



K-STATE
Research and Extension

Extension Agronomy

eUpdate

12/09/2016

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. Wheat growth and development this fall in Kansas

Some regions of Kansas had a very good start to the 2016-17 wheat growing season, establishing a good stand at the optimum sowing date. These conditions were experienced in most of central, north central, and northwest Kansas. While northwest Kansas wheat is already experiencing some level of drought stress, most fields in central and north central Kansas are still in very good conditions. In the following article, I'll discuss some of the major concerns that other regions of the state are currently facing.

Dry fall, poor emergence, and lack of secondary root development

The dry conditions prevailing in a large portion of the Kansas wheat growing region (Figure 1) has impacted secondary root development in many fields across the state. This is particularly prevalent in the southwest portion of the state, where drought has been established for months, current conditions are severe.

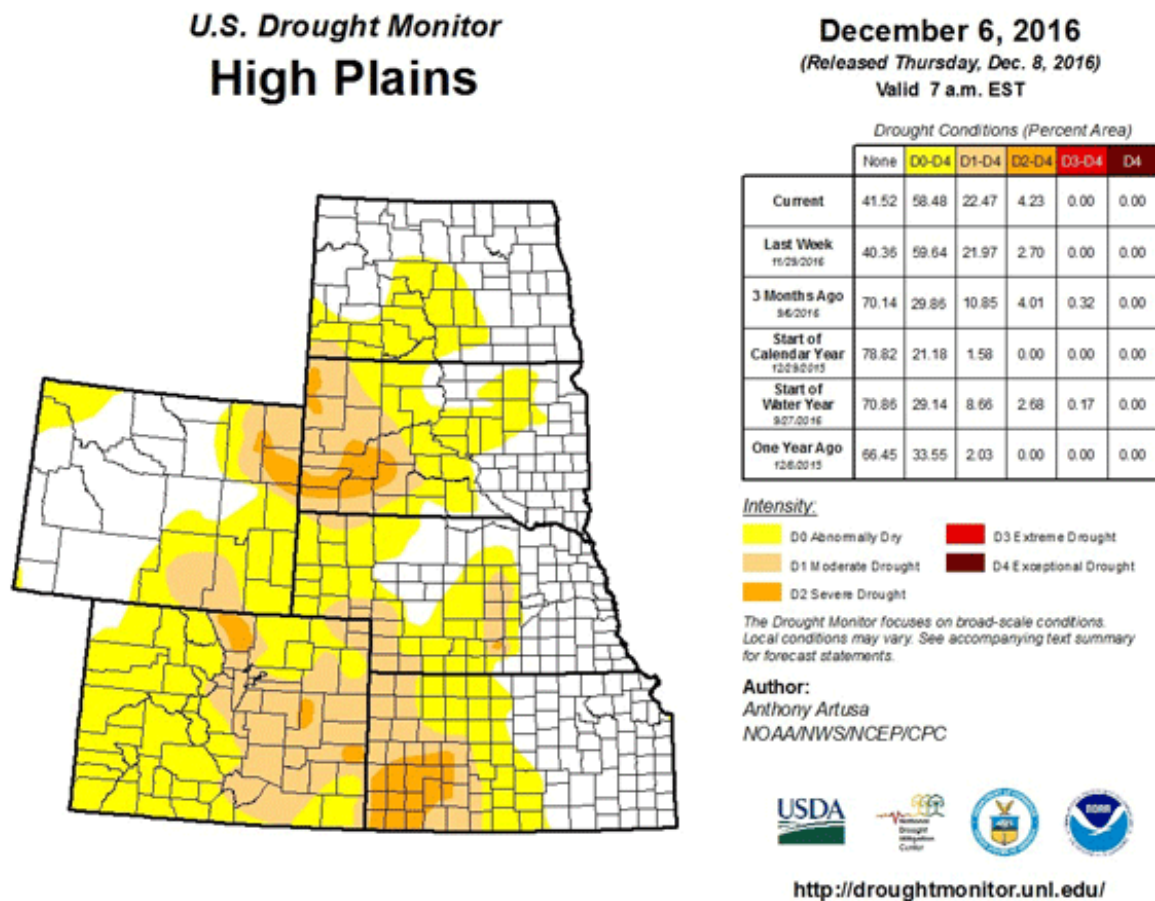


Figure 1. U.S. Drought monitor indication that most of the western half of Kansas is experiencing some level of drought stress. Southwest Kansas is the region where drought is more prevalent. Source: <http://droughtmonitor.unl.edu/>

The severe drought experienced in the southwest has impaired wheat germination and emergence in many fields. As a consequence, stands are erratic, with less than 40-50% of targeted plants per acre in many fields southwest from Finney Co. One example is shown in Figure 2 from a field around Garden City. Producers have a few options in this situation. If the seed has not started to germinate until now, chances are that they are still viable and might germinate and emerge in the spring if moisture conditions allow. Producers can then re-evaluate the conditions and consider whether to maintain the crop. It is important to realize that spring-emerged winter wheat has a much lower yield potential than fall-emerged crops, so producers have the option to consider the economic return of going with an alternative spring-planted crop (depending on any possible residual carryover concerns from herbicides applied to wheat).



Figure 2. Research plots around Garden City showing very scattered emergence. Many fields in southwest Kansas are facing similar conditions. Photo courtesy of A.J. Foster, K-State Research and Extension.

In contrast to the harsh conditions in the far southwest, fields in the west central and northwest portions of the state overall had very good emergence and stand establishment, in many cases better than last year. Still, the lack of precipitation after the crop emerged has led to a different problem: the lack of secondary root development. Figure 3 is a courtesy of Horton Seed Services,

wheat producers around Leoti. This photo indicates that although the field looks uniform and with an excellent top growth, the secondary root development is very limited. Some fields in the south central portion of the state are also showing poor secondary root development, which is a concern for the crop's winterhardiness. The lack of crown root development is due to dry topsoils. A wheat plant should ideally have a well-developed crown root system by now to help prepare it to survive the winter. Crown roots take up most of the water and nutrients from the soil, so they are very important for the plant to survive the winter.



