for grain loss occurs at each stage of this process.

Ground speed, and matching of ground speed to crop throughput and harvesting conditions, is likely among the most important factors over which the combine operator has control. Excessive ground speed results in increased losses at almost all stages of the harvesting operation. Inadequate groundspeed may fail to keep the combine at full capacity. When operated at less than full capacity, threshing efficiency decreases while specific fuel consumption (gallons/bu) increases.

Header loss

Header loss results when kernels don't make it into the machine. Biological and mechanical factors can both contribute to header loss. Corn that has lodged or is overly dry may shatter, causing whole ears to be lost. Deck plates set too widely may cause excessive butt shelling of the ears. Adjusting both the header speed and relative ground speed can reduce header loss, and slower may be better.

To measure header loss, harvest a portion of the field, placing a marker toward the rear of the machine, ahead of the tailings discharge. Next, back up the machine so that the front of the header is even with the marker. Grain on the ground in the area between the header and the unharvested portion of the field is representative of header loss. To determine that loss per acre, count the number of kernels or ears on the ground between the front of the machine and the harvested corn, and estimate yield loss (see section below on "Estimating yield loss" and Figure 4).

Adjustments to minimize header loss

1. Gathering snouts should be adjusted so that the center snout is just touching the ground when the gathering chains are 2 inches above the ground. Each successive snout (working out from the center) should be about one inch lower than the adjacent snout. Then drive with center snout just touching the ground. This insures that all snouts will float at ground level while combining rough ground.

2. Gathering chains should extend at least ¼ inch beyond the snapping plate when measured at the front of the plate. Chain speed should be controlled so that stalks are guided into the rolls without uprooting.

3. Snapping rolls should be set according to stalk thickness with speed correlated closely to ground speed so that the ear is snapped in the upper third of the roll. This helps reduce ear loss.

4. Deck plates should be set as wide as possible without losing ears or shelling corn off the ear. This

reduces the amount of trash taken into the machine. The spacing between the plates should be □ to 3/16 inch tighter at the front of the plates than at the rear.

In highly variable crop conditions, paying close attention to deck plate spacing likely has one of the largest potentials for payback. Newer headers with automatic or hydraulically actuated deck plates have the potential to significantly reduce header losses.

5. Trash knives (if in use) should usually be set as close to the rolls as possible to prevent wrapping.

Threshing loss and damage

As with most other crops, cylinder or rotor adjustment has a great effect on corn quality. As much as 80 percent of corn kernel damage occurs during the shelling process, so careful management at this point will produce dividends throughout storage and drying. Moisture content has a great effect on the amount of damage, with fines increasing rapidly at high moisture. If possible, harvest should be delayed until moisture is below 25 percent.

Concave clearance and cylinder or rotor speed require careful adjustment, and although a great variation in hybrids exists, a few rules of thumb have been developed. Overshelling the grain (by having the cylinder or rotor speed too high, or the clearance too tight) not only produces excess fines, but also consumes excessive power and fuel. A good way to adjust the cylinder or rotor is to begin with the clearance and speed recommended by the manufacturer (or in the middle of the suggested range), then make small changes after checking the discharge of the machine.

Adjustments to minimize threshing loss and damage

1. Concave clearance should be set so that cobs are fractured into halves or pie-shaped segments. If the cobs are broken into smaller halves or quartered pieces, higher cylinder or rotor speeds will be necessary to remove the grain, which in turn can contribute to grain damage, loss, and decreased sample quality.

2. Cylinder or rotor speed should then be reduced to the point that an occasional kernel is left on the cob. Several studies have shown that the best compromise between unshelled grain and excessive kernel damage occurs when about 0.2 percent of the kernels are left on the cob.

Keep in mind that the most significant contributing factor to grain damage is cylinder or rotor speed. In addition to grain damage, excessive cylinder or rotor speed can lead to increased levels of foreign material (FM) in the grain sample.

Sieve and chaffer settings

Machinery settings can affect grain losses at the sieve and chaffer. Grain losses may be reduced by adjusting fan speed. If there is too much trash, the kernels stay in the trash through the straw walkers in a conventional combine or over the cleaning shoe in a rotary design. The kernels are then thrown out of the machine in the tailings. This can result in a “windrow” effect when the corn kernels germinate (Figure 3).

Figure 3. “Windrowing” effect from grain loss directly behind the combine. Photo by Gretchen Sassenrath, K-State Research and Extension.

Careful adjustments of the combine can improve this. If the air speed is too high, too many kernels are lost. Conversely, if air speed is too low, unnecessary foreign material (FM) will be retained in the grain resulting in quality dockage at the point of delivery. The chaffer and sieve should be adjusted to minimize grain losses in the tailings. Yield losses from cleaning operation can be measured by counting kernels behind the combine. Especially look for windrowing effects if an adequate spreader is not in use.

Estimating yield loss

An estimate of the yield loss can be made by counting the number of kernels per square foot and dividing by 2 (Figure 4).

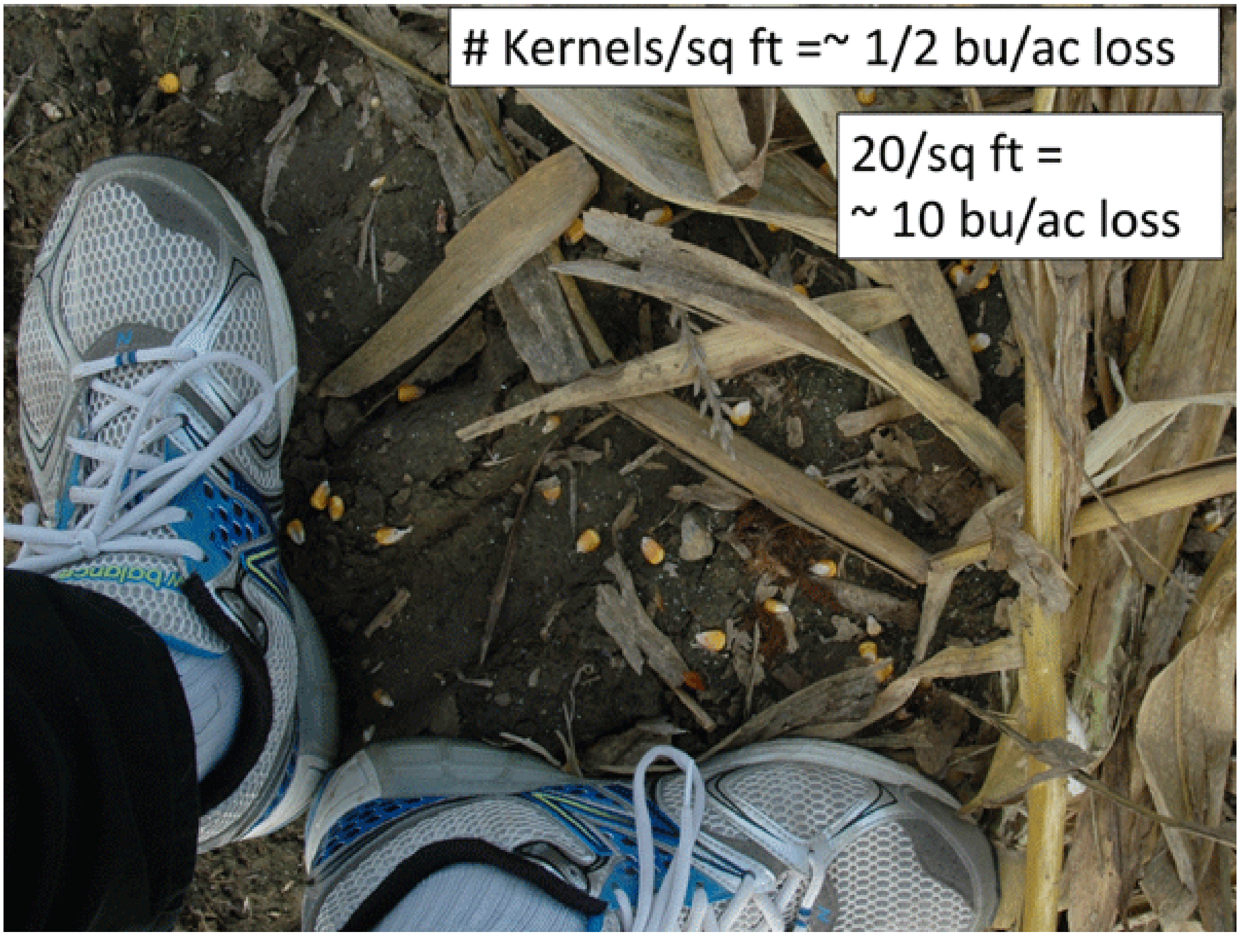

Figure 4. An estimate of the harvest inefficiency can be made by counting the number of kernels in a square-foot area. The number of kernels per square feet is approximately half the bushels per acre lost. If 20 kernels per square foot are lost, that would equal roughly 10 bu/acre lost during harvest. Photo by Gretchen Sassenrath, K-State Research and Extension.

It's important that the average number of kernels per square feet be representative of the entire harvest swath, so as to include both header and threshing losses. Although this corn has already been lost, changes can then be made in the harvest operation to improve the harvest efficiency in the future. It's also important to check for field losses at different times of the day when harvesting, and on different fields. Changes in weather conditions (moisture and temperature) or other factors can impact harvest efficiency.

There is also a free app from AG-PHD that can estimate harvest losses. You select your crop and input the number of seeds/kernels you count on the ground per sq. ft. to get a harvest loss calculation. The download links are iOS and Android.

In addition to combine losses, some obvious loss occurs during transfer events. While this may look substantial, it is usually not very high across the entire field. While harvest efficiency will never be 100% and it is critical to get the harvest completed, paying attention to details during harvest could increase profitability.

