Issue 599

K·STATE
Research and Extension

Extension Agronomy

eUpdate

11/04/2016

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. Factors that help determine winter survival in canola

Fall temperatures in Kansas have once again been warmer than normal. The unusually warm weather has now extended into November. How could this, and other factors, affect the winter survival of canola?

Effect of canola size on winter survival

Canola overwinters -- and is the most tolerant to cold temperatures -- in the rosette growth stage (Fig. 1). At this stage, the crown develops at the soil surface with larger, older leaves at the base and smaller, newer leaves at the center. The stem thickens but its length remains unchanged. For optimum winter survival, a winter canola plant needs 5 to 8 true leaves, 6 to 12 inches of fall growth, a root collar diameter of ¼ to ½ inch, and an extensive root system. Hardened winter canola can withstand temperatures below 0 degrees Fahrenheit for short periods of time.

Figure 1. Winter canola near Concordia at the appropriate size for overwintering. Photo by Mike Stamm, K-State Research and Extension.

On the other hand, canola that has too much top growth (typically 20 inches or more) can succumb to winterkill for a number of reasons, including overuse of available soil water and nutrients, and stem elongation above the soil surface.

Causes of excessive fall stem elongation

Stem elongation in the fall -- not to be confused with bolting, i.e. stem elongation with visible flowering structures -- may occur because:

- The crop was planted too early (Fig. 2)
- The crop was seeded at higher-than-optimal plant populations (Fig. 3)
- Excessive soil fertility is present (particularly nitrogen)
- An unusually warm fall persists (the main cause this year)
- Selection of a poorly adapted cultivar
- A combination of any of these factors

For example, closely spaced and crowded canola plants increase early plant-to-plant competition for light. This "reaching" for light may lead to an extension of the growing point above the soil surface. Any time the growing point (rosette) is elevated, the chances for winterkill are increased because overwintering plant parts are in an unprotected position above the soil surface.

Figure 2. Winter canola plot in mid-October. Early planting and warm temperatures resulted in more than 20 inches of fall growth and an increased risk of winterkill. Photo by Mike Stamm, K-

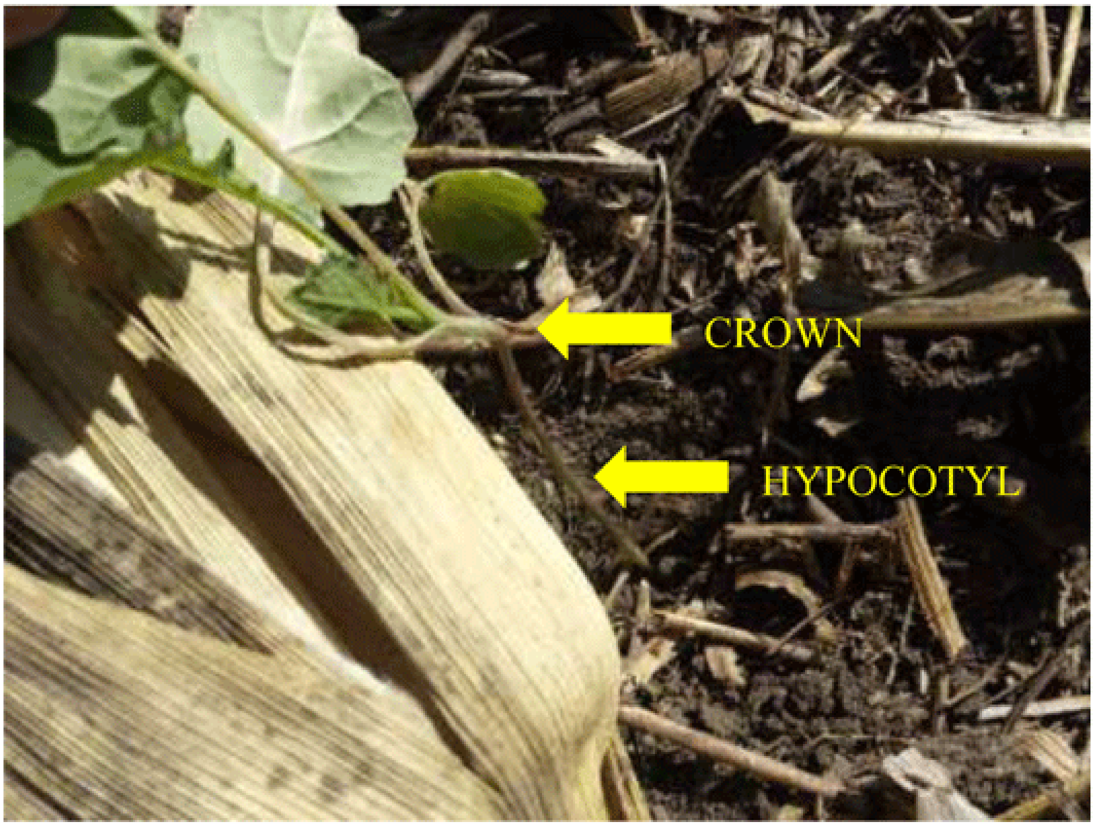
State Research and Extension.

Figure 3. High plant populations in a winter canola plot in mid-October. Competition for light

places the growing point well above the soil surface, increasing the risk of winterkill. Photo by Ignacio A. Ciampitti, K-State Research and Extension.

Another factor in stem elongation and winter survival is the amount of surface residue present in the seed row. K-State research has shown that residue removal from the seed row is important for keeping the rosette, or crown, close to the soil surface, especially in no-till cropping systems. Appropriate residue management (any way to remove residue from the seed row) greatly benefits winter survival.

Figures 4a and 4b show what can happen when residue blows back into the seed row following planting into heavy corn residue. Because of residue in the seed row, the canola hypocotyl in this case is etiolated, or overextended, and thus vulnerable to freezing temperatures and other biotic stresses. Etiolation is when a plant develops in partial or complete absence of light. Under these conditions, plants will have long, weak stems and a pale color. In the situation shown below, the canola hypocotyls grew upward through the corn residue, stopping when they reached sunlight above the soil surface. That is where the rosettes were established. As a result, the crop easily succumbed to cold temperatures, and the field in this specific example was lost because of poor residue management.



Figures 4a and 4b. Inadequate residue management causes etiolation of the hypocotyl to an exposed position above the soil surface. Photos by Mike Stamm, K-State Research and Extension.

Planting dates in 2016

Soil moisture conditions dictated planting dates for winter canola in 2016. Adequate soil moisture allowed for early planting in central, west central, and southwest Kansas. In these areas, some canola has become excessively large. This, in combination with warmer-than-normal fall temperatures, puts the crop at increased risk for winterkill, especially if temperatures drop off rapidly and the crop does not have adequate time to winter harden. A slow, gradual cool-down with mild freezes would greatly benefit the crop.

Other areas of Kansas (south central) had adequate to surplus soil moisture this fall for planting. In some cases, planting was delayed because of wet soils and in other cases producers had to replant their crops following heavy rain events. The concern there is that the crop may be too small heading into the winter months. However, the warmer-than-normal temperatures and one-month temperature outlook (Figure 5) give us confidence that the crop will be able to grow sufficiently for overwintering (Figure 6).

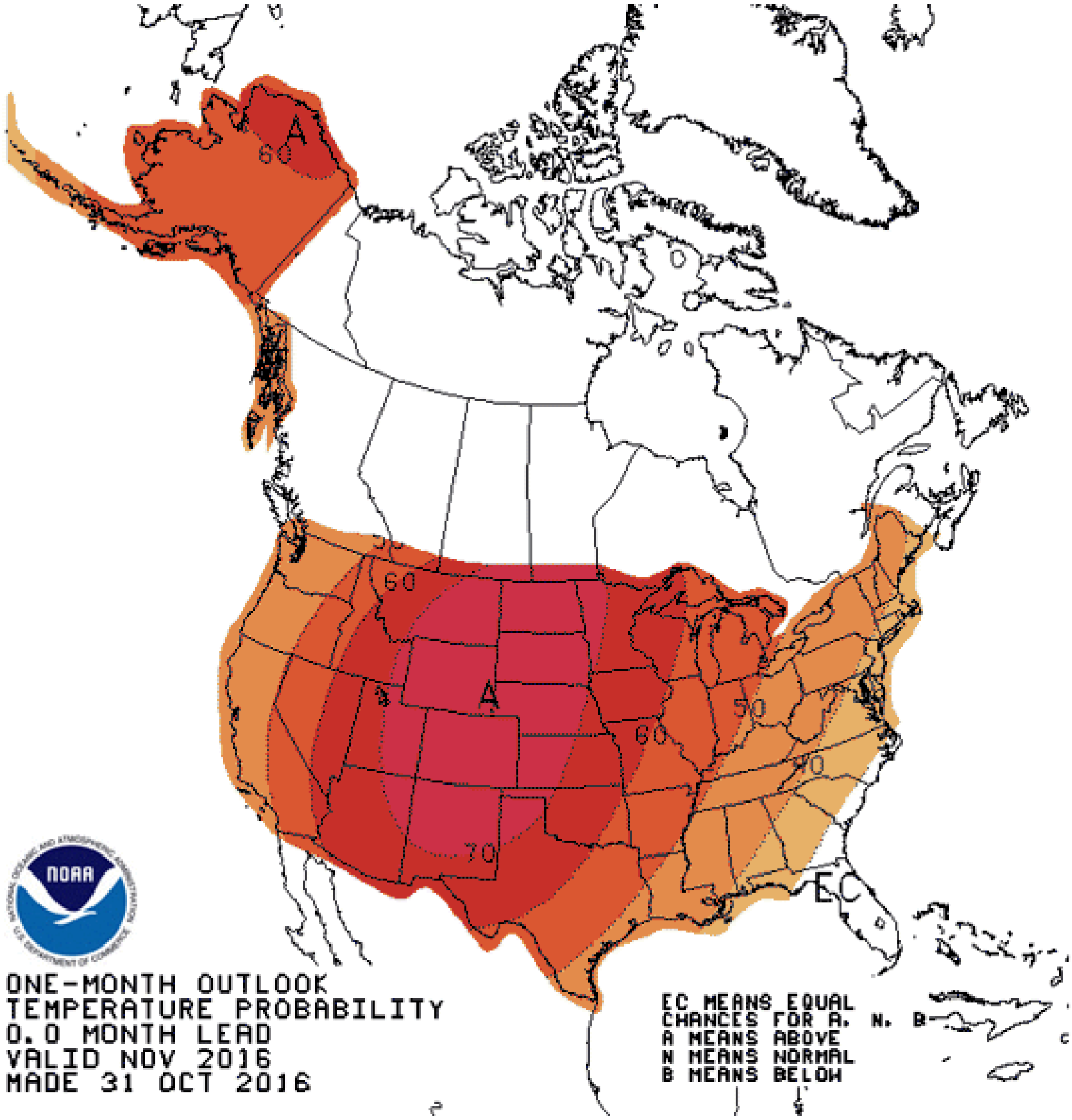


Figure 5. One-month temperature outlook shows warmer-than-normal temperatures are predicted to persist through November.