Figure 3. Wheat field with good topgrowth but restricted secondary rooting system. Photo by Rick Horton, Horton Seed Services, Leoti, KS.

Late planted wheat following a summer crop, or delayed by October moisture

In most regions of Kansas, wheat is part of a rotation with other crops. Double-cropped wheat sown after soybeans are sown after the optimum window and will be delayed in development as compared to wheat sown at an optimal date. Many fields in central and north central Kansas fall into this category, especially with the moist 2016 summer prolonging soybean maturity in many parts of the state. In these systems, it was not uncommon for producers to sow wheat after the first of November, which might not have provided the crop enough time to tiller during the fall.

Similar situations occurred in many fields in south central Kansas, but for a different reason. Early October brought several rainfall events to south central Kansas, delaying several producers in getting their crop planted. Many producers who generally aim to have finished sowing by October 10th were still sowing wheat towards the late portion of the month in south central Kansas this year, delaying wheat development and tiller formation. Wheat needs at least 4-5 leaves and 1-2 tillers prior to winter dormancy for maximum cold tolerance. Wheat that has fewer tillers and leaves will be more susceptible to winter kill (Figure 4).



Figure 4. Differences in wheat growth and development as affected by planting date. Wheat planted late October showing no primary tillers, while wheat planted early October has started

to tiller. Both crops still need significant fall growth to properly prepare for winter dormancy. Photo taken at the North Agronomy Farm, Manhattan, by Romulo Lollato, K-State Research and Extension.

What to look for?

Producers can assess the status of their wheat crop going into the winter in a few different ways. One important way is looking at the topgrowth and counting leaves and tillers. As mentioned before, wheat needs at least 4-5 leaves and 1-2 tillers prior to winter dormancy for maximum cold tolerance. Wheat that has fewer tillers and leaves will be more susceptible to winter kill (Figure 4).

It is important to look not only at the topgrowth, but at the root system development as well (Figure 5). Roots coming out from the seed are called seminal roots and are used to take up water and nutrients throughout the entire growing season. Still, there aren't very many of these roots so their contribution to overall wheat water and nutrient uptake is limited. The two white protrusions coming out of the white area about an inch above the seed in the photo of early-October planting in Figure 5 are crown roots. These roots take up most of the water and nutrients the plant will need, and they are very important for the plant to survive the winter. If a cow were grazing on this wheat, though, she would probably pull the plant out of the ground as there aren't many roots holding the plant in the soil yet. This wheat crop still needs considerable fall growth prior to grazing or winter dormancy.

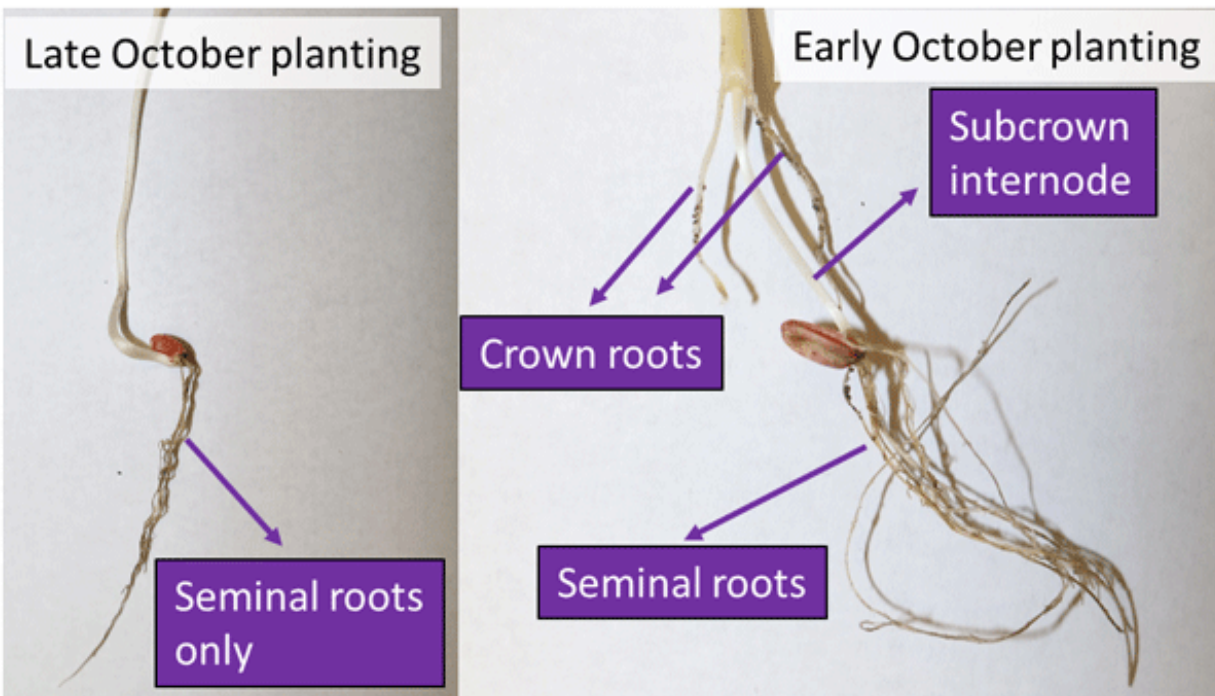


Figure 5. Wheat seminal and crown roots development as affected by planting date. Both rooting systems are not well enough developed to be grazed, and may be susceptible to nutrient deficiencies or desiccation damage over the winter if the crown roots do not get more developed. Photos taken at the North Agronomy Farm, Manhattan, by Romulo Lollato, K-State Research and Extension.

The photos below illustrate various degrees of what you'd like to see when you examine your wheat this fall.