Producers may consult the chapter on harvesting in the K-State Corn Production Handbook, C-560, available online at: http://www.bookstore.ksre.ksu.edu/pubs/c560.pdf

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2. Managing glyphosate-tolerant volunteer corn in summer fallow

There may be stands of glyphosate-tolerant volunteer corn sometimes in fallow fields of wheat-corn-fallow cropping systems. A common question is how these volunteer corn stands affect subsequent winter wheat yields and at what point they should be controlled.

Research on this has been conducted by K-State agronomists across 9 site years in western Kansas. In 8 of 9 site-years available soil water at wheat planting was reduced when uncontrolled volunteer corn was present. Overall, wheat tillers were reduced by 1/square foot for every 170 volunteer corn plants per acre and wheat grain yields were reduced 1 bu/acre for every 500 volunteer corn plants/acre. Producers can estimate volunteer density using the following table:

Plant population / acre	Plants in a 30-ft x 30-ft area
250	5
500	10
1,000	21
1,500	31
2,000	41
4,000	82
6,000	124

The economic threshold of control is likely between 1,000 and 1,500 plants/acre depending upon the price of wheat and the producer's cost of herbicide and application. In years of extremes – either very high wheat yields (i.e. greater than 70 bu/acre when water is largely non-limiting), or years of very low yield potential (<35 bu/acre) -- the effect of volunteer corn will be much less. But for the majority of years yield reductions in wheat should be expected when volunteer corn density is greater than 500 plants/acre and not controlled.

Quantifying the density of volunteer corn stands within a field and determining priority among fallow fields is a potential use for UAV imagery. Imagery collected in northwest Kansas clearly shows volunteer corn plants in a chem-fallow field (Figure 1). Volunteer corn densities could be evaluated manually or with software tools.

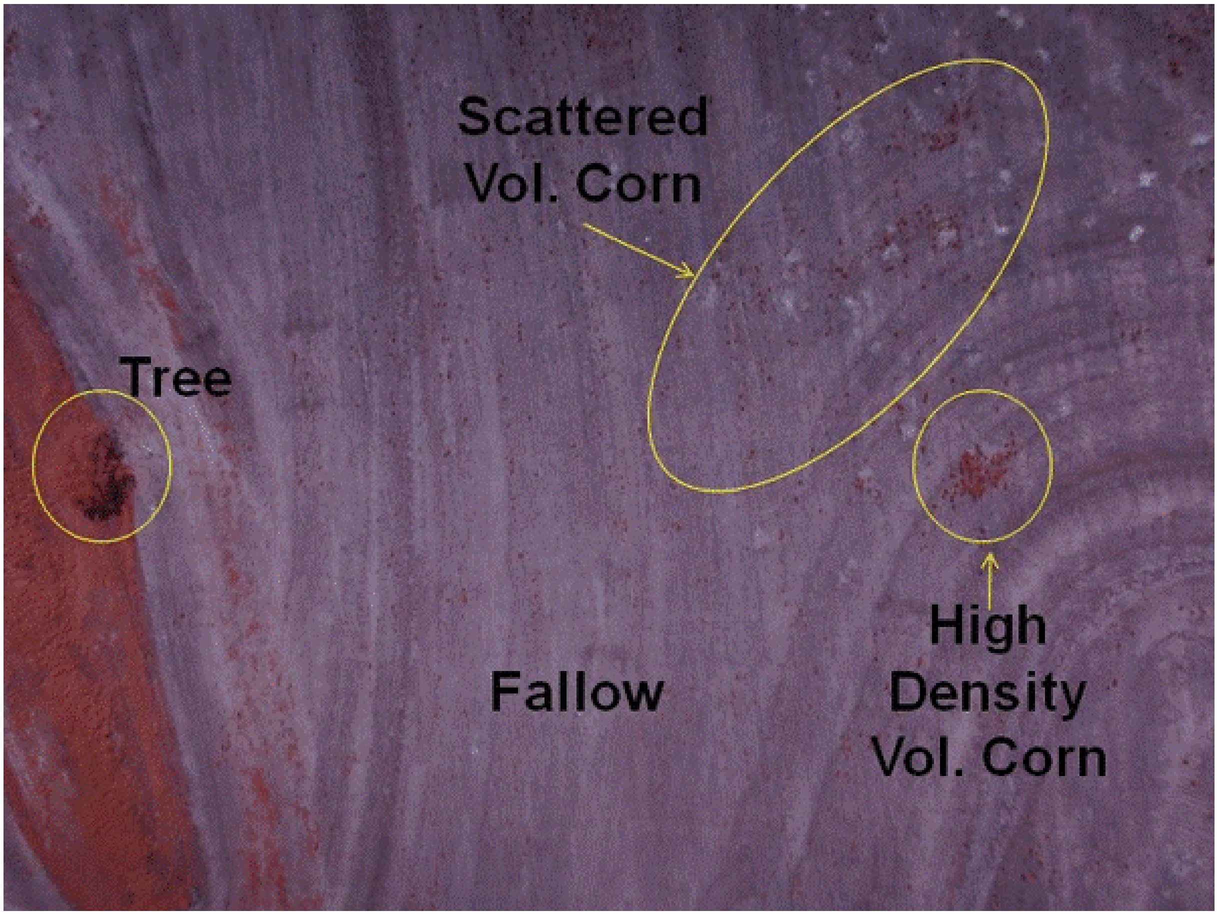

Figure 1

Figure 2

A variety of herbicide options are available for attaining control. Clethodim products (e.g. Select Max) provide control to volunteer up to 36 inches in height. Volunteer corn should be controlled as soon as possible however to minimize water use and increase the probability of achieving full control.

Achieving good coverage, the use of adequate spray solution volume, and proper use of crop oil and AMS are key to attaining good control. For example, the SelectMax label specifies a minimum of 10 gallons/acre spray solution, NIS at 0.25% v/v or COC/MSO at 1 qt/acre or 1% v/v, and the use of ammonium sulfate (AMS) at 2.5 to 4 lb/acre. In drought-stressed conditions or when treating large plants, using the full rate of AMS will improve efficacy. Producers should be aware that some products have a restriction period before planting wheat. Always read and follow label directions.

In addition to chemical control, crop management that minimizes lodging in corn, proper adjustment of combine settings at corn harvest to minimize grain losses, and the use of no-till can reduce volunteer corn populations. Previous research found 80% germination of volunteer corn kernels within a tillage system, and only 10% germination within a no-till system.

For more information see K-State Research and Extension publication SRL141, *Keeping Up With Research: Volunteer Corn in Fallow* at:
http://www.ksre.ksu.edu/bookstore/pubs/SRL141.pdf

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3. Factors to consider before baling or burning wheat residue

Following wheat harvest, some producers might be thinking about baling or burning their wheat stubble. Producers may consider burning for several reasons: to control pests such as plant diseases or weeds, to improve the seedbed for the subsequent crop, and possibly other reasons. While burning is inexpensive, and baling provides additional income, producers should understand the true value of leaving crop residue in the field. Some of the information below comes from K-State Extension publication MF-2604, *The Value of Crop Residue*.

There are four main factors to consider.

Loss of nutrients

The products of burned wheat stubble are gases and ash. Nutrients such as nitrogen (N) and sulfur (S) are largely combustion products, while phosphorus (P) and potassium (K) remain in the ash. When residue is burned, about one-third to one-half of the N and S will combust. The nutrients in the ash may remain for use by the plants, if it doesn't blow or wash away first (more on that below). Therefore, instead of cycling these important plant nutrients back into the soil, they can essentially become air pollutants when the residue is burned.

Amounts of nutrients remaining in wheat stubble (assuming 50 bu/ac yield)	
Nutrient	Pounds present in 5,000 lbs of wheat straw
N	27.0
P_2O_5	7.5
K_2O	37.5
S	5.0

Protection from soil erosion

Bare soil is subject to water and wind erosion.

Water erosion. Without residue, the soil will receive the full impact of raindrops, thus increasing the amount of soil particles that may become detached during a rainfall event. Bare, tilled soils can lose up to 30 tons per acre topsoil annually. In no-till or CRP systems where residue is left, annual soil losses are often less than 1 ton per acre. The detachment of soil particles can lead to crusting of the soil surface, which then contributes to greater amounts of sediment-laden runoff, and thus, reduced water infiltration and drier soils.

Leaving residue on the field also increases surface roughness, which decreases the risk of both wind and water erosion. Most agricultural soils in Kansas have a "T" value, or tolerable amount of soil loss, of between 4 and 5 tons per acre per year, which is about equal to the thickness of a dime. To prevent water erosion, 30% ground cover or greater may be needed to reduce water erosion to "T" or less, especially in fields without erosion-control structures such as terraces.

What about removing residue from a no-till field? Is that better than removing it from a tilled field? A great deal of research is being conducted in Kansas and around the U.S. on the subject of how much residue can be removed safely. The answer varies on almost a field-by-field basis, because of differences in management, soil type, the amount of residue produced by the previous crop, etc.

Research in western Kansas near Hays compared sediment loss from a 20-year no-till field to that from a freshly tilled field. There was less sediment lost from the no-tilled field. However, the results suggest that no-till benefits for controlling soil erosion are quickly lost when residue is removed at rates above 25%.

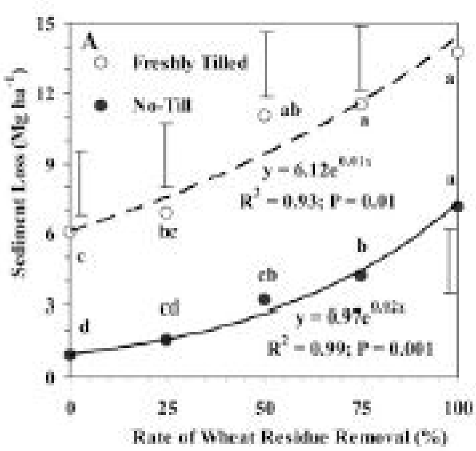

Figure 1. Influence of wheat residue removal on sediment loss in runoff in two soils in western Kansas. Source: Blanco-Canqui et al., 2009.