Figure 6. Late-planted (September 30) winter canola near Manhattan is benefiting from the above-normal fall temperatures in 2016. The bottom picture was taken on Oct. 19 and the top picture was taken on Nov. 2. Photo by Mike Stamm, K-State Research and Extension.

The high and low temperature trends for 2016 are much above normal for Manhattan (Figure 7). Mid- to late-October was very warm with temperatures approaching freezing only one time. Temperatures are trending very similarly to the fall of 2015 when we had a warmer-than-normal fall and winter with little to no winterkill observed in winter canola. A slow decline in temperatures this fall would be ideal for achieving adequate winter hardiness in 2016. This is important as the canola crop should begin to winter harden this time of year. Low temperatures at or below 30 degrees F are essential for winter hardening.

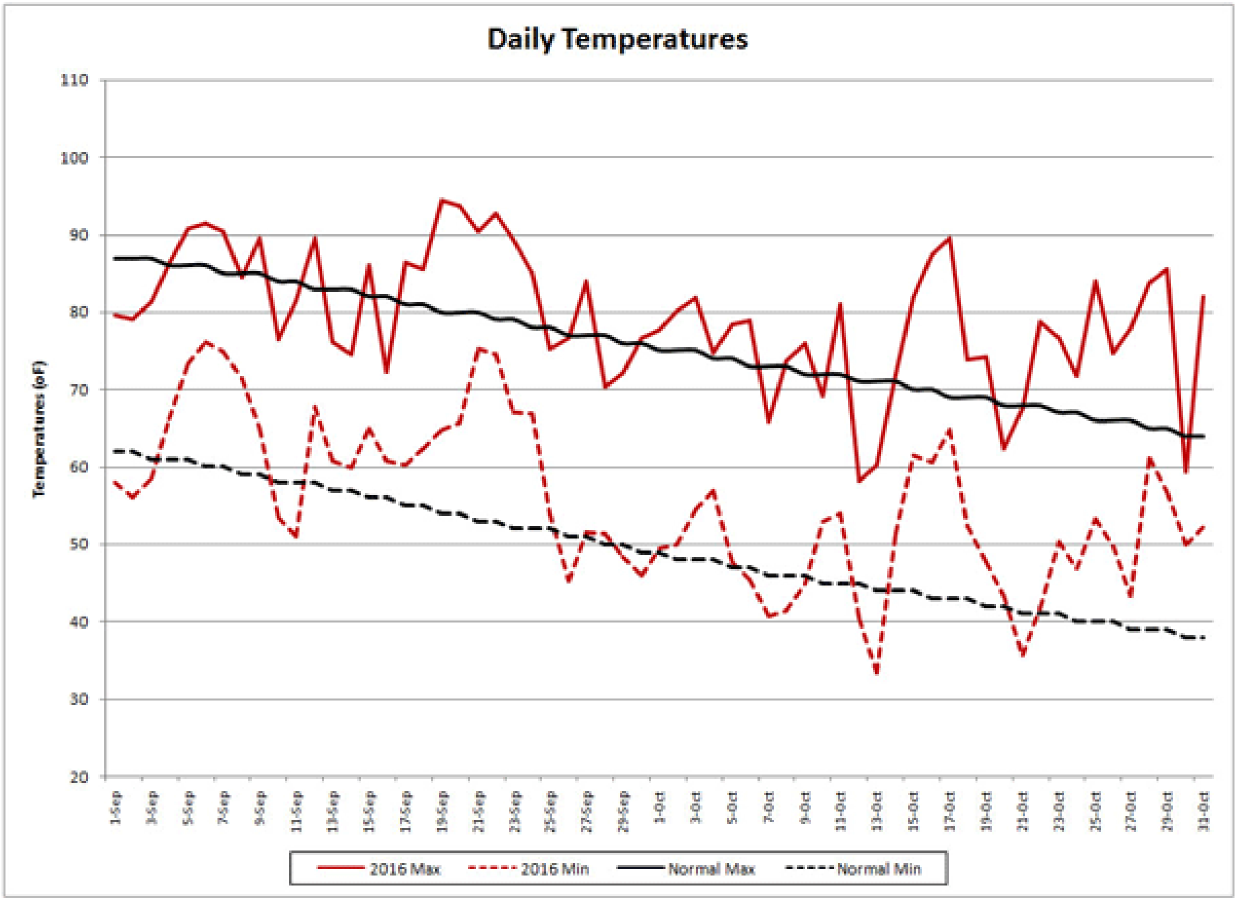


Figure 7. High and low fall temperatures in 2016 at Manhattan. Mid- to Late-October temperatures were very warm. Source: Kansas Mesonet, K-State Weather Data Library.

Varietal differences

Varietal differences exist for traits such as fall vigor, the ability to avoid fall stem elongation, and winter survival. More hybrids are being grown each year, and the industry will one day switch from open-pollinated (OP) varieties to hybrids. Hybrids tend to have quicker establishment in the fall than OP varieties because of hybrid vigor. This is important because it results in rapid plant development for overwintering. However, with hybrids and certain OP varieties, there can be a tradeoff between good fall vigor and too much fall growth, and this usually has to be managed by agronomic practices such as planting date and seeding rate. Planting hybrids later to take advantage of improved vigor may present some challenges in terms of winter survival if weather conditions are not favorable for fall growth.

The K-State canola breeding program has been selecting for lines that avoid fall stem elongation regardless of the planting date or seeding rate. These lines have prostrate fall growth and this often translates into better winter survival. This trait could be especially useful in years when soil moisture conditions are ideal for planting but the calendar indicates it is too early to plant. In addition, we hope to broaden the optimum planting window by planting these lines earlier while avoiding the risks of fall stem elongation and winterkill.

Another tool under development by private industry and being evaluated by the K-State canola breeding program is the semi-dwarfing trait, or low-biomass-producing trait. The semi-dwarfing trait also helps keep the crown closer to the soil surface regardless of planting date or seeding rate. We have seen enhanced winter survival in hybrids that possess this trait.

Figure 8 shows three entries from the National Winter Canola Variety Trial. The stake represents the soil surface while the yellow arrows point to the canola plants' growing points. The hybrid on the left was developed in the European Union (EU) and is exhibiting about 2 to 3 inches of fall stem elongation (or crown elevation). The variety in the center is an experimental line from the K-State canola breeding program, showing no stem elongation. The hybrid on the right possesses the semi-dwarfing trait and it is showing only slight crown elevation. We would expect the hybrid on the left to be more susceptible to winterkill because of the elevated crown.

Figure 8. Varieties exhibiting differences in fall stem elongation in the National Winter Canola Variety Trial. Photo by Mike Stamm, K-State Research and Extension.

Current research

K-State agronomists are investigating production practices to help manage fall vigor and growth. We have studies evaluating seeding rate by variety (OP vs. hybrid) in narrow and wide row spacing (9-in and 30-in). In the first year of the studies, we did not see consistent differences in winter survival among the cultivar by seeding rate interactions because the winter temperatures were warmer than normal. However, in several cases, winter survival was greater with reduced seeding rates, and yield was similar to that achieved with higher seeding rates.

In collaboration with private industry, we are evaluating plant growth regulators and certain fungicides and their ability to help manage fall growth. Using plant growth regulators and fungicides in winter canola is a common practice in the EU. Other questions we want to address through these studies include: How far can we reduce seeding rates and remain profitable? How do varieties respond to different seeding rates? What is the optimum seeding rate for a given row spacing by variety interaction? At what growth stage and what rate do we apply growth regulators to manage fall growth?

Having too much or too little fall growth in winter canola depends on an interaction of the variety chosen, management practices (primarily related to planting date, seeding rate, and row spacing), and the weather. Predicting the weather is challenging enough and this can be stressful on canola producers. Through breeding and production research at K-State, we hope to find improved ways to manage these risks.

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2. Current status of new herbicide-resistant crops

Starting next year, producers may have access to several new crop cultivars with resistance to a wider range of herbicides than has been available until now. These technologies are tools that will help growers combat herbicide-resistant weeds. Here is a brief summary of these new crop cultivars and when they are expected to reach the market.

Inzen grain sorghum. K-State released to sorghum breeding programs a line of grain sorghum that is resistant to ALS herbicides several years ago. DuPont assumed ownership of the technology. Two seed companies signed agreements with DuPont to develop and market "Inzen" hybrids using this technology: Pioneer and Advanta (Alta Seeds). In addition, K-State sorghum breeders have continued to develop excellent Inzen sorghum experimental inbreds that could be used to create high-yielding commercial Inzen sorghum hybrids. DuPont's Zest WDG, a 75% ai dry formulation of nicosulfuron for use on Inzen grain sorghum hybrids, was registered during October 2015. As an ALS grass herbicide, Zest WDG will provide new opportunities for postemergence annual grass weed control. A limited number of Inzen hybrids will be available from Alta Seeds in 2017. Pioneer's first Inzen hybrids likely will be available in 2018.