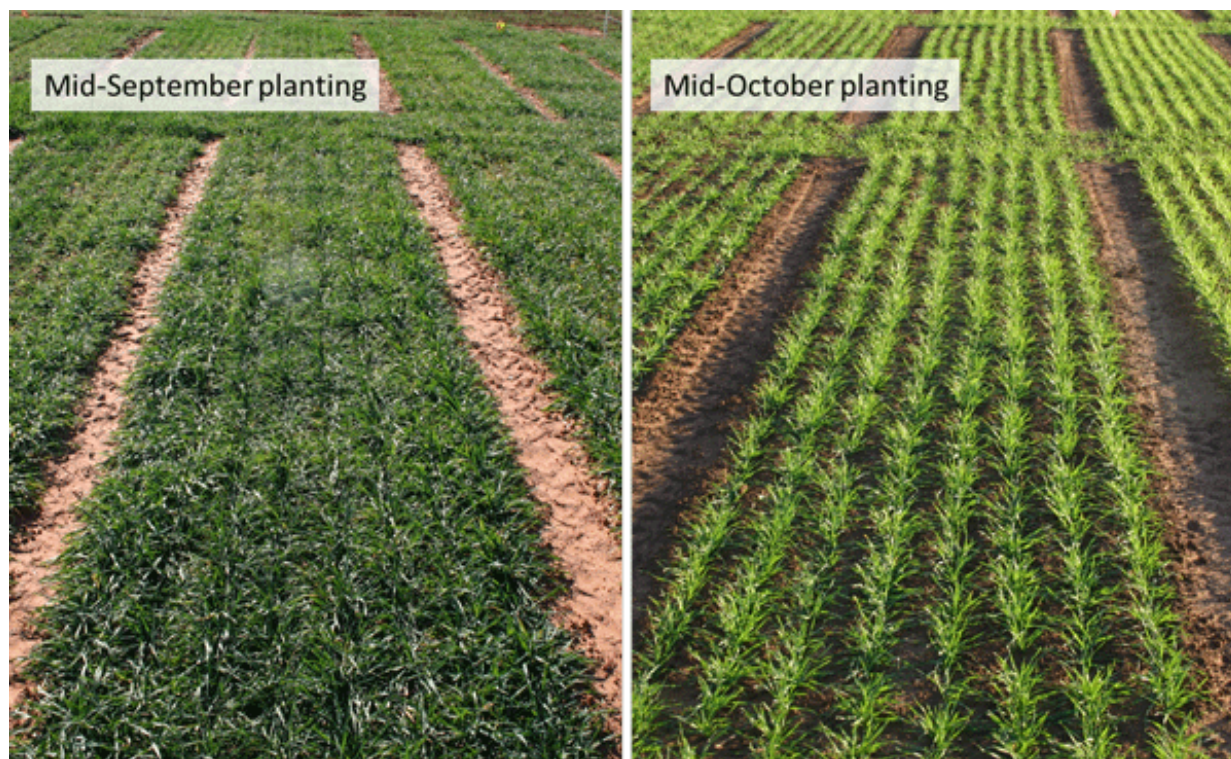


Figure 6. Wheat fall growth and development as affected by planting date. As expected, there is better canopy coverage with early-planted wheat for dual purpose (mid-September planting) as compared to wheat planted at the optimal planting time for grain only (mid-October planting). This does not necessarily mean the early-planted wheat is in better condition for winter, however. As long as the wheat planted in mid-October has 1-2 tillers and good crown root development (as in Figure 4B below), the plants will have adequate growth going into winter. In addition to having adequate topgrowth and root development, factors such as the extent of the plants' cold hardening, variety differences in winterhardiness, soil moisture and temperature, and snow or plant residue protection on the soil surface will ultimately have an impact on winter survival. Photos by Romulo Lollato, K-State Research and Extension.

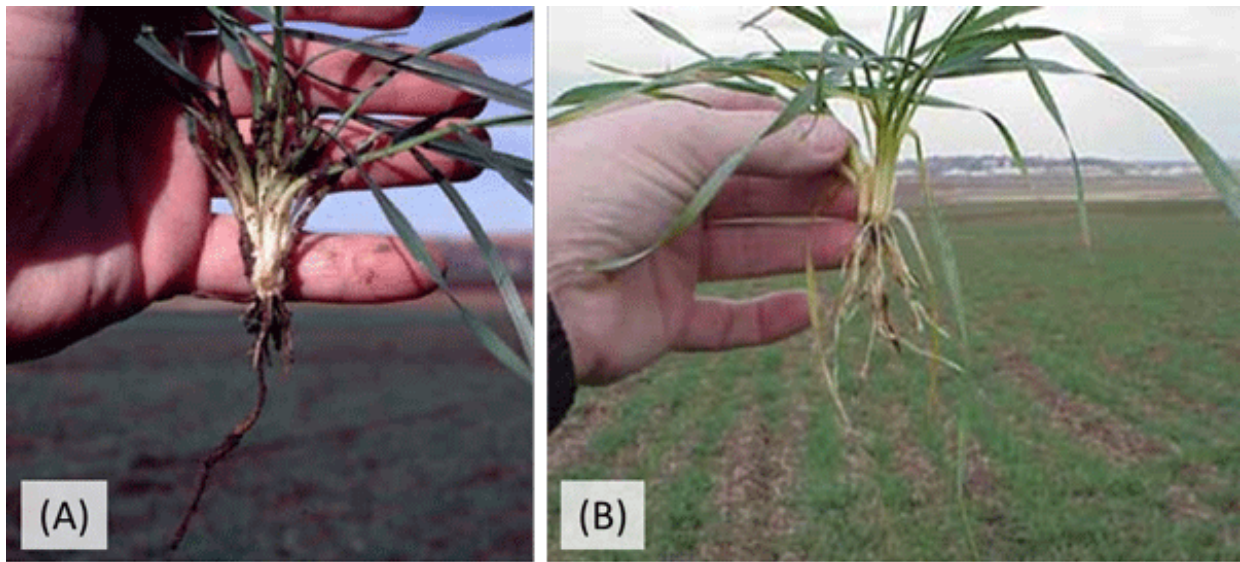


Figure 7. (A) Some of the crown roots are over an inch long. If the weather is mild for a couple more weeks, the roots should grow even more, which would be desirable. (B) Ideal wheat above and below ground development before winter dormancy, with crown roots fully developed and able to provide water and nutrients to the plant. With this amount of crown root development, wheat plants should be well anchored so that if cattle were grazing the wheat they couldn't pull the plants out of the ground. Photos by Jim Shroyer, professor emeritus, K-State Research and Extension.