These results underscore the critical role of residue cover in keeping the soil in place. Residue removal left the soil surface unprotected against the impact of raindrops, which is likely to have caused rapid soil detachment and surface sealing. Residue removal left the soil with little or no residue cover needed for intercepting raindrops, ponding runoff, and increasing the time available for rainfall to infiltrate the soil surface (Blanco-Canqui et al., 2009).

Wind erosion. Standing stubble is more effective at preventing wind erosion than flat stubble. On occasion, accidental residue burns have resulted in devastating wind erosion events that happen over and over again until a new ground cover is established. Once a field begins to erode from wind, it is extremely difficult to stop. During extended droughts the soil profile gets dried out and not even emergency tillage is effective at stopping the wind erosion. Losing topsoil degrades soil productivity, and the long-term effect of this loss is not easy to quantify.

The figure below shows research results from six locations in western Kansas, conducted by Yuxin He, former agronomy graduate student. In this experiment He removed crop residue at different levels, accomplished by cutting the crop residue at different heights. For example, if the residue was 10" after it was combined, the residue would be cut to 5" and removed from the plot, and that would equal 50% removal. The wind erodible fraction is the part of the soil less than 0.84 mm in size.

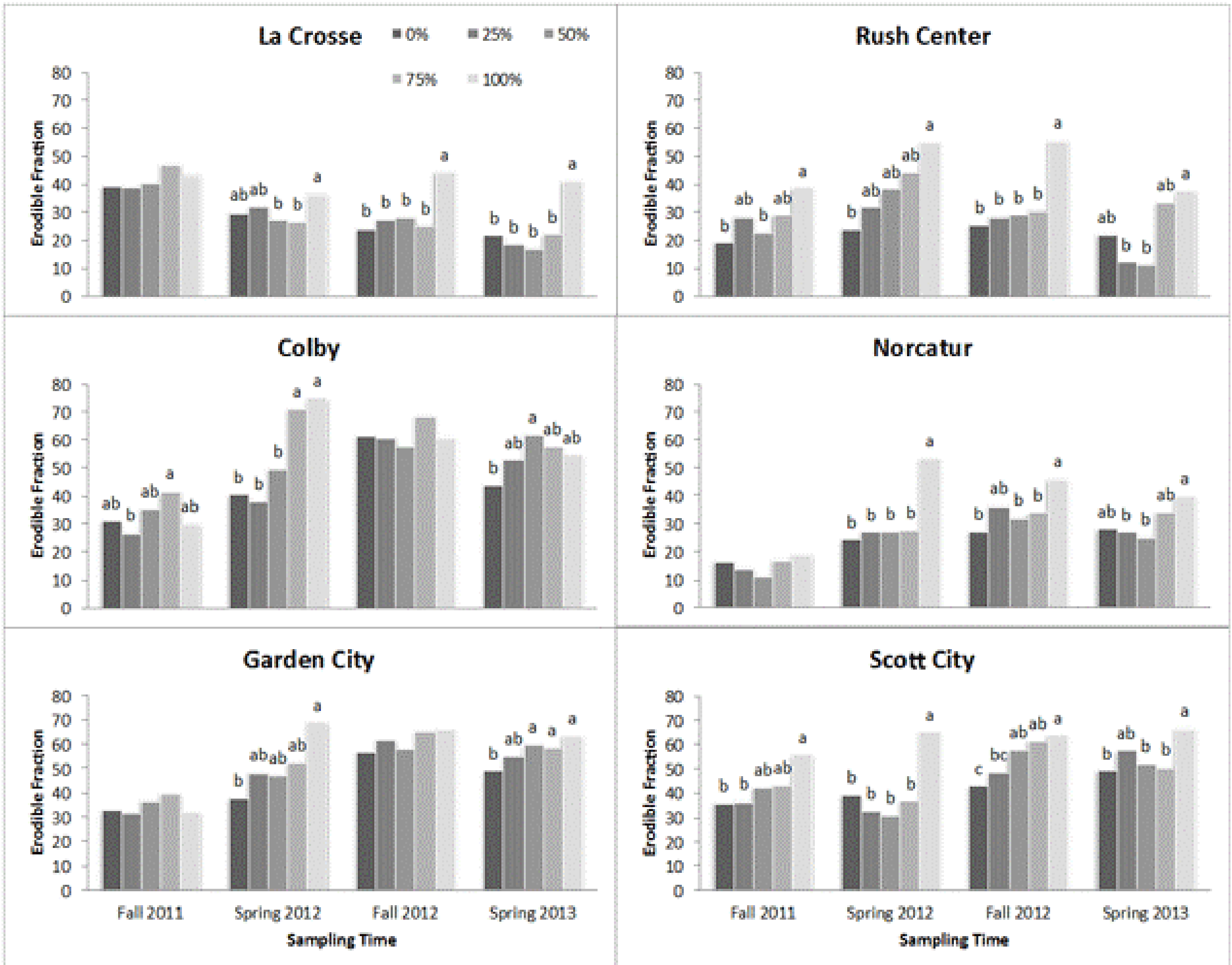

Figure 2. Effects of crop residue removal on the wind erodible fraction of soil, defined as <0.84 mm. the different shadings of the bars refer to the percent residue removed (the key is in the upper left panel). For example 0% means no residue was removed, while 100% means that all residue was removed. Lowercase letters indicate treatment differences at $p<0.05$. Ph.D. dissertation, Yuxin He, 2015, available at:
http://krex.k-state.edu/dspace/bitstream/handle/2097/19043/YuxinHe2015.pdf?sequence=1

Moisture infiltration rates and conservation

Wheat residue enhances soil moisture by increasing rainfall infiltration into the soil and by reducing evaporation. Residues physically protect the soil surface and keep it receptive to water movement into and through the soil surface. Without physical protection, water and soil will run off the surface more quickly.

Ponded infiltration rates were measured at Hesston in September 2007. Very low infiltration rates (1.9 mm/hour) were observed for continuous winter wheat in which the residue was burned each year prior to disking and planting the following crop. In contrast, high infiltration rates (13.3 mm/hour) were observed for a no-till wheat/grain sorghum rotation (Presley, unpublished data).

Another way residue increases soil moisture is by reducing evaporation rates. Residue blocks solar radiation from the sun and keeps the soil surface cooler by several degrees in the summer. Evaporation rates can decline dramatically when the soil is protected with residue. Research from dryland experiments has shown that crop residues are worth 2 to 4 inches of water annually in the central Great Plains states (Presley, 2012).

Soil quality concerns

Over time, the continued burning of cropland could significantly degrade soil organic matter levels. By continually burning residue, soil organic matter is not allowed to rebuild. Soil organic matter is beneficial for plant growth as it contributes to water holding capacity and cation exchange capacity. Soil organic matter binds soil particles into aggregates, which increases porosity and soil structure and thus, increases water infiltration and decreases the potential for soil erosion. One burn, however, will not significantly reduce the organic matter content of a soil (unless the field erodes, as discussed above).

If producers do choose to burn or harvest their wheat stubble, timing is important. It's best to burn as late as possible, close to the time when the next crop is planted. This minimizes the time that the field will be without residue cover and vulnerable to erosion. Before choosing to burn residue, producers should check with the USDA Natural Resources Conservation Service and/or the Farm Service Agency to find out if this will affect their compliance in any conservation programs.

For more information, see:

* *Efficient crop water use in Kansas*, MF3066, available at:
http://www.ksre.ksu.edu/bookstore/pubs/mf3066.pdf

* *Emergency wind erosion control*, MF2206, available at:
http://www.ksre.ksu.edu/bookstore/pubs/MF2206.pdf

**Crop residue management strategies in Kansas*. 2015. Yuxin He. Ph.D. dissertation, Kansas State University,
http://krex.k-state.edu/dspace/bitstream/handle/2097/19043/YuxinHe2015.pdf?sequence=1

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Reference: Blanco-Canqui, H., R.J. Stephenson, N.O. Nelson, and D.R. Presley. 2009. Wheat and sorghum residue removal for expanded uses increases sediment and nutrient loss in runoff. **J Environ Qual.** Oct 29;38(6):2365-72. doi: 10.2134/jeq2009.0021. Print 2009 Nov-Dec.

4. Drought stress in corn

In many areas of the state, dryland corn has received plenty of rain and the crop is in good condition. But over the last few weeks some locations have not received any rain and drought conditions are starting to show up. Since the growing season is progressing very fast, it is best to be prepared to take a close look for symptoms of potential drought stress.

Early vegetative

One of the first visible corn responses to insufficient water availability is leaf rolling. If the stress is severe, the leaf rolling process can be detected even very early in the morning. Leaf rolling is just a plant defense mechanism to reduce transpiration and plant canopy temperature, and with an overall improvement in water use efficiency. Under continuous drought for several days, reductions in leaf elongation and in plant height should be expected.

Figure 1. Leaf rolling in corn under drought stress. Photos by Ignacio Ciampitti, K-State Research and Extension.

Shorter, less leafy plants are also among the most visible symptoms of drought stress conditions. Plants may not be as green as usual if chlorophyll production is affected. In addition, root systems will be smaller under drought conditions since all below- and above-ground plant growth will be affected. Those symptoms are the outcome of plants that are less efficient in growing as photosynthesis is slowing down.

Figure 2. Effect of drought stress on root systems. On the left is a plant with a smaller root system and stalk diameter caused by drought stress. On the right is an unstressed corn plant, with greater root system, more nodal roots, and greater stalk diameter.

Overall reductions in potential yield can be expected even if the stress is occurring early (10-leaf to 15-leaf stages) or late (dough and dent stages) in the crop growing season.

Critical period bracketing silking

At what stage of growth is corn most sensitive to drought stress? To answer the question, we need to know the most important growth stages for grain determination. The final number of kernels for corn is determined around the pollination period (2 weeks before and 2 weeks after flowering). Thus, corn is extremely sensitive to drought stress during that period. Drought stress directly affects the final number of kernels through different processes, such as:

1. Potential delays in silking (asynchrony between the development of male and female reproductive parts). This happens when the tassel is shedding pollen but the ear is not yet receptive (silks are not yet out of the husk).