Enlist corn, soybeans, and cotton. Enlist traits are being developed by Dow AgroSciences. These traits confer resistance to both 2,4-D and aryloxyfenoxypropionate (the "fop" grass herbicides) in corn, and 2,4-D resistance in soybeans and cotton. Dow has developed a new formulation of 2,4-D called 2,4-D choline, which is lower in volatility than 2,4-D amine or ester. Enlist Duo is a premix of 2,4-D choline plus glyphosate. Enlist Duo has been approved for application to Enlist corn and soybean, but is still awaiting approval on Enlist cotton.

Enlist soybean and corn traits have been deregulated by the U.S. Department of Agriculture. However, certain export markets have not been approved yet, so commercial availability of Enlist corn and soybean will be limited until key markets are approved. Enlist cotton likely will be commercially available in 2017 and Enlist corn and soybeans could potentially be available for the 2017 growing season if key export markets are approved. Enlist soybeans and cotton could alleviate concerns about drift onto the crop from adjacent applications of 2,4-D. Enlist cotton and soybeans will be stacked with both glyphosate- and glufosinate-resistant genes as well, which would also allow the use of glyphosate and glufosinate herbicides on those crops.

Xtend soybeans and cotton. Xtend traits are being developed by Monsanto. These traits confer resistance to dicamba herbicide. This would allow direct application of new formulations of dicamba to soybeans and cotton to help address glyphosate-resistant weeds, as well as alleviate concerns about dicamba drift onto Xtend crops.

Monsanto, DuPont, and BASF are developing new formulations of dicamba with lower volatility and drift potential than Clarity, which already has much lower volatility than Banvel. Monsanto will sell a premix of glyphosate and a new formulation of dicamba under the product name of Roundup Xtend. New dicamba formulations will also be available under the product names of XtendiMax from Monsanto, Fexapan from Dupont, and Engenia from BASF.

Like Enlist crops, Xtend crops have been deregulated by USDA and key foreign markets, but dicamba products have not yet been approved by EPA for application to Xtend crops.

DO NOT add AMS to spray mixtures containing any of the dicamba formulations as unacceptable dicamba volatility could result.

Note: Dicamba- and 2,4-D-resistant soybeans and cotton are not cross-resistant, so application of dicamba on Enlist soybeans or cotton or 2,4-D on Xtend soybeans or cotton would still result in severe injury or plant death. As mentioned above, new formulations of dicamba and 2,4-D are being developed with reduced volatility, but spray drift will still be a concern onto susceptible or non-resistant crops.

HPPD-resistant soybeans. GMO soybeans with resistance to the HPPD-inhibiting class of herbicides are in development by both Bayer and Syngenta. No HPPD herbicides are currently available for use in soybeans, so this would provide a new mode of action and allow for greater diversification of weed control options to help manage herbicide-resistant weeds. HPPD-resistant soybeans have been deregulated by USDA, but matching herbicide and export approvals must be in place before the technologies become commercially available.

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3. Grass control management in 2-gene Clearfield wheat

There are several 2-gene Clearfield wheat varieties currently on the market in our geography, including AP503 CL2 from Syngenta/AgriPro, Brawl CL Plus from Colorado State University, and Doublestop CL Plus from Oklahoma State University.

It is important that spray applicators know whether a Clearfield wheat variety is 1-gene or 2-gene since the spray adjuvants that can be used when spraying 2-gene Clearfield varieties with Beyond herbicide can severely injure 1-gene Clearfield varieties. What exactly is the difference between 2-gene and 1-gene Clearfield varieties in terms of how they can be managed, herbicide applications, grass control, and crop injury?

There is no difference in the labeled rates of Beyond that can be applied in a single growing season to 1-gene and 2-gene Clearfield varieties. However, 2-gene Clearfield varieties have expanded application timing and adjuvant options compared to 1-gene Clearfield varieties.

Beyond plus nonionic surfactant can be applied from the 2-leaf to the second joint stages of wheat on 2-gene varieties, but only after tiller initiation until jointing on 1-gene varieties. Beyond plus methylated seed soil can be applied to 2-gene Clearfield varieties after tiller initiation until the jointing stages of wheat, but methylated seed oil cannot be used with Beyond at any time on 1-gene varieties. In all cases, a nitrogen-based fertilizer such as AMS or 28 percent UAN should also be added to the spray solution.

The adjuvant can make a significant difference in the level of feral rye and downy brome control with Beyond, especially with spring treatments. Since cheat, Japanese brome, and jointed goatgrass are usually quite susceptible to Beyond, the adjuvant usually does not make as much difference in the level of control of these grasses. Research at K-State near Manhattan illustrates the effect.

Winter Annual Grass Control and Crop Response in 2-gene Clearfield Wheat

Treatment	Application rate (oz/acre)	Application timing	Wheat injury (%)	Japanese brome control (%)	Downy brome control (%)	Rye control (%)
Beyond + NIS + AMS	4	Fall	0	100	99	95
Beyond + MSO + AMS	4	Fall	0	100	99	100
Beyond + MSO + AMS	6	Fall	0	100	100	100
Beyond + MSO + AMS	12 (2x)	Fall	0	100	100	100
Beyond + NIS + AMS	4	Spring	0	98	75	57

Beyond + MSO + AMS	4	Spring	0	99	82	78
Beyond + MSO + AMS	6	Spring	0	100	91	93
Beyond + MSO + AMS	12 (2x)	Spring	0	100	97	100
LSD (0.05)			NS	NS	4	11

Note: The maximum single application use rate of Beyond is 6 oz/acre. The 12 oz/acre rate would simulate spray overlaps in the field and is not a labeled broadcast application rate.

For spring applications of Beyond, including MSO as an adjuvant measurably improved control of downy brome and feral rye compared to using NIS as the adjuvant. But as mentioned above, Beyond with MSO can only be used on 2-gene Clearfield varieties. MSO has been more effective than COC in these situations.

Beyond is labeled for control of many winter annual grasses (including jointed goatgrass, cheat, downy brome, and Japanese brome), but only suppression of feral rye. Control of feral rye with Beyond in K-State tests has been somewhat erratic and unpredictable. The best control will likely be achieved with fall applications, using the 6 oz rate instead of the 4 oz rate, and using MSO instead of NIS where that is allowed. In general, the best control of feral rye in 1-gene Clearfield varieties has been with fall applications. With 2-gene Clearfield varieties, producers have more options for better rye control.

The other advantage of 2-gene Clearfield over 1-gene Clearfield wheat varieties is in the higher degree of crop safety from applications of Beyond. Occasionally, Beyond has caused some crop injury to 1-gene Clearfield wheat. This occurs most often where there is spray overlap (2x rates), when stress conditions prevail, or where wheat was not at the recommended treatment stages at the time of application. In K-State tests, 2-gene Clearfield wheat varieties have demonstrated much less potential for crop injury than 1-gene varieties in these situations.

Photo by Dallas Peterson, K-State Research and Extension.

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4. Cover Crop Road Show planned Nov. 17 in southwest Kansas

Producers can get an up-close look and discussion about cover crops in several southwest Kansas settings at K-State Research and Extension's Cover Crop Road Show, Thursday, Nov. 17. The U.S. Department of Agriculture-Natural Resource Conservation Service is the tour's co-sponsor.

The tour starts near Jetmore at the Brit Hayes Farm and ends with lunch and discussion in Ford.

The goal of the program is to foster dialogue between producers, university researchers and specialists, government officials, and industry.

The schedule includes:

8:30-9 a.m. - Registration – Brit Hayes Farm, 22918 N. Hwy 156, Jetmore.

9-10 a.m. – Cover Crops in a Cow-Calf System, including Q&A and presentation on cover crop choices – Brit Hayes Farm.

10:30-11:30 a.m. – Cover Crops in a Stocker System, including Q&A and presentation on maximizing the benefit of cover crops – Dennis Bradford Farm, 28326 S.E. D. Rd., Jetmore.

Noon-1 p.m. – Grazing Cover Crops, including a Q&A and presentation on the multiple reasons for using cover crops – 128 Rd. & Warrior Rd., Bucklin.

1-2 p.m. – Lunch and discussion – The Blue Hereford, 807 Main, Ford.

Participants are asked to register by Nov. 11 at www.southwest.k-state.edu or contact Norma Cantu at cantu@ksu.edu or 620-275-9164.

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5. K-State Crop Production Schools scheduled for 2017

Ten K-State Crop Production Schools will be offered from early January to early February 2017 across the entire state. Each school will provide in-depth training targeted for corn, soybean, or sorghum producers.

The one-day schools will cover several current crop-related topics relevant to corn, soybean, and sorghum producers in Kansas.

Winter Crop Schools - Schedule

2017 Corn Schools

Kansas State University Department of Agronomy | Kansas Corn Commission

- Monday Jan. 9, Wichita.
- Wednesday Jan. 11, Oakley.
- Friday Jan. 13, Olathe.

2017 Soybean Schools

Kansas State University Department of Agronomy | Kansas Soybean Commission

- Tuesday Jan. 24, Parsons.
- Thursday Jan. 26, Newton.
- Friday Jan. 27, Highland.

2017 Sorghum Schools

Kansas State University Department of Agronomy | Kansas Grain Sorghum Commission

- Tuesday Jan. 31, Colby.
- Wednesday Feb. 1, Wichita.
- Thursday Feb. 2, Concordia.
- Friday Feb. 3, Iola.

Further details on the final agenda (speakers/topics), schedule, registration, and contact information for each Crop School will be available in the coming weeks.

Stay tuned for more information on all Crop Schools!