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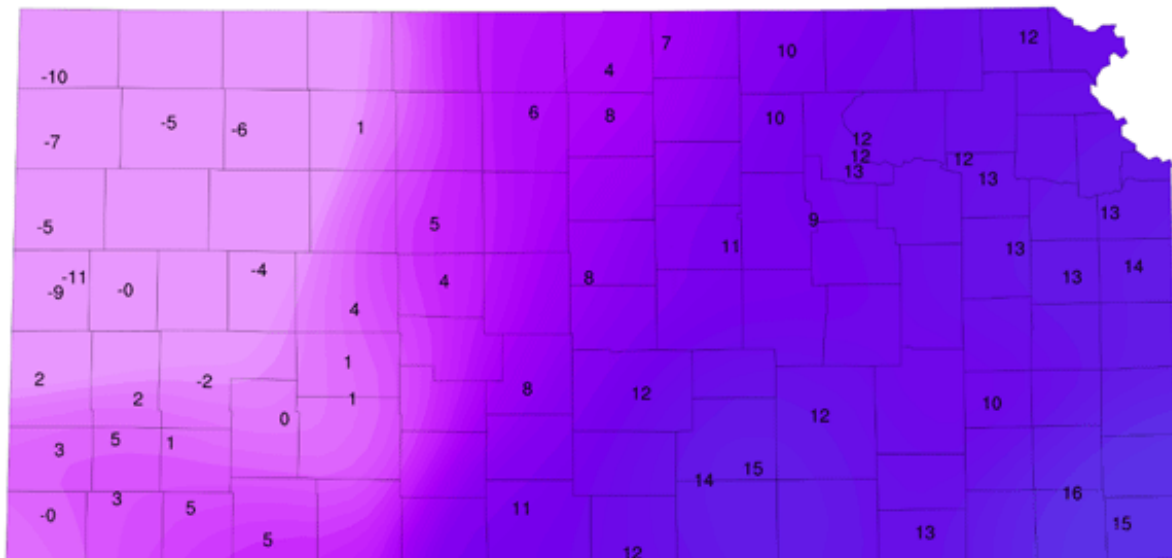
Mary Knapp, Weather Data Library
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2. Possible consequences of very cold temperatures to the Kansas wheat crop

The extent of possible winter damage to the developing wheat crop during the fall will depend on several variables. Minimum air temperatures achieved are the leading factor in any possible winter injury, as is the duration of the minimum temperatures. However, it is important to remember that the crown is protected by the soil during this stage, so factors other than air temperature also need to be considered. For instance, crown insulation by the soil (influenced by seed-to-soil contact at sowing and sowing depth), crown root development, soil temperature, soil moisture, snow residue, crop residue, and how well the crop acclimated during the fall, will all influence the crop's response to below freezing temperatures at this stage.

How cold did it get?

Minimum air temperatures reached very low levels on December 8th and 9th across Kansas, especially in the northwest portion of the state (Figure 1). Most of the state was exposed to minimum temperatures below 20°F on both days. While minimum temperatures the eastern half of the state never reached single digits, the northwest portion of the state was exposed to negative temperatures (Figure 1).