2. Potential reductions in ear size (smaller ears with less physical space for bearing grains).

3. Shorter time for pollen receptivity. This occurs when the silks dry out very fast under warm temperatures, impeding a successful pollination.

4. Pollination is concentrated in just a few days. In general, pollination takes place earlier and with a short duration under drought stress. High temperatures can also potentially impact pollen viability.

5. Even when pollination is effective, kernel abortion or cessation can occur right after flowering, in the blister and milk stages, if drought stress continues.

Under extreme drought and heat stress, plants may be barren, with no ears being formed at all, but that is unlikely to occur in Kansas this year.

Figure 3. Leaf rolling in corn under drought stress during early reproductive stages.

Management practices and other factors

From a management practice perspective, situations that tend to make corn more susceptible to drought stress include high plant densities, narrow row spacing, and excessive applications of fertilizer or manure. Also, sandy soils are prone to the drought stress due to reduced water holding capacity.

Summary

Scout your acres for drought symptoms. The impacts of the drought stress on grain yield can be known with more precision right after flowering. If stress is impacting the potential kernel number, and if conditions for the coming weeks continue to be on the dry side, yield reductions can be expected. Continuing drought stress could potentially reduce yields further by lowering seed weight, on top of a reduction in kernel numbers.

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5. Kansas climate basics: Top 10 hottest, coldest, driest, and wettest years in Kansas

(Editor's note: The following article is one in a series of articles in the Agronomy eUpdate that examines the historical climate observations in Kansas. The methods used to do this analysis are explained in the introductory article in this series, from eUpdate No. 571, May 20, 2016. – Steve Watson)

Top 10 hottest, coldest, driest, and wettest years in Kansas

We wrap up this series of articles in the Agronomy eUpdate on "Kansas Climate Basics" with a set of "Top 10" listings. Table 1 provides the top ten hottest, coldest, driest, and wettest years during the period of 1895 to 2015. The hottest year recorded during this period was 2012 and coldest year was 1912. Five of the ten hottest years occurred during the 1930s. Both the driest and wettest years occurred in 1950s. Perhaps surprisingly, only two of the driest years were during the Dust Bowl decades of the 1930s.

The temperature difference between hottest year and coldest year is about 5 degrees F (2.7 degrees C) in Kansas. Perhaps more significantly, the precipitation difference is 19 inches between the wettest and driest years. These significant swings of temperature and precipitation make Kansas's crop and livestock productions relatively vulnerable to changes of increasing climate extreme events from short-term and/or longer-term perspectives, which requires that adaptive measures are taken for sustaining Kansas agricultural production.

Table 1. Kansas Top 10 hottest, coldest, driest, and wettest years from 1895 to 2015					
Rank	**Hottest year**	**Degrees F**	**Rank**	**Coldest year**	**Degrees F**
1	2012	58.9	1	1912	52.3
2	1934	58.1	2	1951	52.5
3	1954	57.7	3	1993	52.6
4	2006	57.6	4	1924	52.6
5	1938	57.5	5	1917	52.7
6	1939	57.4	6	1979	52.8
7	1946	57.4	7	1903	52.9
8	1933	57.3	8	1895	52.9
9	1931	57.1	9	1929	52.9
10	1921	57.1	10	1985	53.0
Rank	**Driest year**	**Inches**	**Rank**	**Wettest year**	**Inches**
1	1956	17.3	1	1951	43.7
2	1966	19.3	2	1973	42.7
3	2012	19.4	3	1915	41.3
4	1936	19.8	4	1993	41.1

5	1952	20.1	5	1961	38.1
6	1939	20.7	6	1941	37.5
7	1910	20.7	7	2007	36.6
8	1917	21.0	8	1944	36.4
9	1963	21.1	9	1985	35.9
10	1988	21.3	10	1992	35.8

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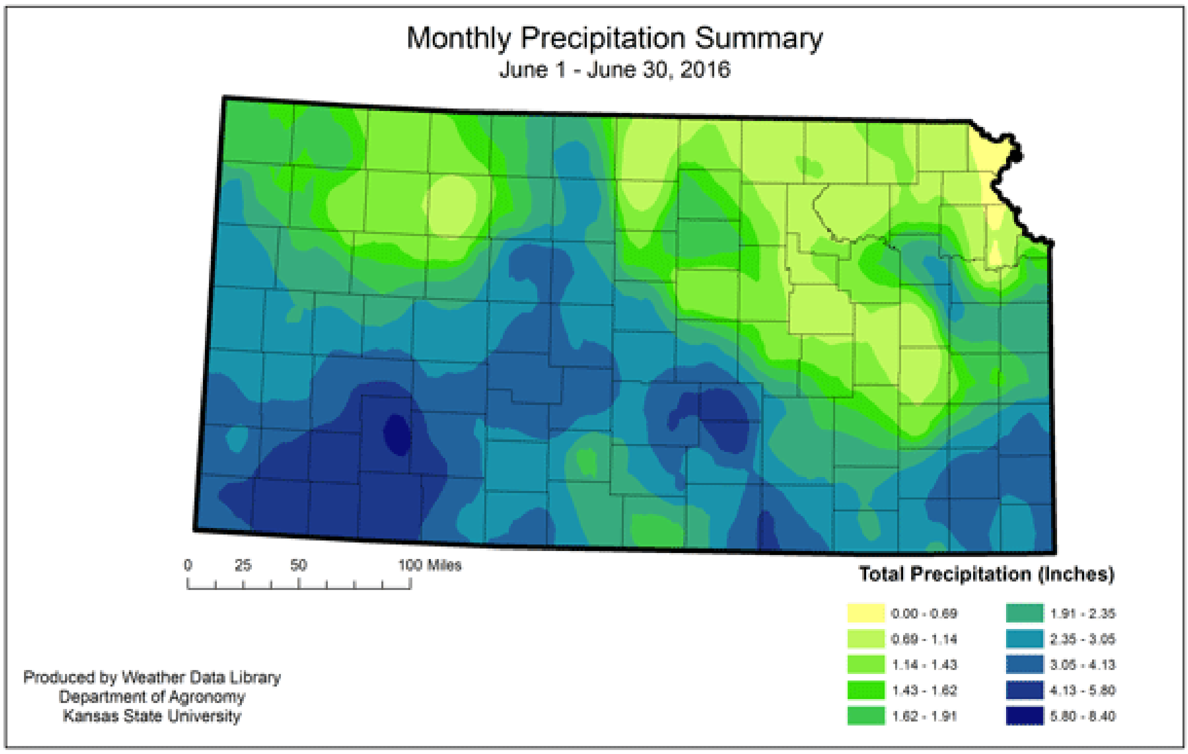
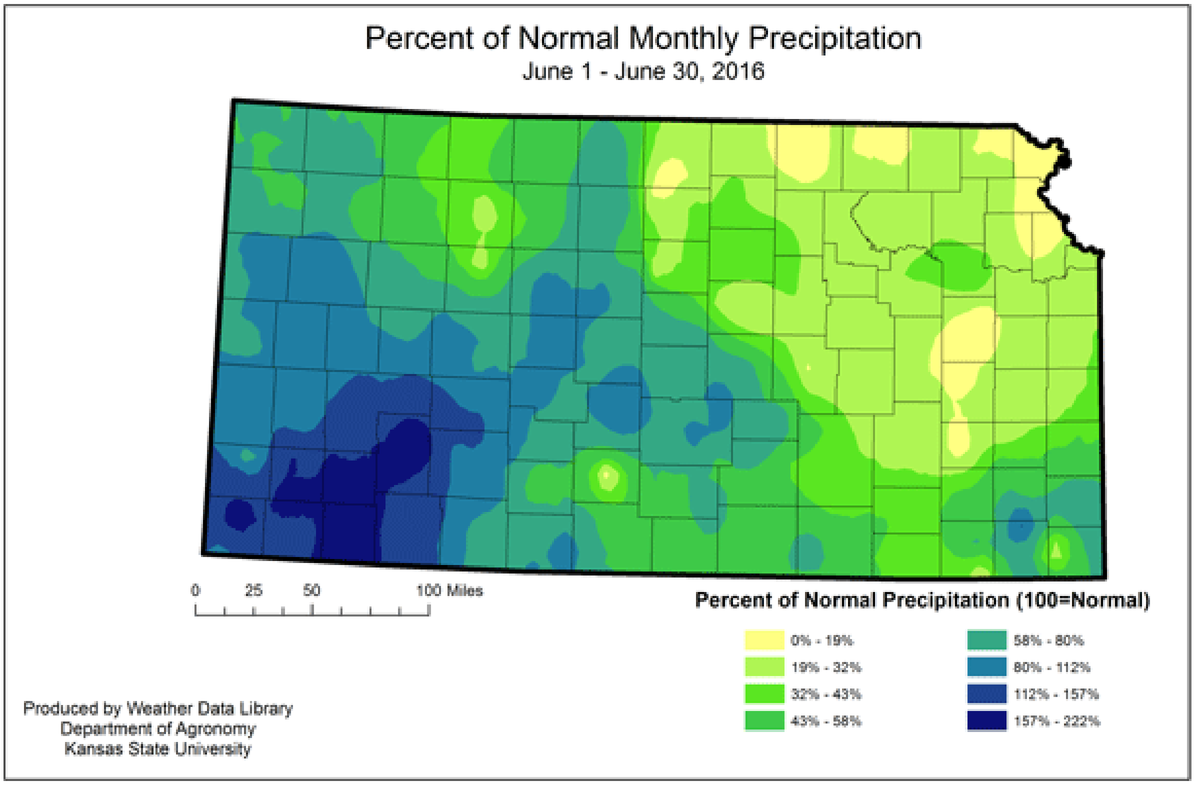
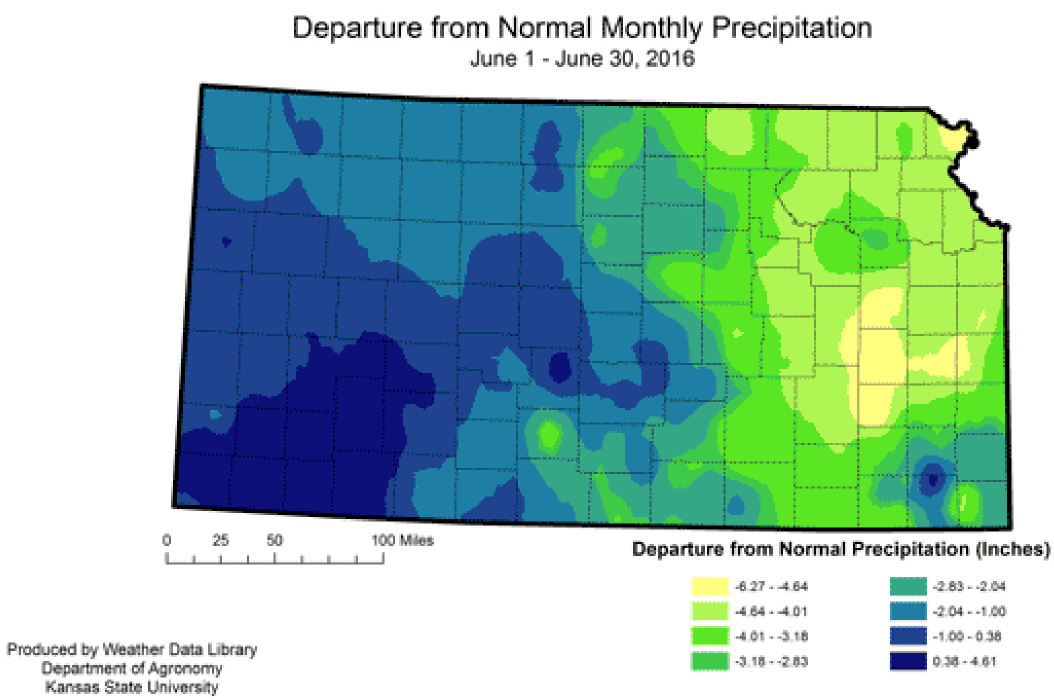
6. June weather summary for Kansas: Summer arrives early