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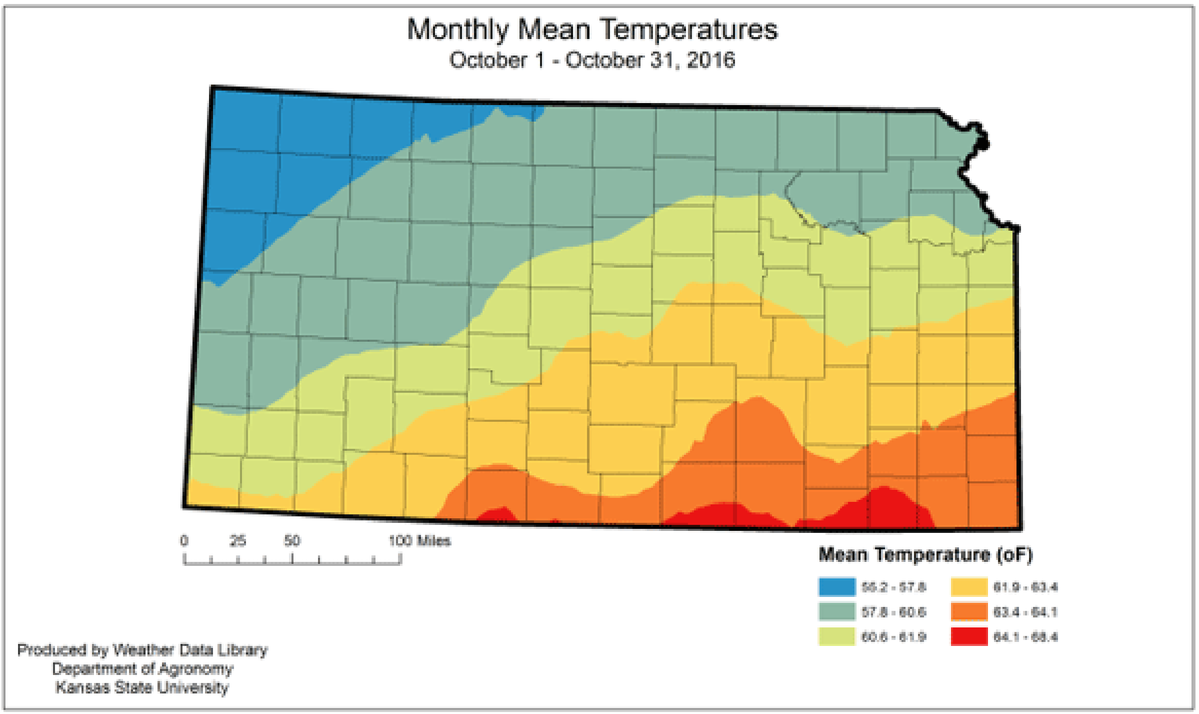
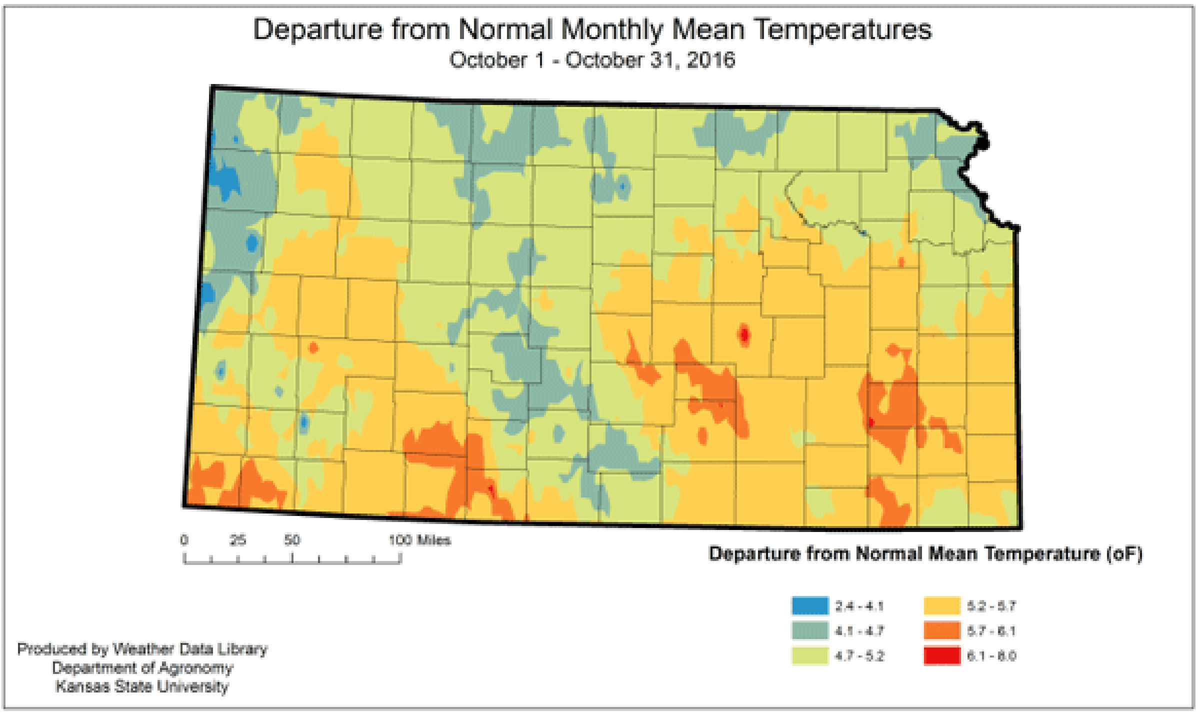
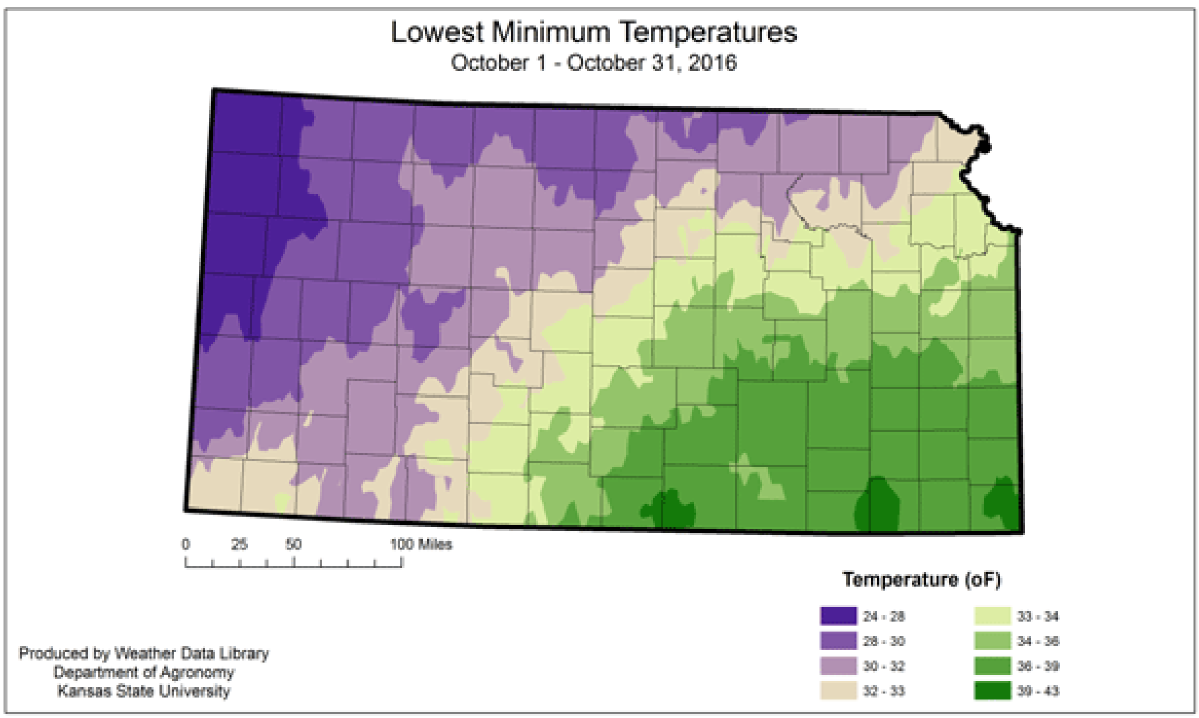
6. Kansas weather summary for October: Record warmth

Temperatures in Kansas continued the warmer=-than-normal pattern through much of October. The statewide average temperature was 60.9 oF, or 5.6 degrees warmer than normal. This was the 8th warmest since 1896. The Northeast Division was closest to normal for the month. Its average was 59.8 oF, or 4.8 degrees warmer than normal. The division with the greatest departure was the Southwest Division where the average temperature was 62.3 oF or 6.7 degrees warmer than normal. There were 102 new daily record high temperatures set in the month; of those, 12 set new record highs for October. Ashland, in Clark County, had the highest reading for the month, with 102 oF reported on both the 17th and the 18th. In contrast, there were no new record low maximum temperatures or minimum temperatures set. There were 58 new record warm minimum temperatures set. The coldest temperature recorded for the month was 25 oF at Brewster 4W, Thomas County, on the 8th and Tribune 1W, Greeley County, on the 7th.