24 Hour Low Temperatures (F) - Kansas Mesonet 12/08 09:30

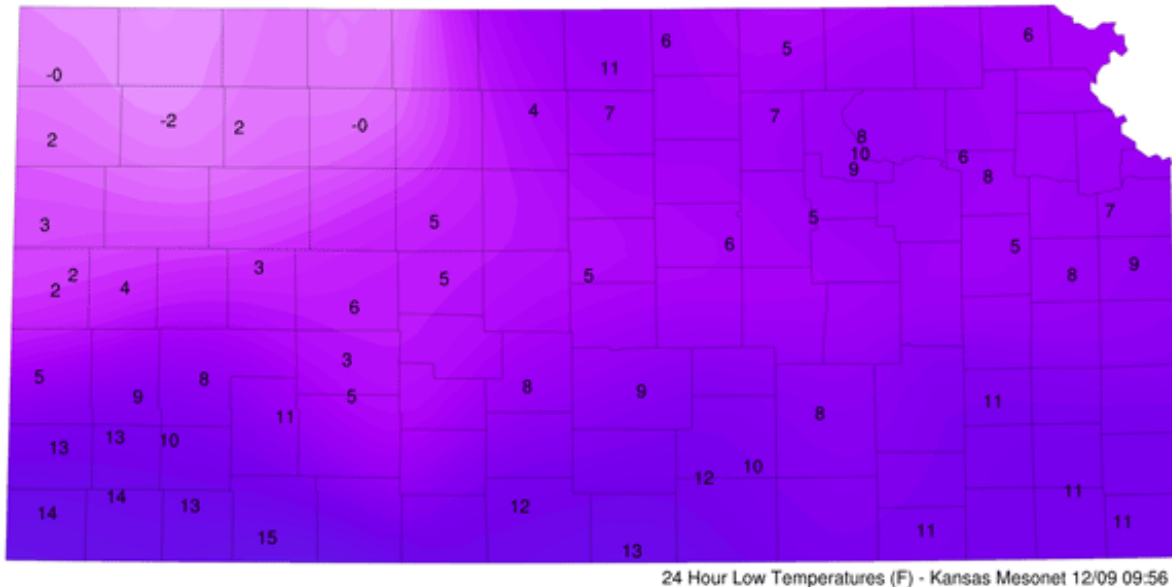
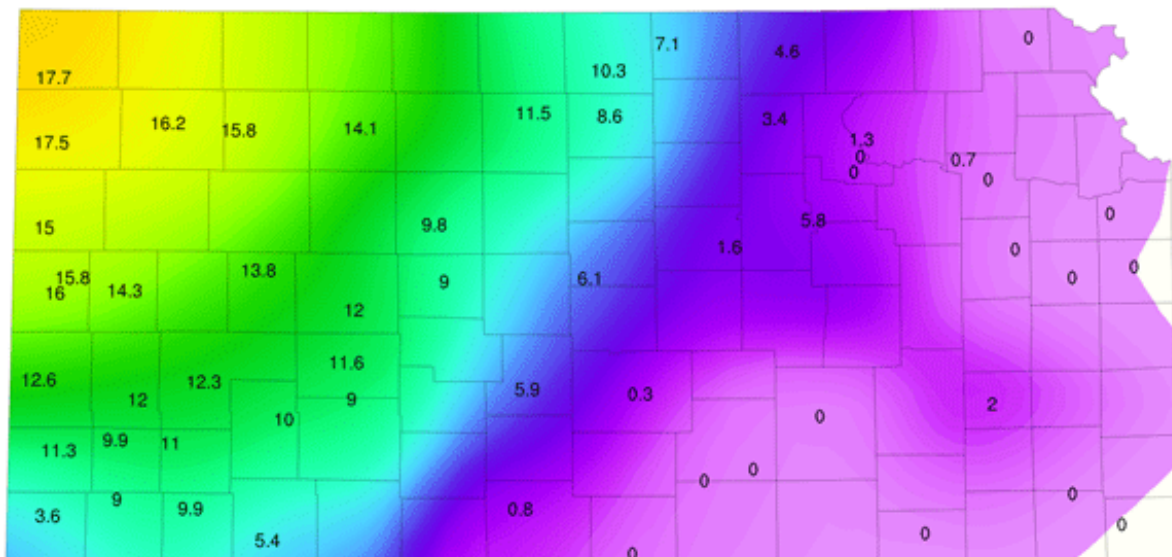


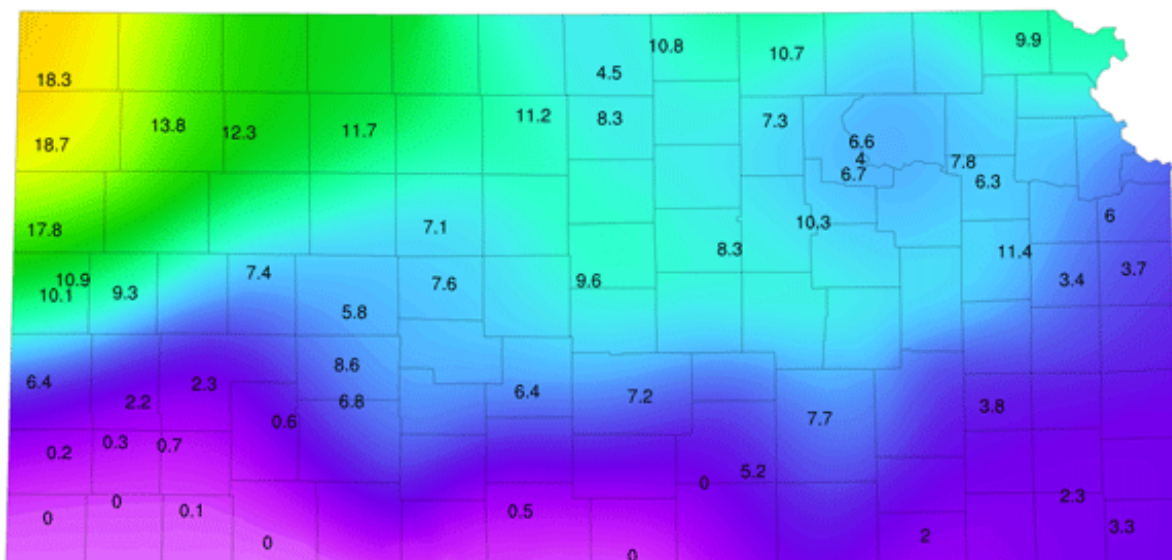
Figure 1. Coldest minimum temperatures measured in December 8 (upper panel) and December 9 (lower panel).

How long were these cold temperatures sustained?

The risk of freeze damage to wheat is a function of the minimum temperature and duration of time spent potentially damaging temperatures. During December 8th and 9th, the number of hours below 12 degrees F varied according to geographical location within Kansas. Counties in the northwestern portion, neighboring Colorado and Nebraska, were exposed to as many as 17 hours below 12 degrees F during December 8th and 18 hours during December 9th (Figure 2). Minimum temperatures below 12 degrees F were registered throughout the half western portion of the state during December 8th, and across the entire northern two-thirds of the state on December 9th.



Hours below 12F - Kansas Mesonet 12/08 09:30



Hours below 12F - Kansas Mesonet 12/09 09:30

Figure 2. Total hours with temperature below 12 degrees F during December 8th (upper panel) and December 9th (lower panel).

Soil temperatures

As freeze damage potential is a result of many interacting variables, evaluating only air temperatures may not completely reflect the conditions experienced by the wheat crop. In this situation, soil temperatures can help determining the extent of the cold stress at crown level.

While air temperatures reached critical levels, soil temperatures at 2" and 4" depth were above 27 degrees F in northwest Kansas, and in most cases between 30-35 degrees F in other regions of the

state. During the fall, most of the wheat winterkill occurs when temperatures reach single digits at the crown level. Higher soil temperatures may have helped buffering the cold air temperatures experienced, minimizing possible injury to the wheat crop.