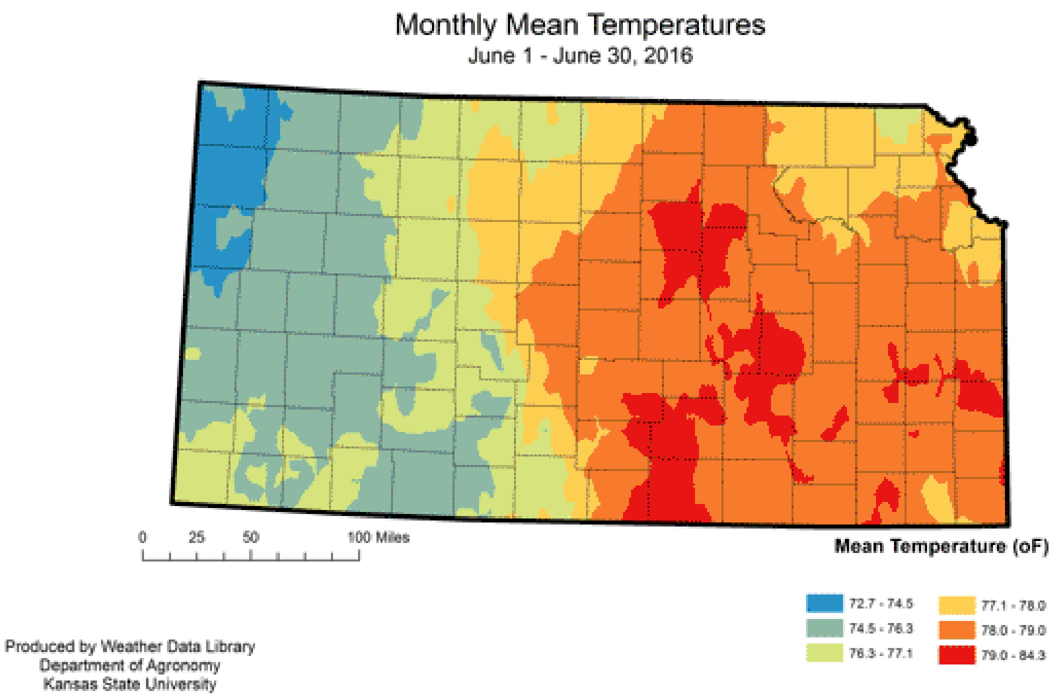
June made a quick turn-around in most of Kansas with regard to both temperature and precipitation. Only the Southwest Division averaged above normal in precipitation for the month. The June average precipitation in southwest Kansas was 5.14 inches, or 158 percent of normal. In contrast, the Northeast Division averaged just 0.98 inches, or 19 percent of normal. The statewide average was 2.53 inches, or 65 percent of normal. That places this June as the 23rd driest since 1896. The driest June on record occurred in 1911, when the statewide average total was just 0.68 inches. Despite the overall dry pattern, there were 32 new record daily rainfall totals. Of those, Cimarron's daily record of 4.89 inches set on June 13th set a new monthly record as well. The greatest 24-hour total for a NWS station was 5.80 inches at Bentley, Sedgwick County, on the 16th. The greatest 24-hour total for a CoCoRaHS station was 6.13 inches at Halstead, Harvey County, also on the 16th. Highest monthly totals: 9.79 inches at Winfield, Cowley County (NWS); 7.52 inches at Wichita, Sedgwick County (CoCoRaHS).

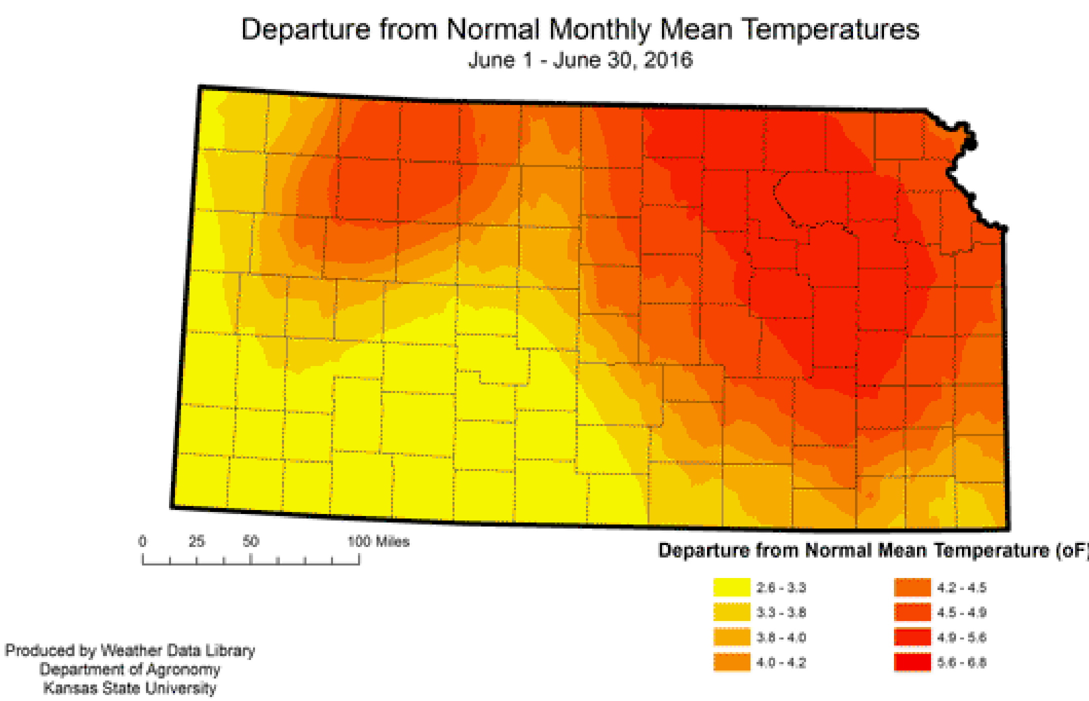






On the temperature side, June was the 10th warmest since 1896. The statewide average temperature was 77.5 degrees F. The Southwest Division was closest to normal for the month. The average was 76.7 degrees F, or 2.9 degrees warmer than normal. The warmest division was the East Central where average temperature was 78.4 degrees F, or 4.9 degrees warmer than normal. There were 61 new daily record high temperatures set. In addition there were 31 new record warm minimum temperatures. Of those, 4 set new record warm minimum temperatures for the month of June. Toronto Lake set a new record minimum of 78 degrees F on the 18th, then tied it again on the 23rd. The highest temperature recorded for the month was 106 degrees F, set at both Abilene, Dickinson County, and Salina, Saline County, on the 15th. The coldest temperature recorded for the month was 42 degrees F, reported at Brewster 4W in Thomas County on the 5th.



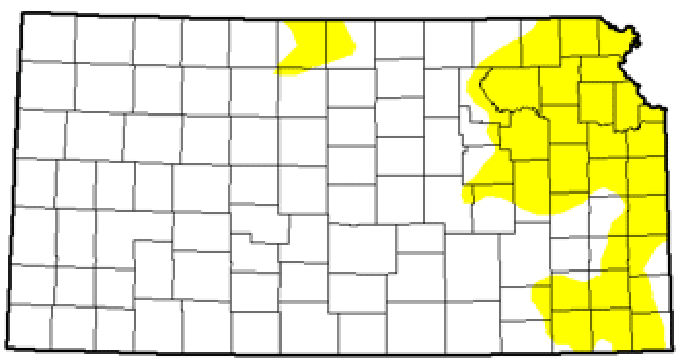


As the rainfall pattern decreased, there were also fewer severe weather reports. There were no tornadoes reported in June. There were 51 hail reports which were much fewer than the 223 reported in May. The most common severe weather report was damaging winds. There were 86 damaging wind reports in the month.