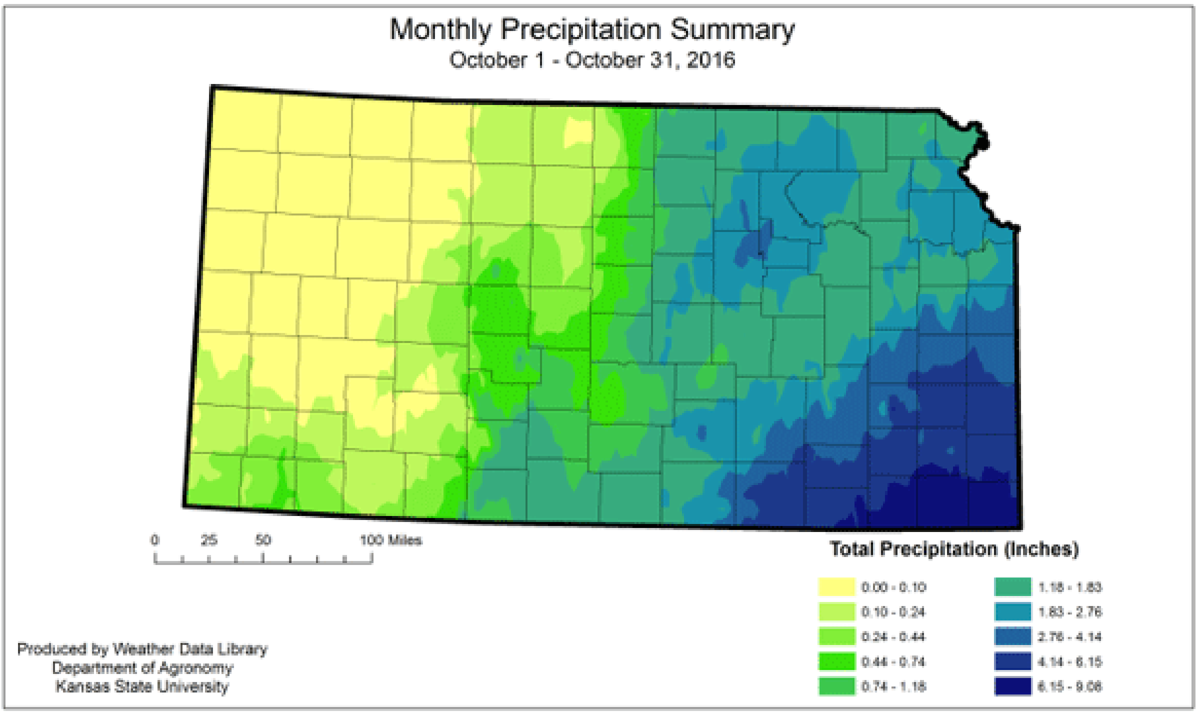


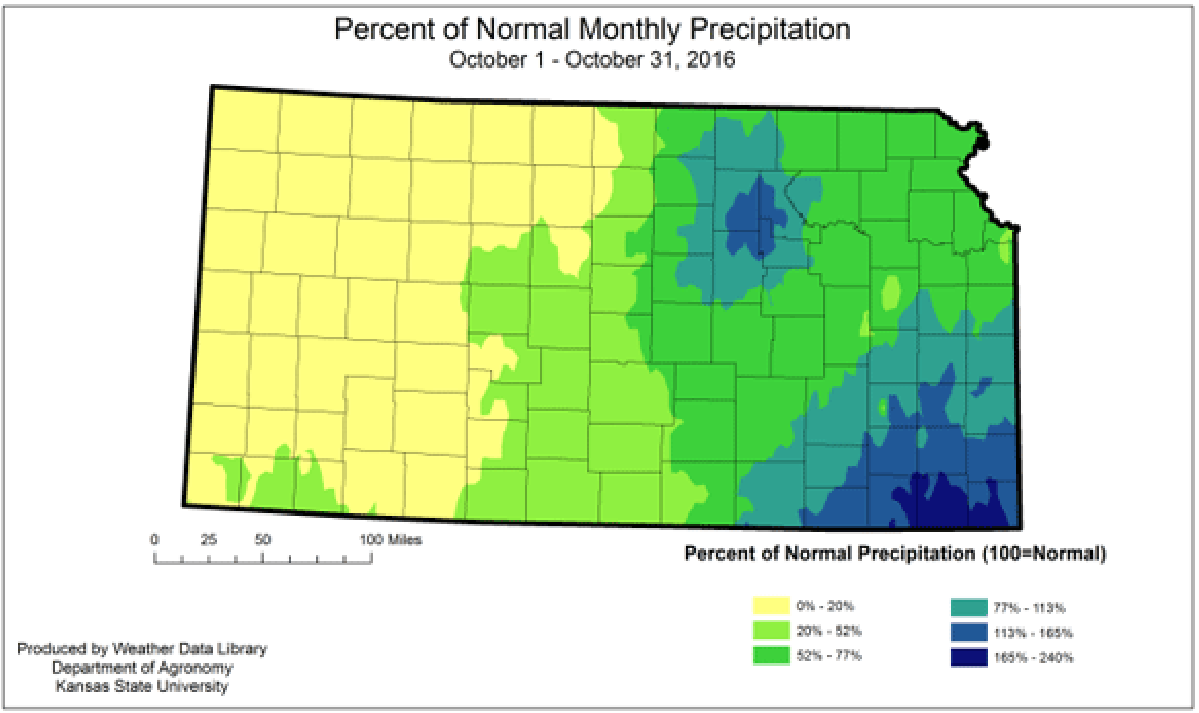


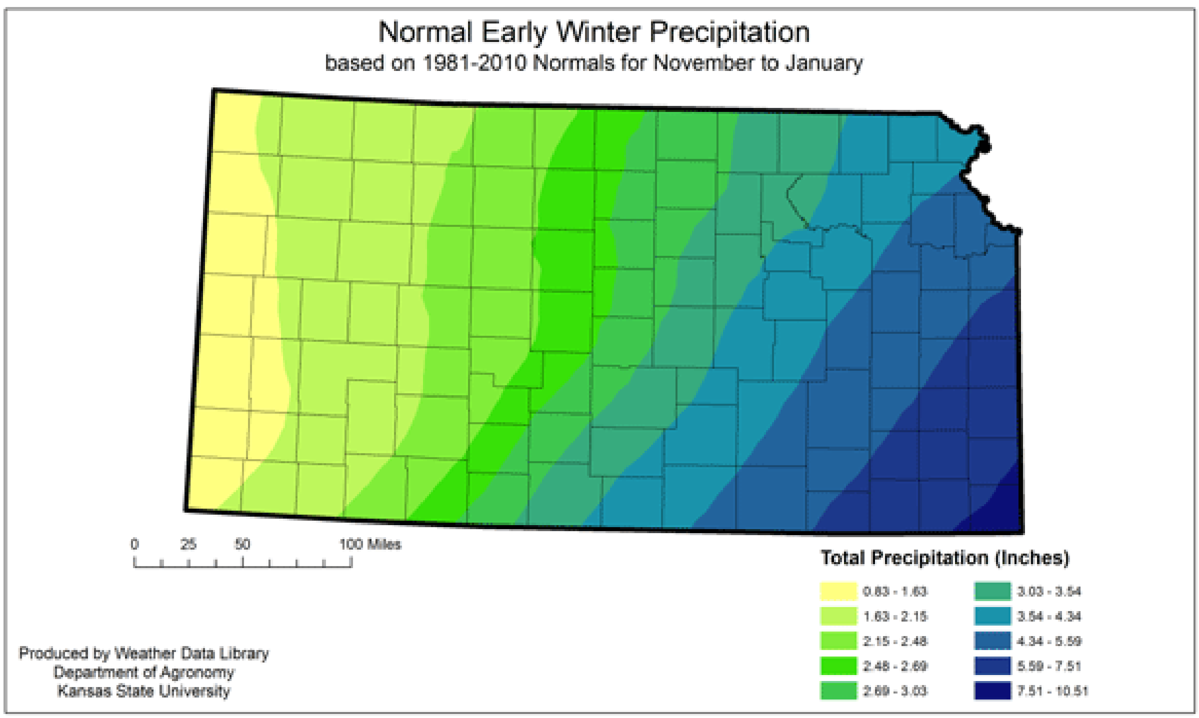


Statewide average rainfall for October was well below normal; however the distribution was quite skewed. The statewide average was 1.35 inches or 45 percent of normal. The western three divisions all averaged less than 10 percent of the normal October precipitation. The Northwest Division missed out on most of the rainfall. The divisional average was just 0.02 inches, or one percent of normal. The Southwest Division was the wettest of the western areas, and averaged just 0.14 inches of precipitation. That is just 9 percent of normal. In contrast, the Southeastern Division averaged 4.50

inches or 120 percent of normal. This October ranks as the 34th driest in the 122 years of record. The wettest October on record occurred in 1941, when the statewide average total was 5.99 inches. The driest October occurred in 1973 when the statewide average was just 0.02 inches. Despite the dry pattern there were 35 new record daily rainfall totals. The greatest 24-hour total recorded at a CoCoRaHS station was 6.69 inches at Beaumont 6.6 SSW, Butler County, on the 7th. The greatest 24-hour report for a National Weather Service station was 6.44 inches at Parsons Tri City AP, Labette County, on the 6th. The greatest monthly totals: 9.91 inches at Independence, Montgomery County (NWS) and 7.27 inches at Beaumont 6.6 SSW, Butler County (CoCoRaHS)