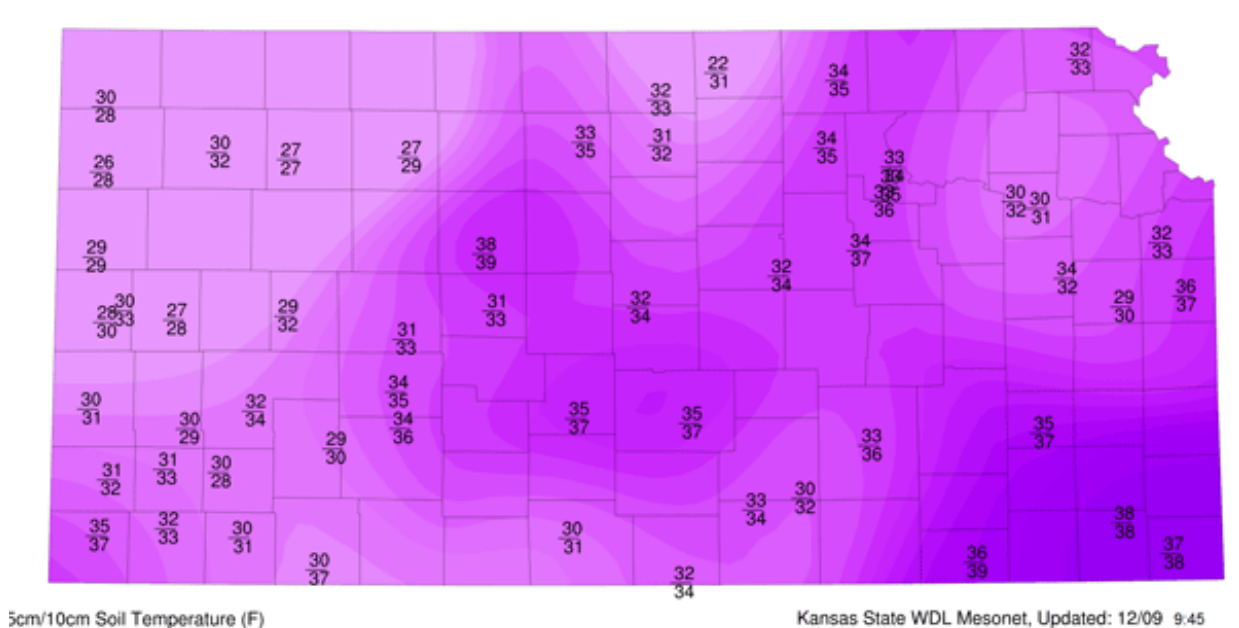


Figure 3. Soil temperatures measured 9:45am on December 9th for the 2”/4” depth.

Potential effects to the wheat crop

Northwest Kansas recorded the lowest temperatures for a longer period of time compared to other regions of Kansas during this two-day period. In addition to the low temperatures, northwest Kansas is also under moderate drought, without significant precipitation for weeks. The lack of soil moisture decreases the capacity of the soil to buffer temperature changes. As a result, a dry soil will cool down faster than a moist soil will, increasing the chances of lower temperatures at the crown level. Thus, the circumstances in which I would be concerned with the crop’s ability to make it through these recent cold days include:

- i. Fields without substantial snow cover (less than ~2 inches)
- ii. Extremely dry soils with poor root development
- iii. Late-sown crops with delayed development (less than 4-5 leaves and 1-2 tillers)
- iv. Shallowly-sown fields where the crown is closer to the soil surface
- v. Heavy-residue situations which may have precluded good seed-soil contact

Other than the above circumstances, most of the damage at this stage should only involve leaf tissue, which might give the crop a rough look for a few weeks. The first apparent sign of freeze injury will be leaf dieback and senescence (Figure 4), which should occur across most of the state regardless of damage to the actual growing point. Existing leaves will almost always turn bluish-black after a hard freeze, and give off a silage odor. Those leaves are burned back and dead, but that in itself is not a problem as long as newly emerging leaves are green. Provided that the growing point is not damaged, the wheat will recover from this damage in the spring with possibly little yield loss.



Figure 4. Leaf tip burn from freeze damage. By itself, this is cosmetic damage only. Photo by Romulo Lollato, K-State Research and Extension.

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3. Wheat scab resistance gene found

(Note: The following article is a slightly edited transcript of a short K-State Research and Extension YouTube video produced by Dan Donnert, KSRE videographer. The link to this video is: <https://youtu.be/EG-i3srgriE> – Steve Watson, Agronomy eUpdate Editor)

Wheat scab has been described as a wheat-industry-threatening disease. Essentially this fungus thrives on corn stubble. When you plant wheat into corn stubble, the fungus can jump into the wheat flower and causes the disease.



Figure 1. Fusarium head blight (scab) in wheat. Source for all photos: <https://youtu.be/EG-i3srgriE>

All the wheat varieties essentially are susceptible to this disease. It turns out that the only source of resistance is in the Chinese landrace Sumai 3. All the other world's landraces of wheat lack this resistance. We essentially cloned the DNA of this variety into bacteria. There were millions and millions of clones and eventually, through painstaking work, identified a small piece of DNA, which turned out to be, when you introduced them to wheat plants, made them resistant.

So we essentially identified this gene, and this gene hunt has been ongoing for the last 20 years. We have been fortunate to be the first one to get it. Now that we have this gene, we can diagnose whether any variety has this resistance gene or not. So number one, identifying this gene is very useful as a diagnostic asset. It's a perfect marker. Number two, we can now play around with this gene. We can forward express this gene. We can put in promoters that make the plant more resistant. We can also use the gene sequence to fix susceptible genes in other cultivars with a technique called

genome editing.