The dry month resulted in a return of abnormally dry conditions across much of the eastern third of the state. The last Drought Monitor issued in June had a little more than 20 percent of the state as abnormally dry. The precipitation outlook for June was for wetter an-average conditions, but that didn’t materialize. The July outlook is neutral on precipitation, with chances equally likely for above or below normal precipitation. Statewide, the outlook is for warmer-than-normal temperatures.

U.S. Drought Monitor

Kansas



June 28, 2016

(Released Thursday, Jun. 30, 2016)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	79.16	20.84	0.00	0.00	0.00	0.00
Last Week	91.82	8.18	0.00	0.00	0.00	0.00
3 Months Ago	25.99	51.81	22.20	0.00	0.00	0.00
Start of Calendar Year	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year	80.79	14.72	4.48	0.00	0.00	0.00
One Year Ago	90.36	6.15	3.49	0.00	0.00	0.00

Intensity:

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

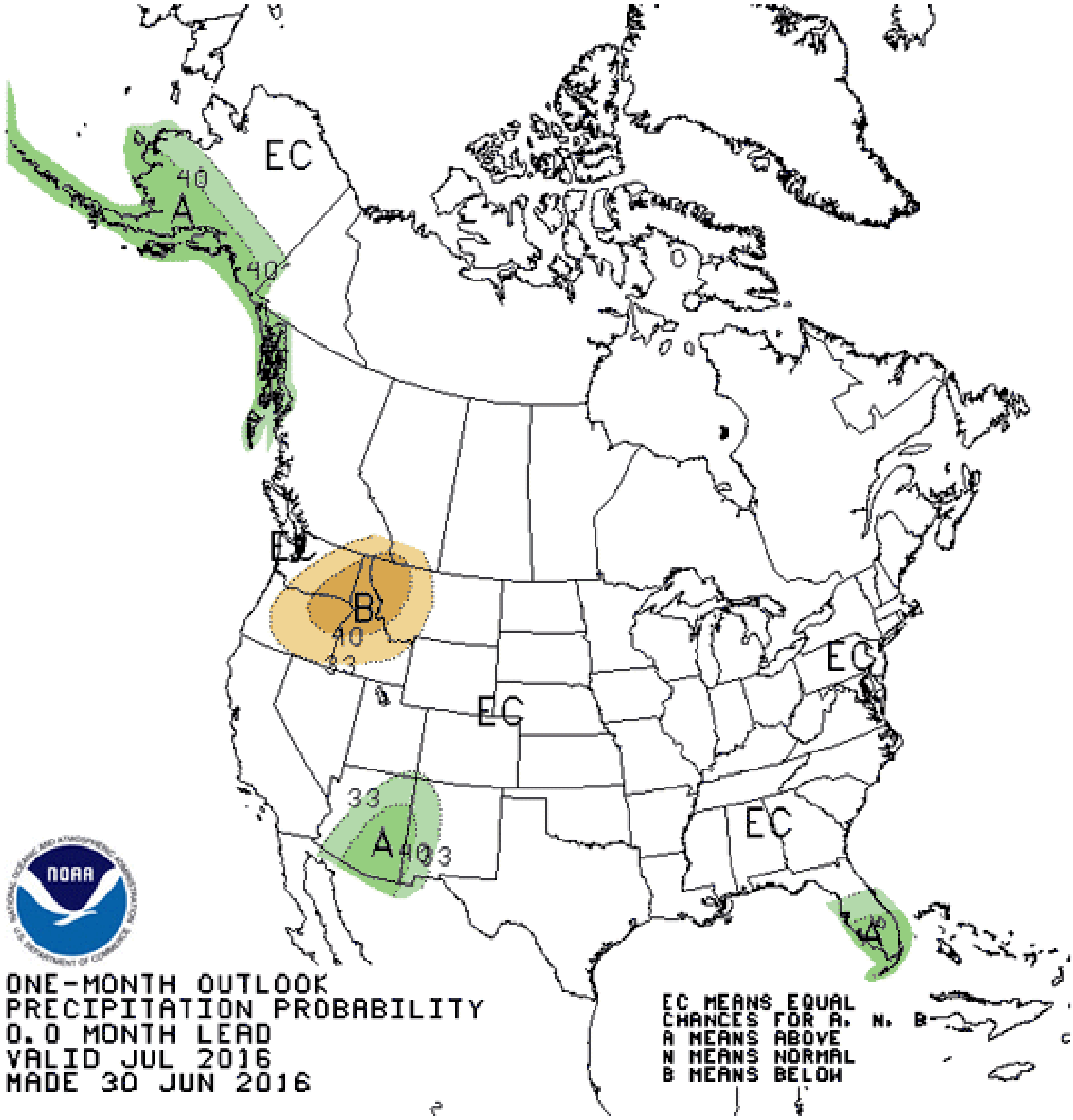
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Eric Luebehusen

U.S. Department of Agriculture

http://droughtmonitor.unl.edu/



Jun 2016

Kansas Climate Division Summary

	Precipitation (inches)						**Temperature (°F)**			
	Jun 2016			**2016 Jan through June**					**Monthly Extremes**	
Division	**Total**	**Dep.** [1]	**% Normal**	**Total**	**Dep.** [1]	**% Normal**	**Ave**	**Dep.** [1]	**Max**	**Min**
Northwest	1.19	-1.64	41	10.73	-0.04	99	75.3	4.1	105	42
West Central	2.33	-0.48	82	10.69	0.34	102	75.7	3.6	104	45

Southwest	5.14	1.95	158	12.96	2.91	127	76.7	2.9	102	46
North Central	1.27	-2.56	33	14.66	0.63	104	78.1	4.5	104	50
Central	2.22	-1.85	57	14.98	-0.11	101	78.4	3.8	106	49
South Central	3.11	-1.63	68	15.53	-1.10	94	78.5	3.2	104	45
Northeast	0.98	-4.15	19	15.87	-1.68	90	77.8	4.7	104	50
East Central	1.68	-3.86	30	15.36	-4.00	78	78.4	4.8	105	53
Southeast	3.14	-2.74	53	16.96	-4.79	78	78.3	3.8	100	53
STATE	2.53	-1.70	65	14.26	-0.81	97	77.5	3.9	106	42

1. Departure from 1981-2010 normal value

2. State Highest temperature: 106 oF at Abilene, Dickinson County, and Salina, Saline County on the 15th.

3. State Lowest temperature: 42 oF at Brewster, Thomas County, on the 5th.

4. Greatest 24hr rainfall: 5.80 inches at Bentley 2E, Sedgwick County, on the 16th (NWS); 6.13 inches at Halstead 0.4 S, Harvey County, on the 16th (CoCoRaHS).

Source: KSU Weather Data Library

Mary Knapp, Weather Data Library
mknapp@ksu.edu

7. Comparative Vegetation Condition Report: June 28 - July 4

The weekly Vegetation Condition Report maps below can be a valuable tool for making crop selection and marketing decisions.

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 27-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.

The Vegetation Condition Report (VCR) maps were originally developed by Dr. Kevin Price, K-State professor emeritus of agronomy and geography. His pioneering work in this area is gratefully acknowledged.

The maps have recently been revised, using newer technology and enhanced sources of data. Dr. Nan An, Imaging Scientist, collaborated with Dr. Antonio Ray Asebedo, assistant professor and lab director of the Precision Agriculture Lab in the Department of Agronomy at Kansas State University, on the new VCR development. Multiple improvements have been made, such as new image processing algorithms with new remotely sensed data from EROS Data Center.

These improvements increase sensitivity for capturing more variability in plant biomass and photosynthetic capacity. However, the same format as the previous versions of the VCR maps was retained, thus allowing the transition to be as seamless as possible for the end user. For this spring, it was decided not to incorporate the snow cover data, which had been used in past years. However, this feature will be added back at a later date. In addition, production of the Corn Belt maps has been stopped, as the continental U.S. maps will provide the same data for these areas. Dr. Asebedo and Dr. An will continue development and improvement of the VCRs and other advanced maps.