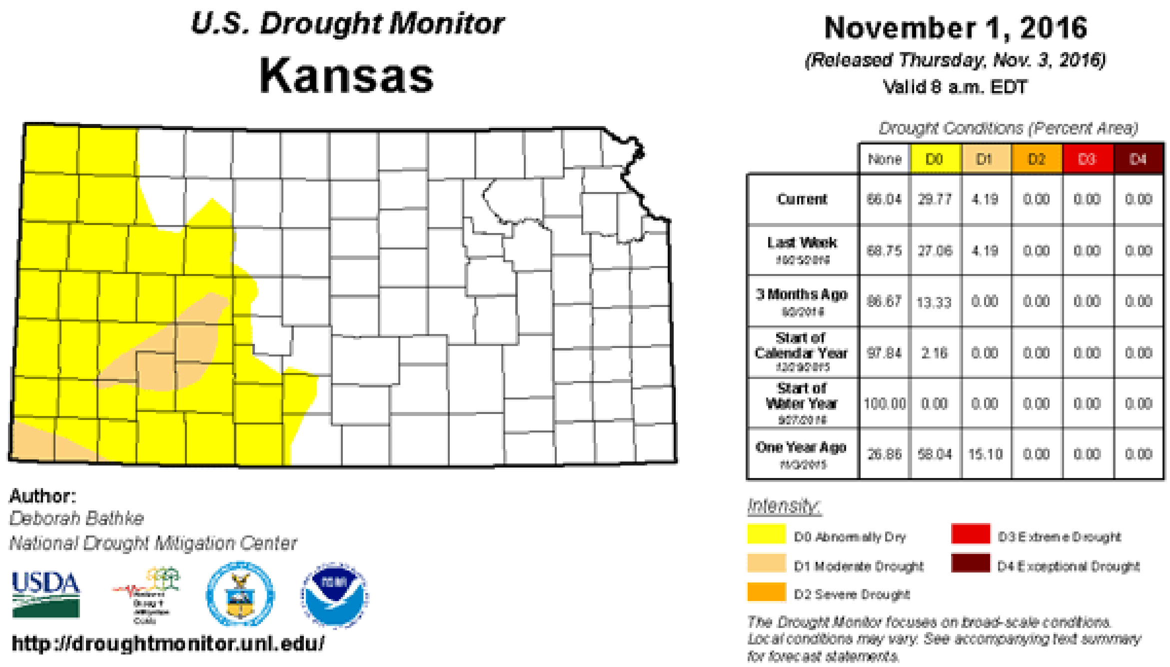






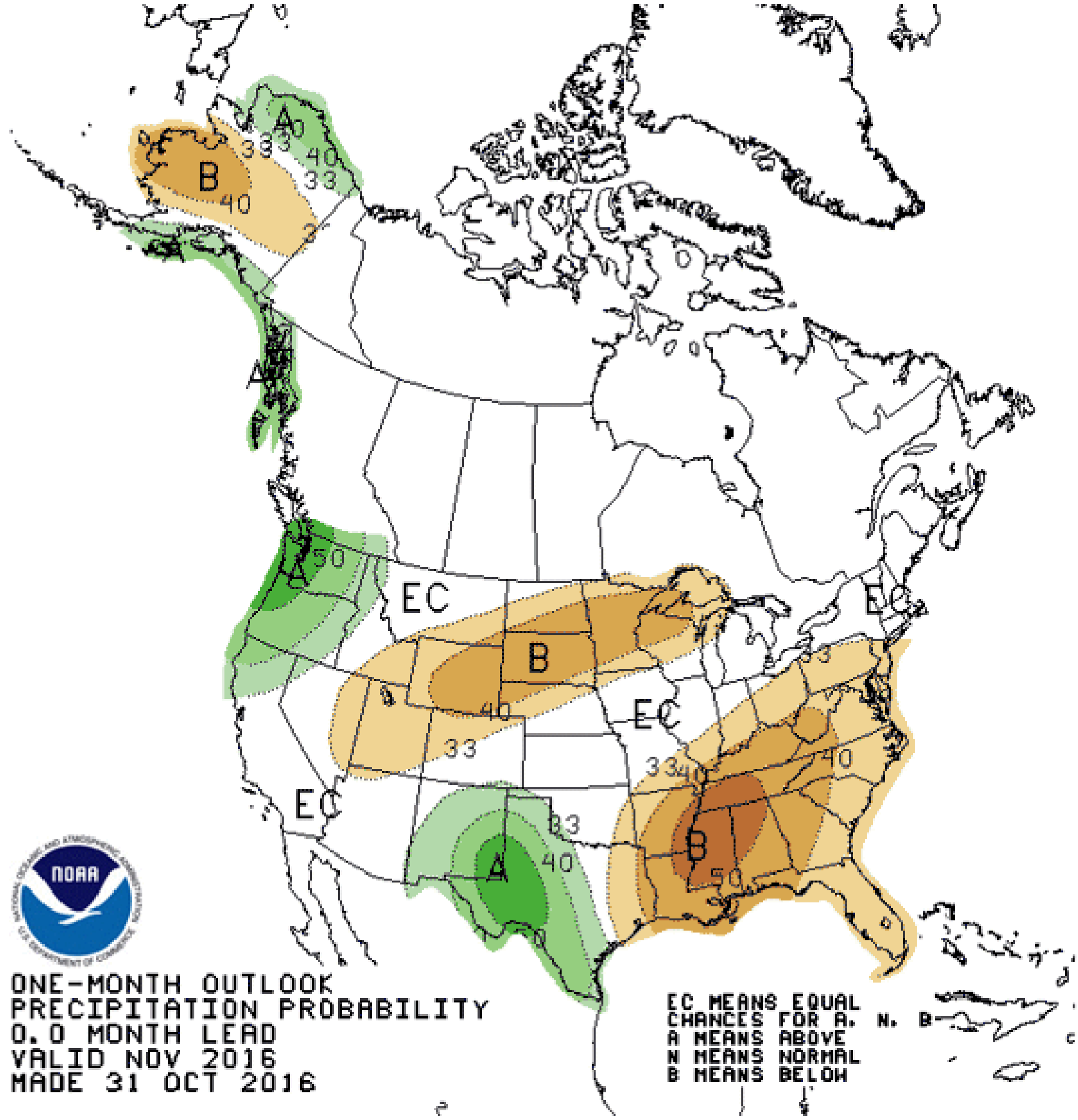
Severe weather was also a factor with an unusual tornado outbreak on the 7th of October. There were 16 tornadoes reported during the event, with storms in Allen, Clay, Cowley, Dickinson, and Labette counties. Fortunately there were no deaths or injuries reported with the storms. There were a total of 33 hail reports and 17 damaging wind reports in the month.

Above-normal temperatures coupled with below-normal precipitation resulted in the return of moderate drought in southwest Kansas, with an expansion of abnormally dry conditions across much of the western divisions. The continued dry pattern, coupled with the outlook for warmer-than-normal conditions in November, is likely to result in further expansion of both categories.



Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	66.04	29.77	4.19	0.00	0.00	0.00
Last Week 10/25/2016	68.75	27.06	4.19	0.00	0.00	0.00
3 Months Ago 8/2/2016	86.67	13.33	0.00	0.00	0.00	0.00
Start of Calendar Year 12/29/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 11/3/2015	26.86	58.04	15.10	0.00	0.00	0.00



Oct 2016

Kansas Climate Division Summary

	Precipitation (inches)						Temperature (°F)		
	Oct 2016			2016 Jan through Oct					Mo
Division	**Total**	**Dep.** [1]	**% Normal**	**Total**	**Dep.** [1]	**% Normal**	**Ave**	**Dep.** [1]	**Ma**
Northwest	0.02	-1.52	1	19.39	-0.61	96	57.5	5.7	94

West Central	0.09	-1.35	5	18.73	-0.66	95	59.1	5.9	98
Southwest	0.14	-1.35	9	19.93	1.32	106	62.3	6.7	10
North Central	0.92	-1.03	43	29.81	3.86	115	59.8	5.1	91
Central	1.38	-0.72	62	30.13	2.95	110	61.6	5.6	95
South Central	1.30	-1.30	48	34.20	5.43	117	63.4	6.2	10
Northeast	1.55	-1.14	57	33.89	1.82	105	59.8	4.8	90
East Central	1.91	-1.15	61	35.03	0.59	100	61.3	5.3	89
Southeast	4.50	0.87	120	41.74	4.56	112	63.2	5.8	89
STATE	1.35	-0.94	45	29.32	2.33	106	60.9	5.7	10

1. Departure from 1981-2010 normal value

2. State Highest temperature: 102 oF at Ashland, Clark County, on the 17th.

3. State Lowest temperature: 25 oF at Brewster 4W, Thomas County, on the 8th and Tribune 1W, Greeley County, on th

4. Greatest 24hr: 6.44 inches at Parsons Tri City AP, Labette County, on the 6th (NWS); 6.69 inches at Beaumont 6.6 SSW
on the 7th (CoCoRaHS).

Source: KSU Weather Data Library

Mary Knapp, Weather Data Library
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7. Comparative Vegetation Condition Report: October 25 - 31

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:

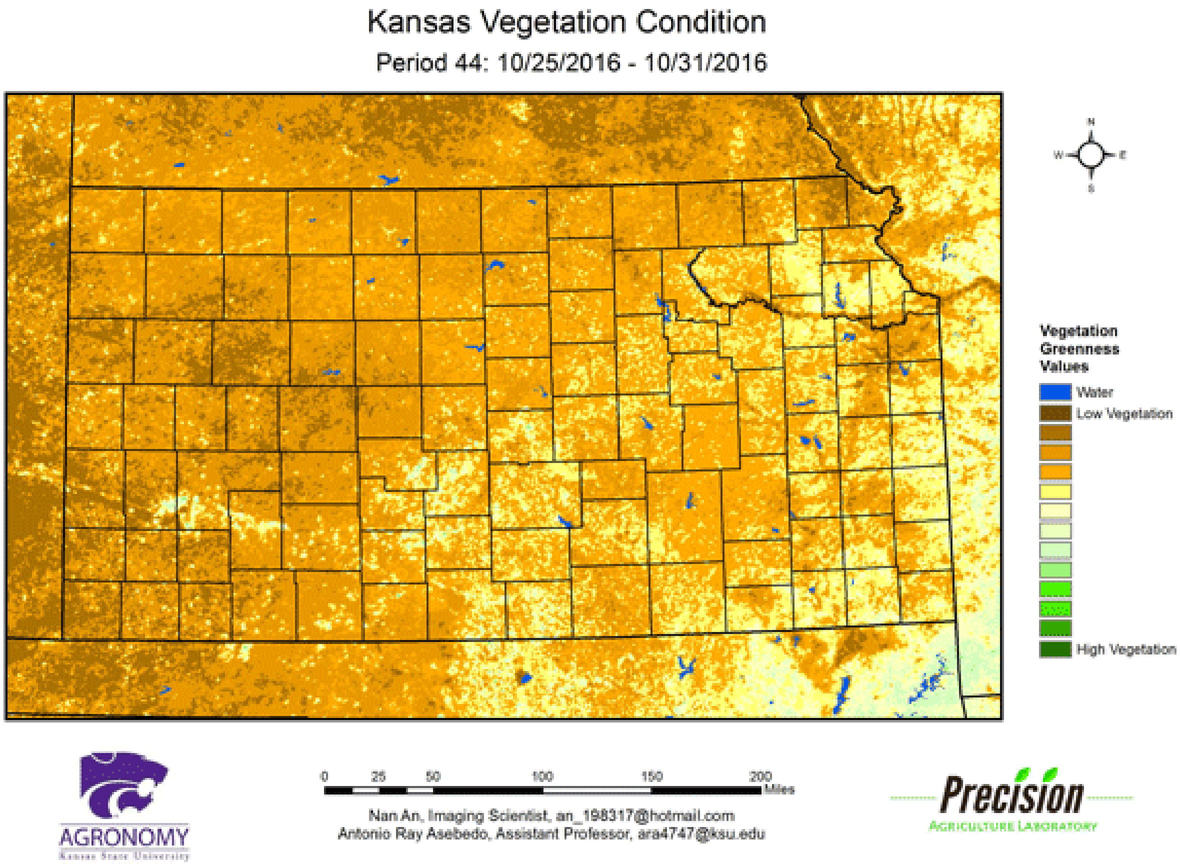

Figure 1. The Vegetation Condition Report for Kansas for October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows only light photosynthetic activity continues to be limited, with the highest NDVI values in the Arkansas River basin where irrigated alfalfa is common.