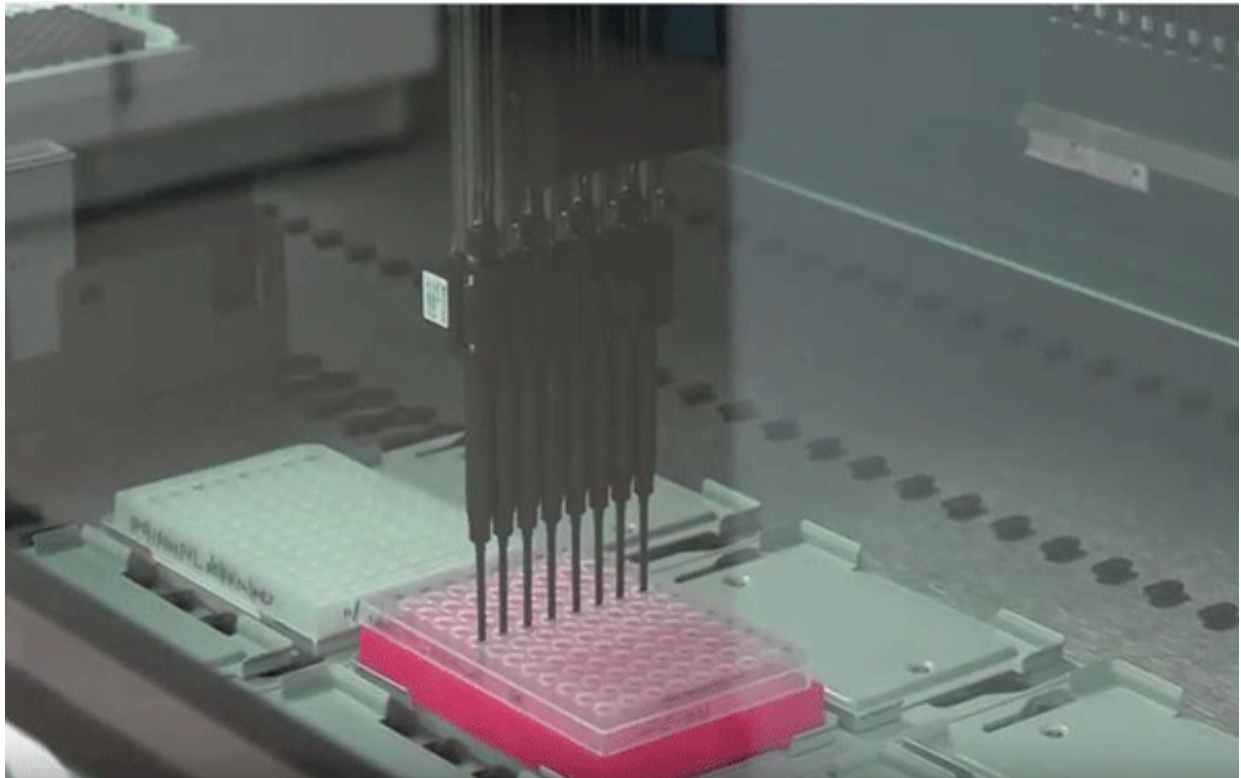


Figure 2. Automated pipetting for DNA analysis.

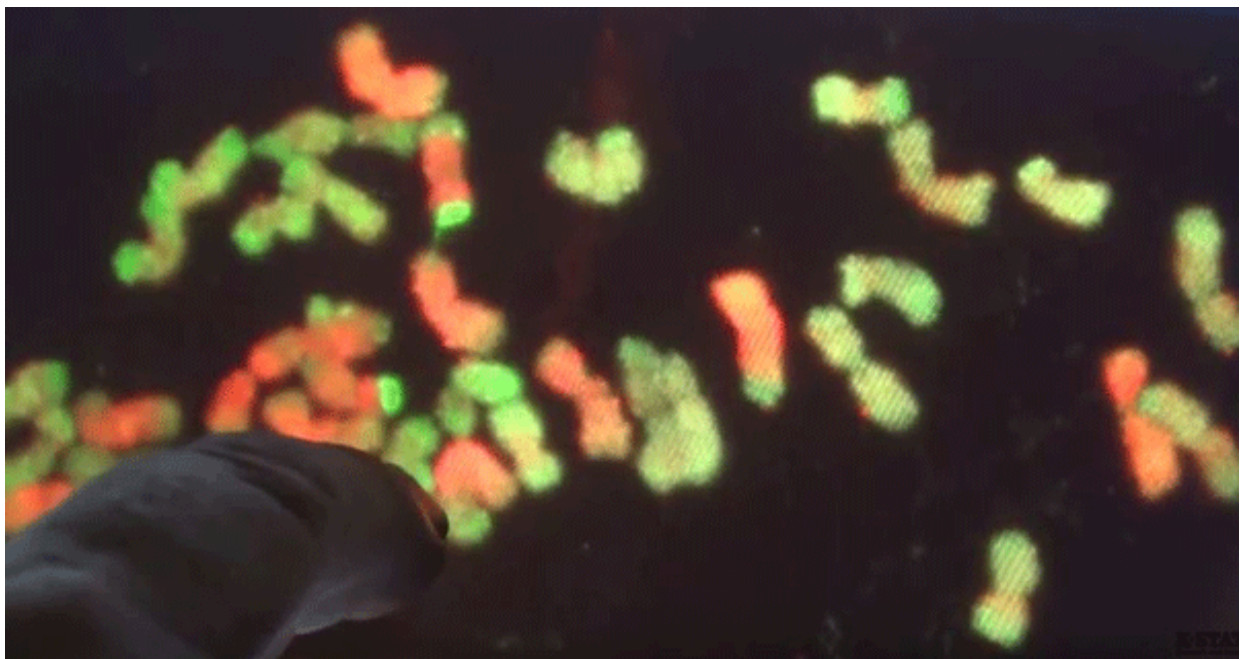


Figure 3. Examining chromosome constitution of wheat.

Generally, if a plant resists a disease it's a very long pathway with many genes involved. Now that we know one piece of the puzzle, we can uncover the whole pathway. And that will even suggest many more approaches and many more targets where we can intervene and make plants resistant to a disease.