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

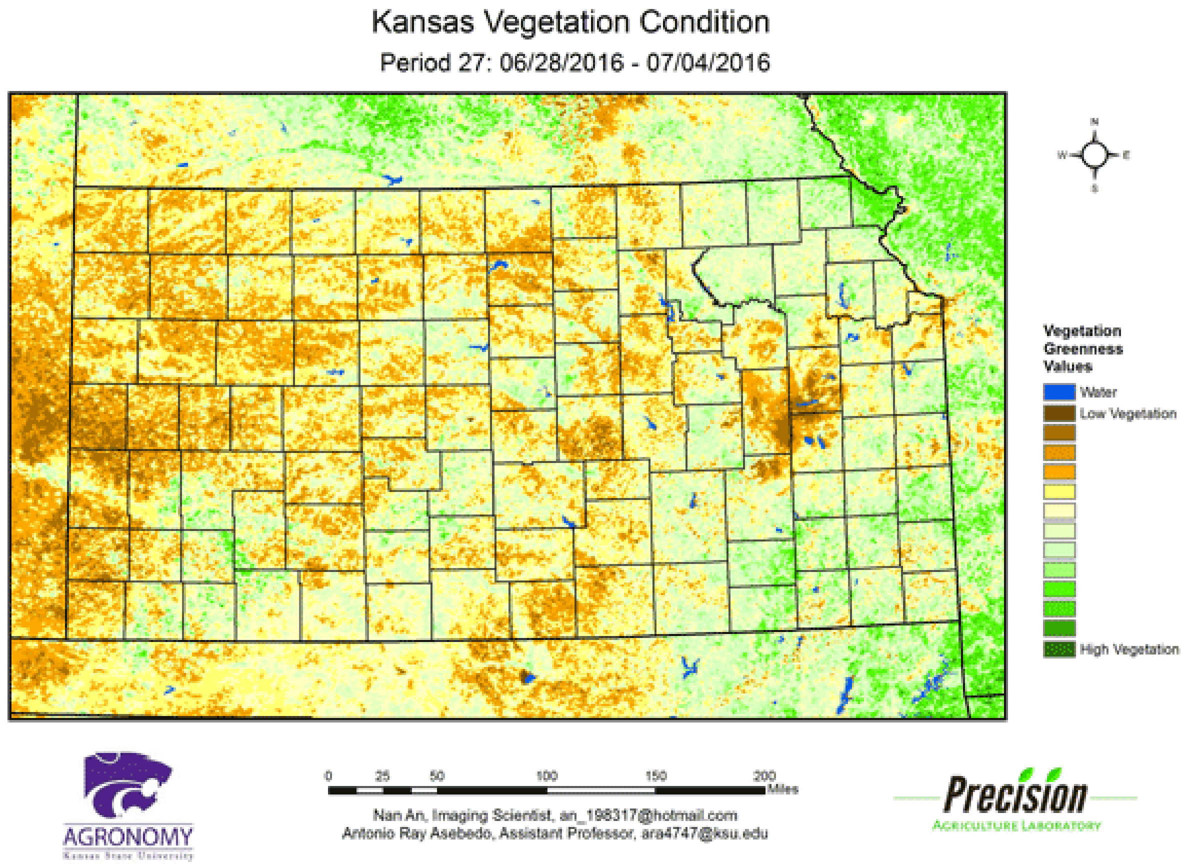


Figure 1. The Vegetation Condition Report for Kansas for June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory continues to show greatest NDVI values are confined to extreme northeast Kansas, along the Missouri River. The continued dry, warm weather has limited vegetative activity in the rest of the state. That is particularly noticeable in the Flint Hills, in Osage, Coffey, and Lyons counties.

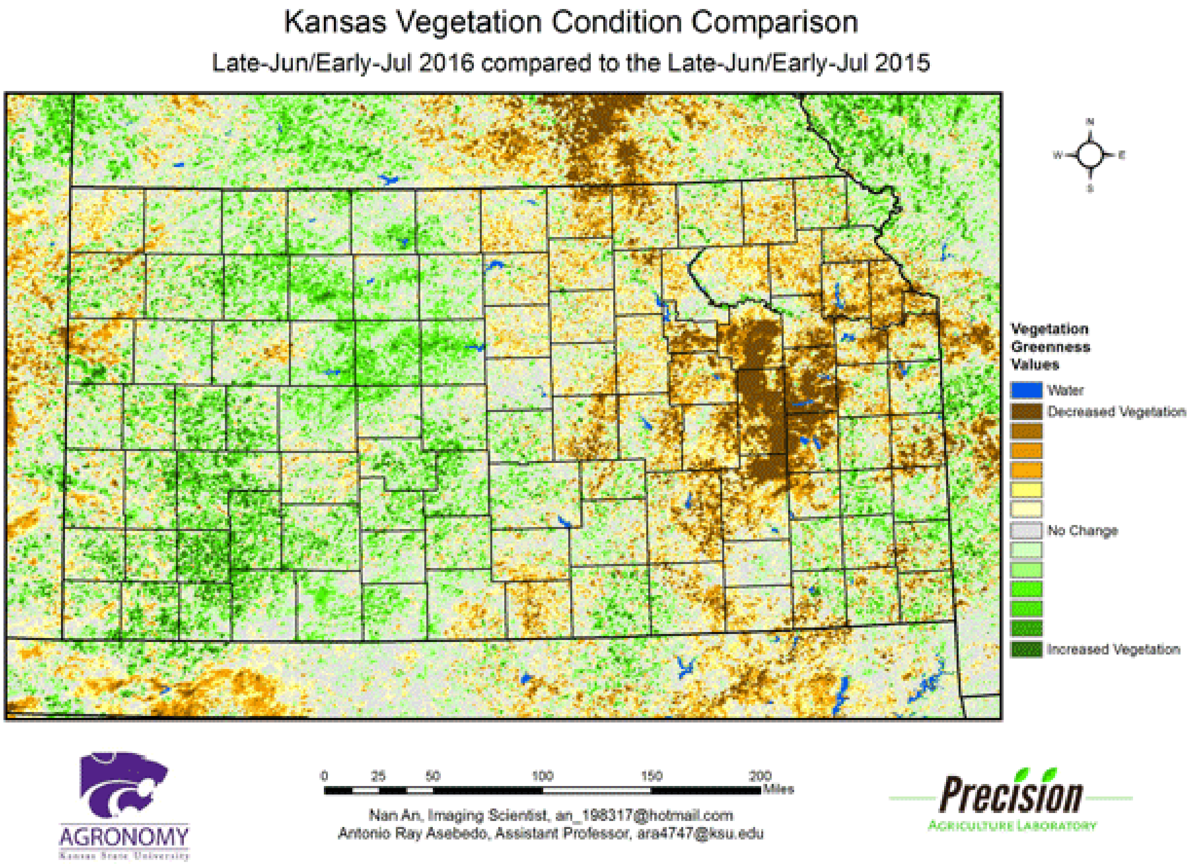


Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory shows much lower photosynthetic activity across eastern Kansas, while the west is seeing higher NDVI values. The area of greatest increase in photosynthetic activity is confined to southwest Kansas. Rainfall has continued to be well distributed in the region and crop progress continues ahead of last year at this time.

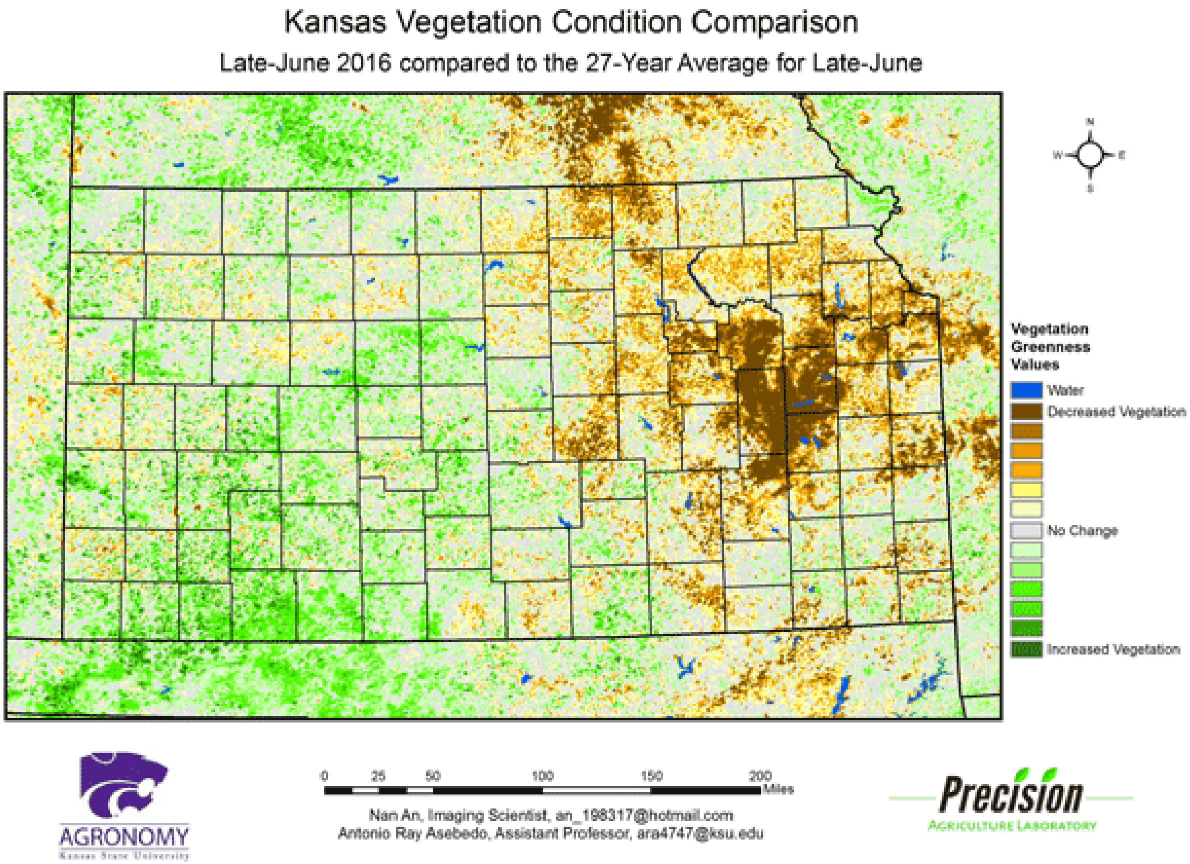


Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory shows below-average vegetative activity is greatest in the east central part of the state. The rapid change to hot, dry conditions has accelerated plant develop and stressed newly planted row crops. Impact from this week's rainfall won't be visible for a while.