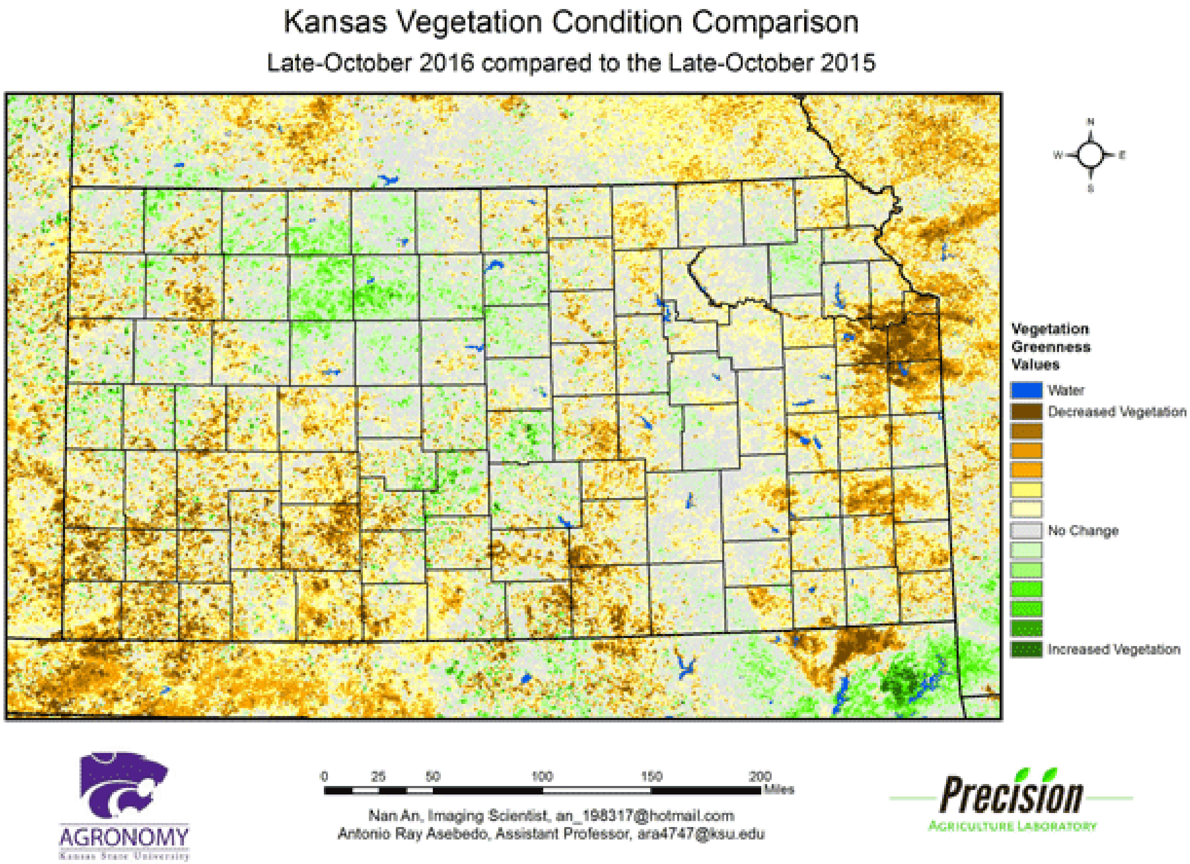

Figure 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows the largest area of higher vegetative activity is in north central Kansas. Pockets of delayed maturity and favorable rainfall continue to be the major contributors to this higher vegetative activity. Expanding drought conditions and the slow establishment of winter wheat in the Southwest into the South Central Divisions is visible as reduced NDVI values there. The low NDVI values in east central Kansas are due to persistent cloud cover.

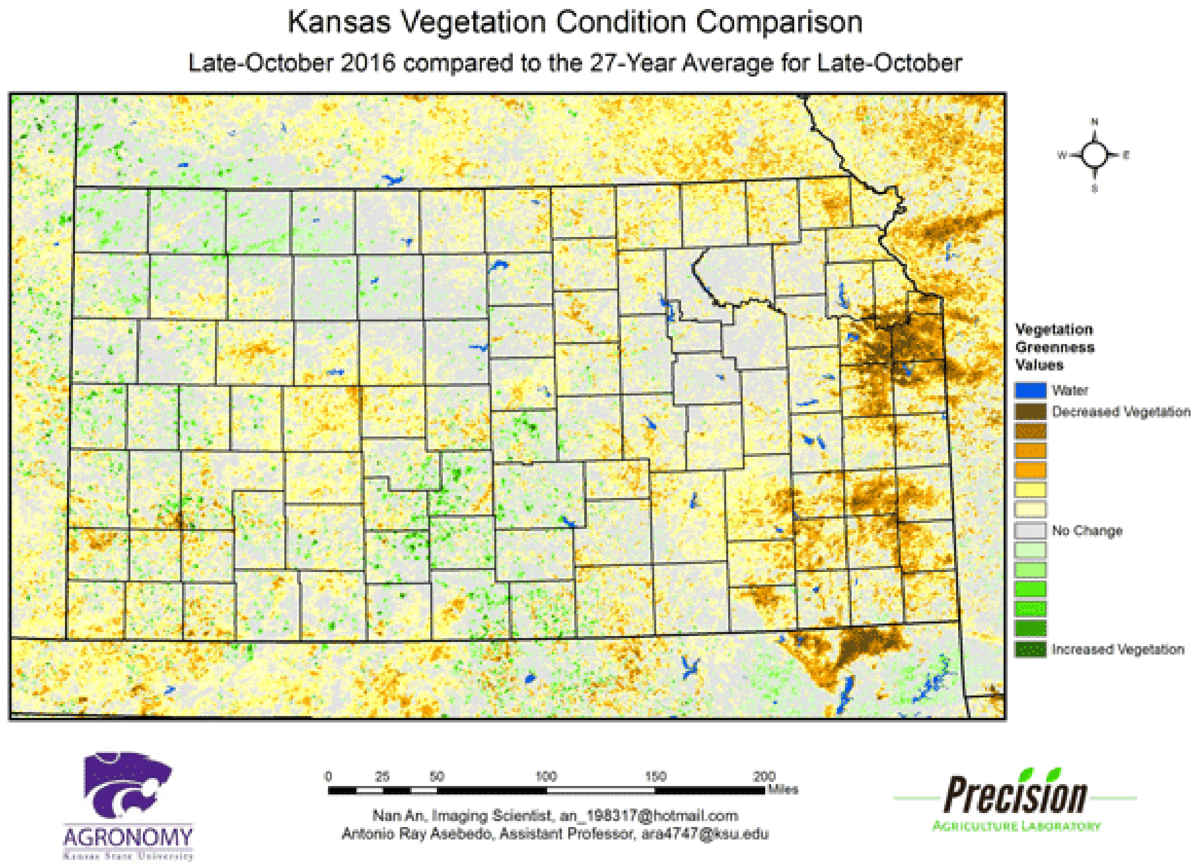

Figure 3. Compared to the 27-year average at this time for Kansas, this year's Vegetation Condition Report for October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows much of the state has close to average vegetative activity. Below-average values are visible in western Kansas, as abnormally dry conditions continue to expand eastward. The very low NDVI values in extreme eastern Kansas, however, are due to persistent cloud cover in the region.