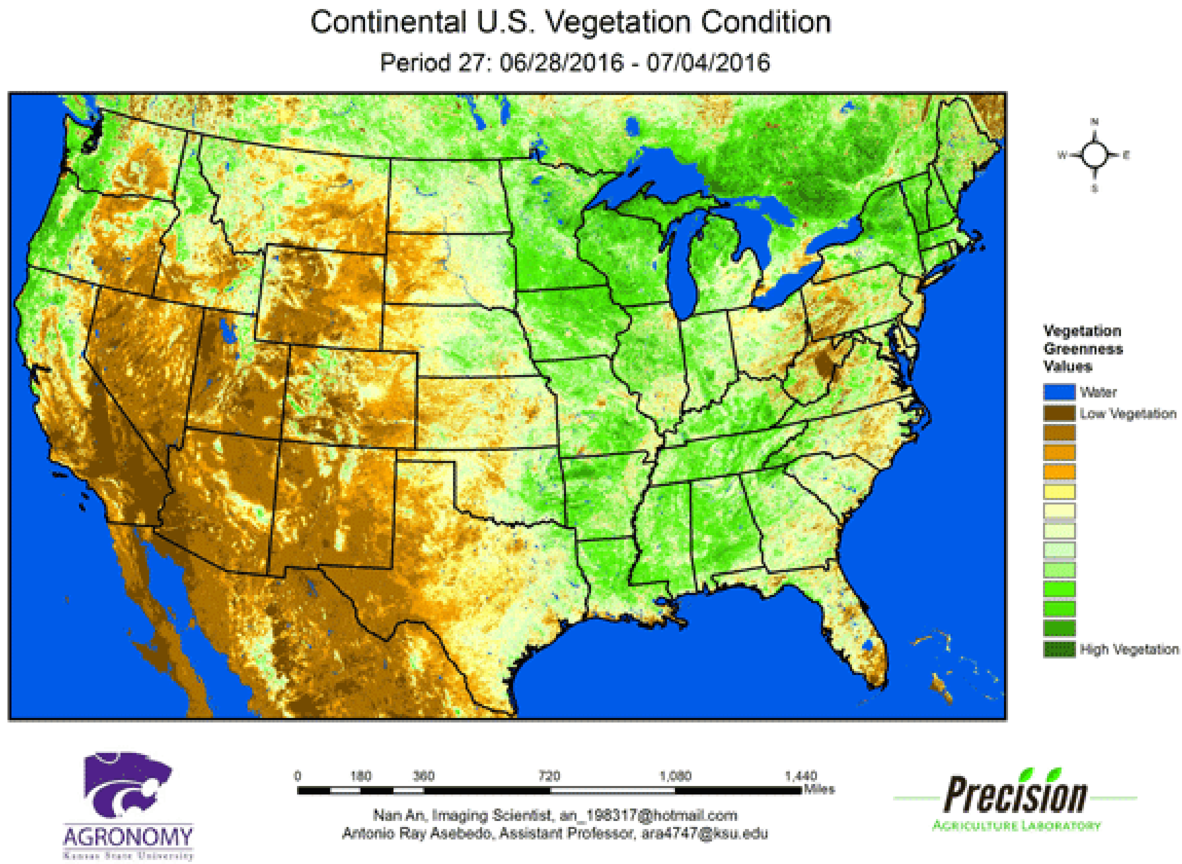


Figure 4. The Vegetation Condition Report for the U.S for June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory shows low NDVI values West Virginia and western Pennsylvania. Much warmer temperatures are driving the downturn in conditions as parts of the Midwest are reporting lower-than-average precipitation. In southeastern Missouri and northern Arkansas conditions are more favorable, although the Boot Heel region of Missouri missed the most recent rains.

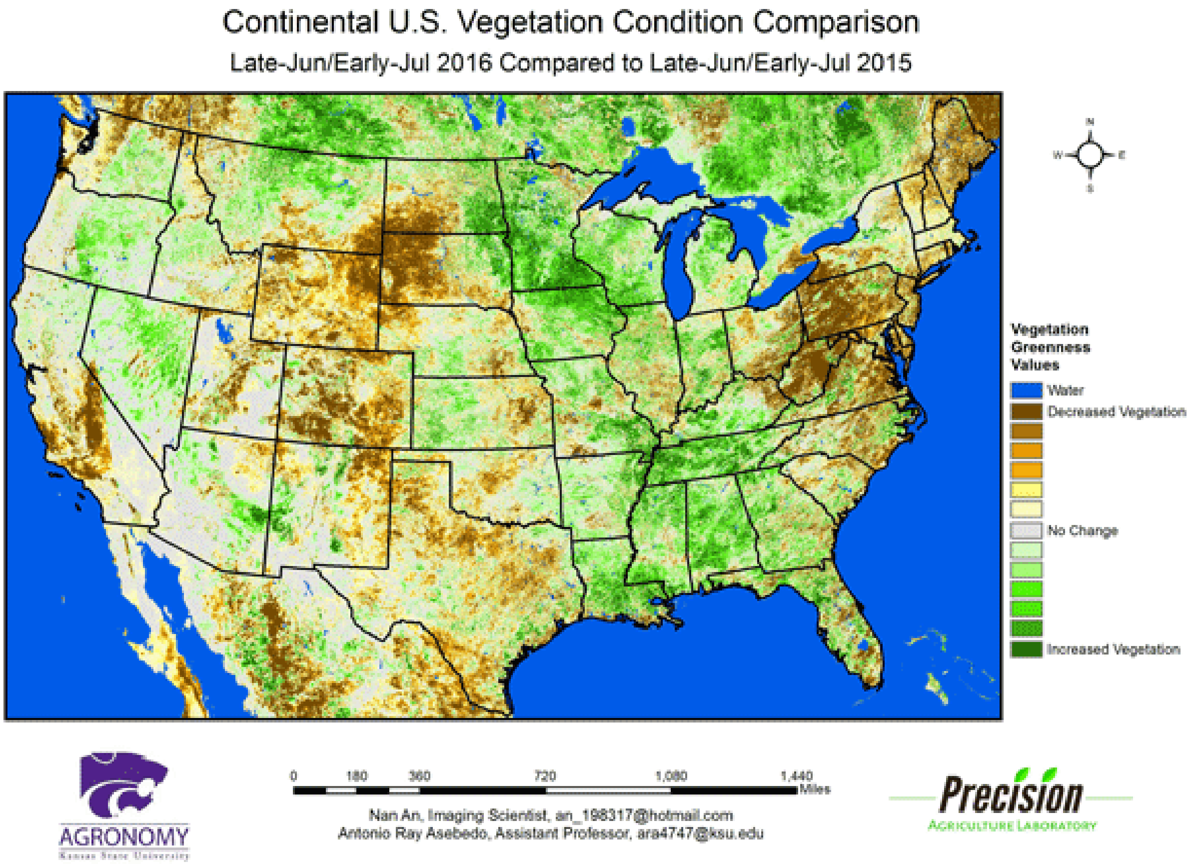


Figure 5. The U.S. comparison to last year at this time for June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory shows that lower NDVI values are most evident in the Mountain West where drier-than-average conditions, coupled with extremely hot weather, have stressed vegetation compared to last year. In the East, heavy rains have limited NDVI values.

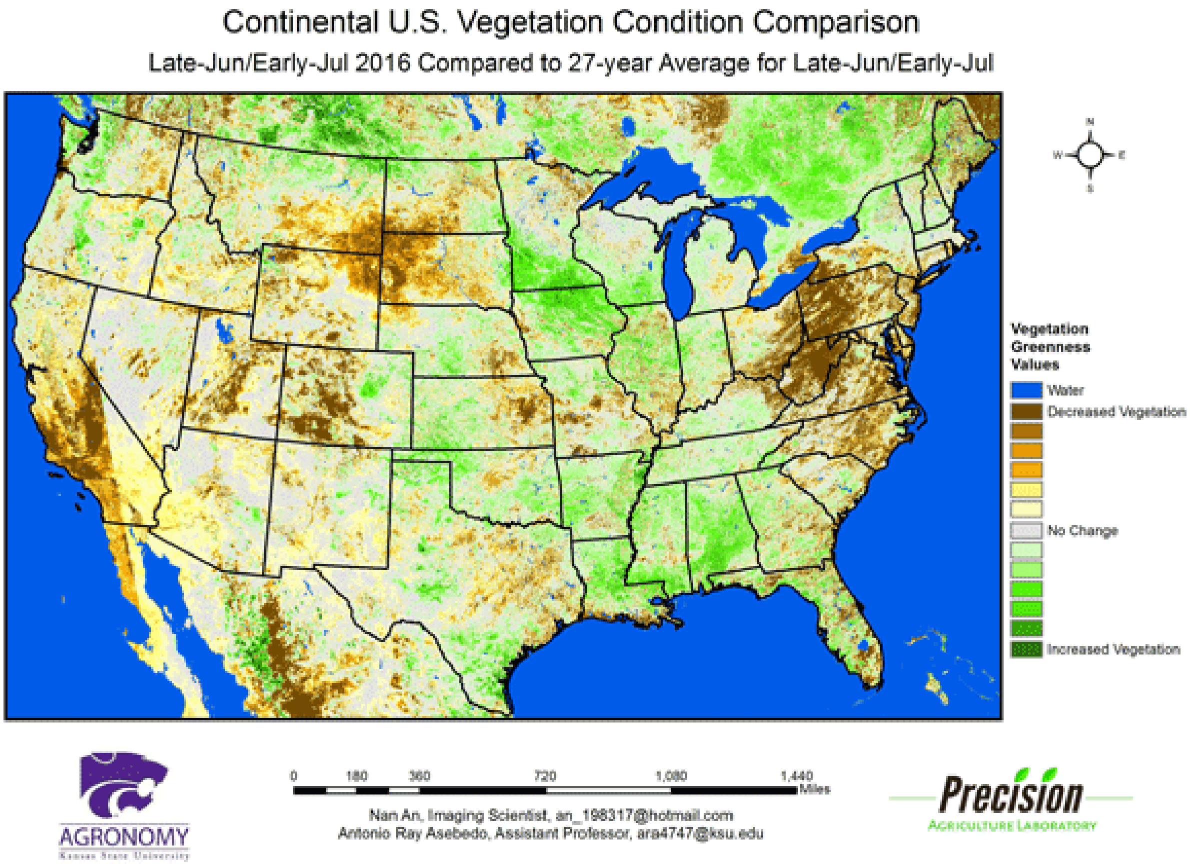


Figure 6. The U.S. comparison to the 27-year average for the period June 28 – July 4, 2016 from K-State's Precision Agriculture Laboratory shows increased areas of below-average photosynthetic activity. The boundary in Texas of favorably moist conditions in the west to excessively wet conditions in the east has shrunk. Lower-than-average photosynthetic activity is also widespread across the Mid-Atlantic states. Widespread heavy rains were common in that area last week.

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