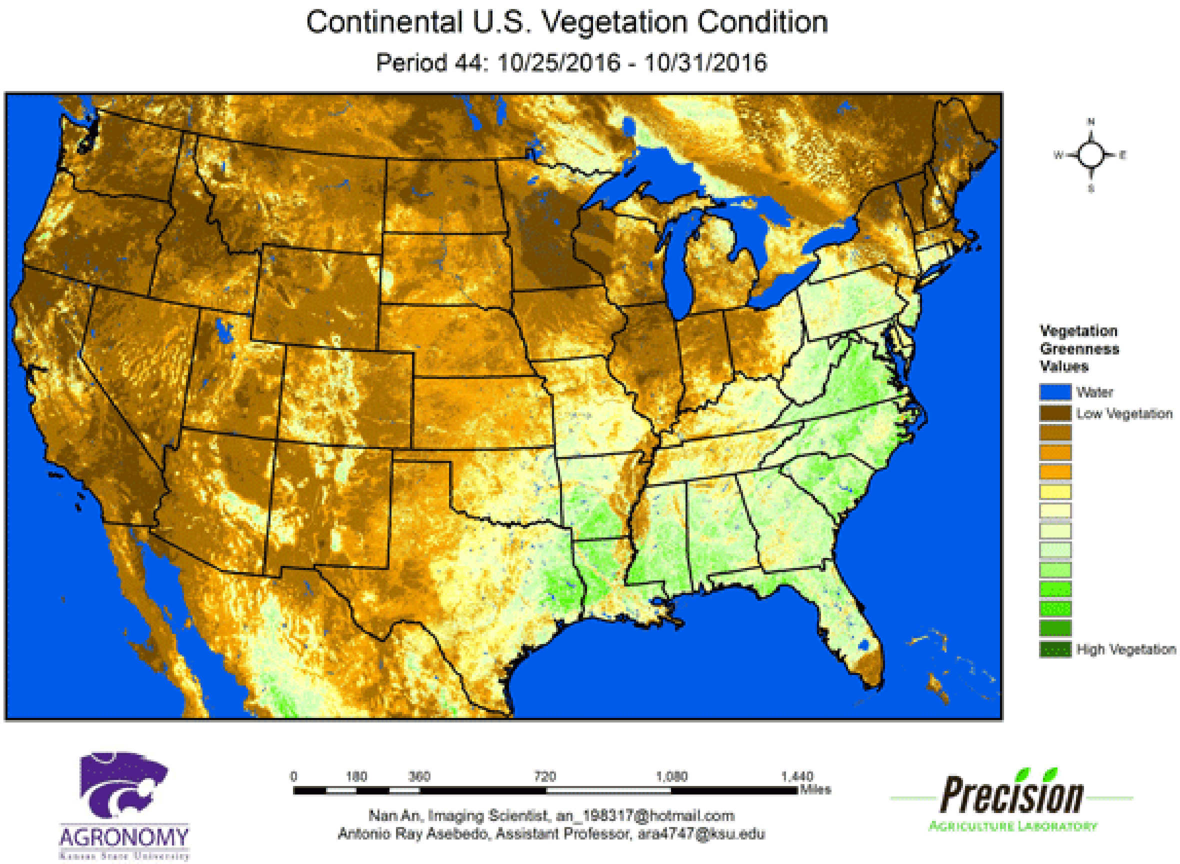

Figure 4. The Vegetation Condition Report for the U.S for October 25 – October 314, 2016 from K-State's Precision Agriculture Laboratory shows an area of high NDVI values in the Southeast as mild temperatures extend the growing season. Low NDVI values are visible in the Corn Belt and along the Mississippi River Valley, where crop maturity is ahead of average.

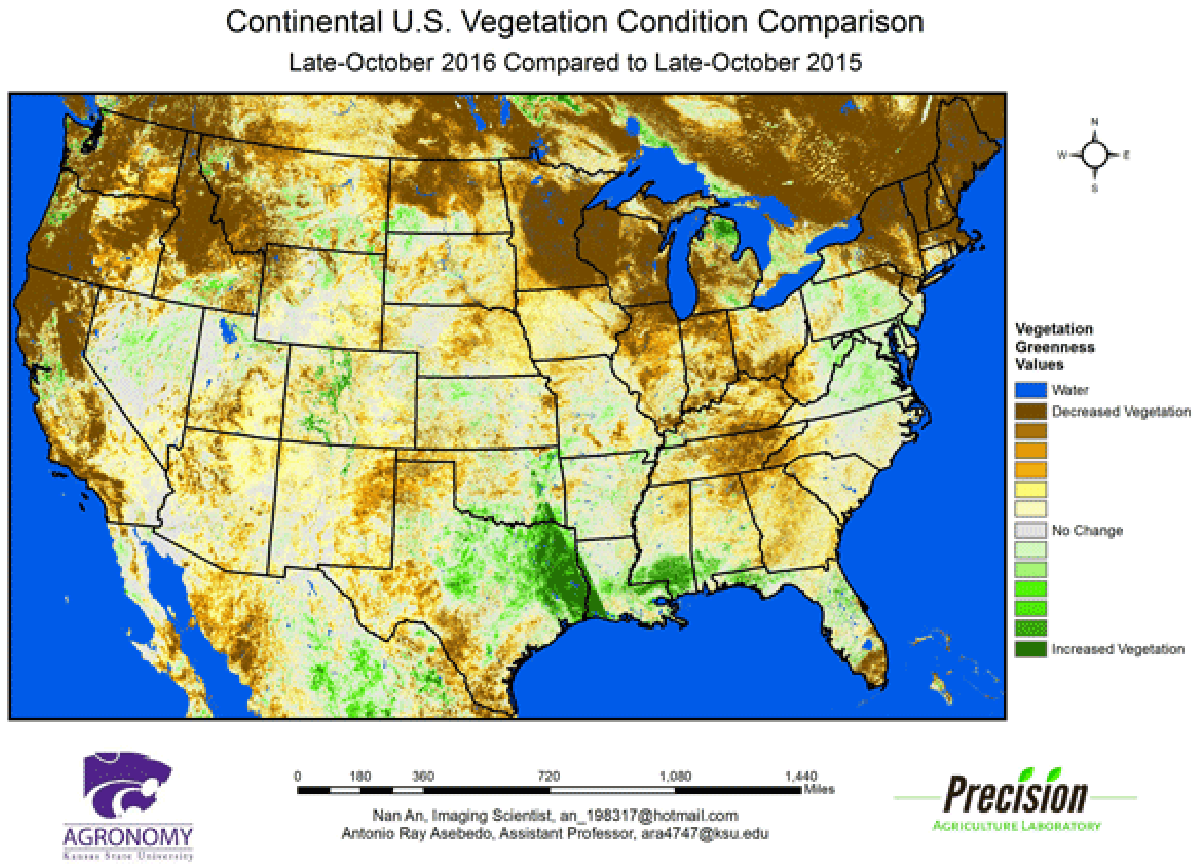

Figure 5. The U.S. comparison to last year at this time for October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows that higher NDVI values in the Southern Plains where warmer-than-normal temperatures continue to be an issue. In the Southeast, NDVI values are lower as this region missed out on the recent tropical systems and drought continues to intensify. The much lower NDVI values in the along the Canadian border are due to persistent cloud cover.

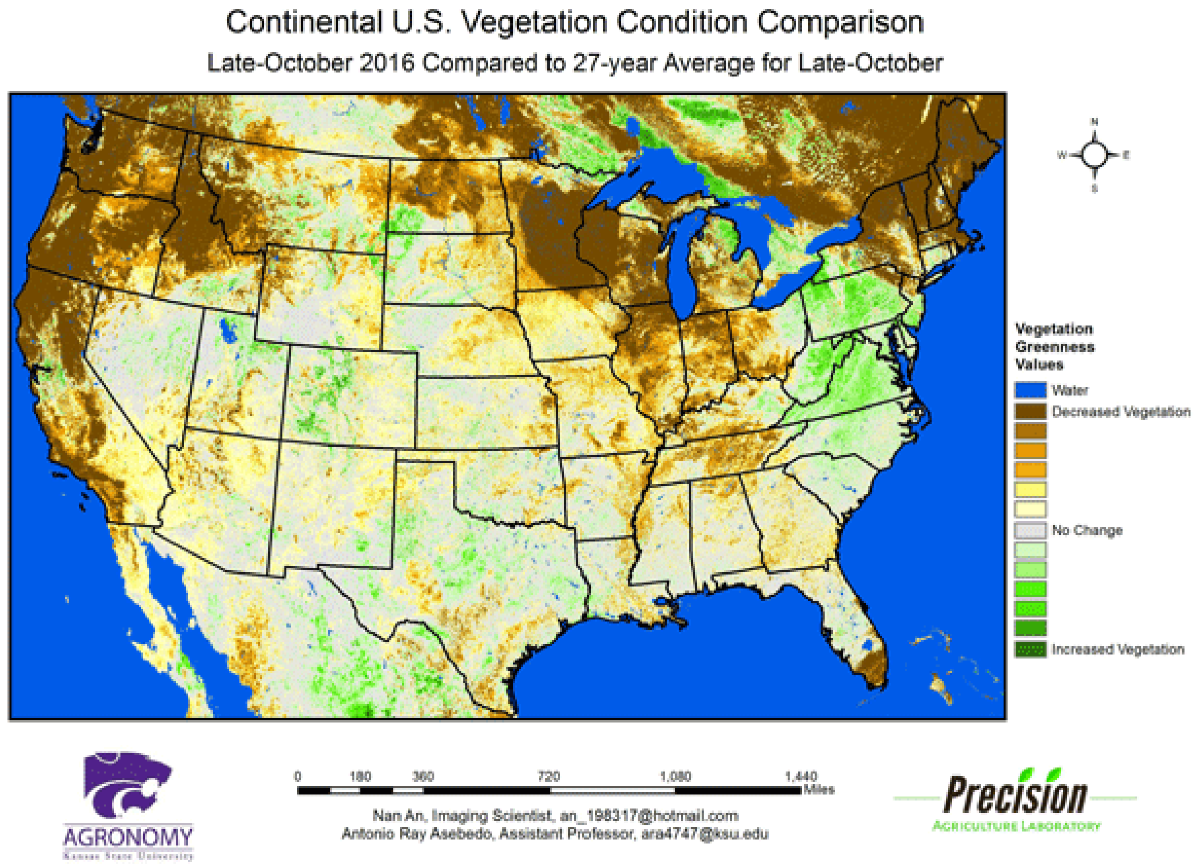

Figure 6. The U.S. comparison to the 27-year average for the period October 25 – October 31, 2016 from K-State's Precision Agriculture Laboratory shows below-average photosynthetic activity in the Pacific Northwest and into the Great Lakes. Persistent rains and cloud cover are the major factors in this area. The South continues to have persistent drought conditions, but as photosynthetic activity is typically reduced in that region during this period, the low NDVI values due to the drought are not especially lower than the long-term average. In other seasons, the low NDVI values caused by the drought would show on the map as an area of below-average activity.

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