Bikram Gill, Distinguished Professor of Plant Pathology
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4. Kansas Forage and Grasslands Council annual meeting, December 13, Wichita

The Kansas Forage and Grassland Council will hold its Winter Conference and Annual Meeting on Tuesday, December 13, 2016, at the Sedgwick County Extension Education Center, 7001 West 21st Street, Wichita.

Registration begins at 8:30 a.m. and the conference kicks off at 9:00 a.m. A grower panel will be part of this year's program along with breakout sessions led by Kansas State University and industry experts covering topics including:

- Forage/Pasture Insect Control
- Late Season Burning and Sericea Lespedeza Control
- Range Beef Cattle Nutrition and Management
- Forage/Pasture Fertility Management
- Mineral Supplementation in Grazing Cattle
- Wheat Grazing Management.

"Forage Profit Strategies" will be the keynote address by Dr. Don Ball, Professor Emeritus Auburn University and author of the books *Southern Forages* and *Practical Forage Concepts*. The full agenda is available on the KSFGC website, <https://ksfgc.org/annual-meeting/>

Individual Conference Registration is \$65 in advance (\$85 at the door) and includes lunch and both KSFGC and AFGC membership for 2017. Additional registration information for businesses, vendors, and forage industry boosters can be found on the KSFGC website.

To register go to <https://ksfgc.org/annual-meeting/> and complete and send the registration form, along with the appropriate fee payable to KSFGC, 1228 Westloop Place, PMB #144, Manhattan, KS 66502-2840; Or simply register online. Direct any questions to Mark Nelson at info@ksfgc.org.

5. K-State Corn Management Schools scheduled for January 2017

A series of three K-State Corn Production Management Schools will be offered in early January of 2017 to provide in-depth training targeted for corn producers. The schools are primarily sponsored by Kansas Corn Commission and Pioneer.

The one-day schools will cover up-to-date and specific corn topics: on-farm research, high-yielding corn production practices, weed control, soil fertility, and price and market perspectives. The focus of the Corn Production Schools will be in northwest, central, and eastern Kansas. Schools will be followed by a tour.

Jan. 9 – Wichita – Drury Plaza Hotel Broadview Wichita, 400 West Douglas Ave.

Jan. 11 – Oakley – Buffalo Bill Cultural Center, 3083 US 83

Jan. 13 – Olathe – John Deere Ag Marketing Center, 10789 South Ridgeview Rd.

Jan. 9 – Wichita

Contact Information:

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Darren Busick, Reno County Extension, darrenbusick@ksu.edu, 620-662-2371
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Randy Hein, Sumner County Extension, rvhein@ksu.edu, 620-326-7477
David Kehler, Butler County Extension, dkeehler@ksu.edu, 316-321-9660

Jan. 11 – Oakley

Contact Information:

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John Beckman, Scott County Extension, jbeckman@ksu.edu, 620-872-2930
Stacy Campbell, Ellis County Extension, scampbel@ksu.edu, 785-628-9430
Allen Baker, Wichita County Extension, abaker@ksu.edu, 620-375-2724
Alicia Boor, Barton County Extension, aboor@ksu.edu, 620-793-1910
Sandra Wick, Post Rock Extension District, swick@ksu.edu, 785-282-6823
Jenifer Sexson, Hamilton County Extension, jsexson@ksu.edu, 620-384-5225

Jan 13 – Olathe (John Deere facility) – Registration is needed

Contact Information:

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David Hallauer, Meadowlark Extension District, dhallaue@ksu.edu, 785-863-2212
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Roberta Wyckoff, Douglas County Extension, rwyckoff@ksu.edu, 785-843-7058
Leroy Russell, Shawnee Count Extension y, lrussell@ksu.edu, 785-232-0062

Lunch will be provided courtesy of the sponsors. There is no cost to attend, but participants are asked to pre-register before or by January 6.

Online registration is available at K-State Corn Schools: <http://bit.ly/KSCORNSchools>

You can also preregister by emailing or calling the nearest local Research and Extension office for the location you plan to attend.

For more information, contact:

Greg Krissek, CEO Kansas Corn; gkrissek@ksgrains.com

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Lucas Haag, Northwest Area Crops and Soils Specialist; lhaag@ksu.edu

AJ Foster, Southwest Area Crops and Soils Specialist; anserdj@ksu.edu

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Primarily supported by:



6. K-State Soybean Schools scheduled for late January 2017



A series of three K-State Soybean Production Schools will be offered in late January 2017 to provide in-depth training targeted for soybean producers and key stakeholders. The schools will be held at three locations around the state.

The one-day schools will cover a number of issues facing soybean growers: weed control strategies; production practices; nutrient fertility; and insect and disease management.

The dates and locations of the K-State Soybean Production Schools are:

Jan. 24th – Parsons, 25092 Ness Road

Contact information:

Josh Coltrain, Wildcat Extension District, jcoltrain@ksu.edu, 620-724-8233

Jeri Sigle, Wildcat Extension District, jsigle@ksu.edu, 620-331-2690

Jan. 26th – Hesston, AGCO building, 420 W. Lincoln Blvd

Contact information:

Ryan Flaming, Harvey County Extension, flaming@ksu.edu, 316-284-6930

Jan. 27th – Highland, Highland Community Building, 501 West Av

Contact information:

David Hallauer, Meadowlark Extension District, dhallaue@ksu.edu, 785-863-2212

Matthew Young, Brown County Extension, mayoung@ksu.edu, 785-742-7871

More information on the final program for each Soybean School will be provided in future issues of the Agronomy eUpdate.

Lunch will be provided courtesy of Kansas Soybean Commission. There is no cost to attend, but participants are asked to pre-register by Jan. 19.

Online registration is available at: [K-State Soybean Schools](#)

You can also preregister by emailing or calling the nearest local Research and Extension office for the location you plan to attend.

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Stu Duncan, Northeast Area Crops and Soils Specialist
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7. K-State Sorghum Schools scheduled for late January and early February 2017



A series of four K-State Sorghum Production Schools will be offered in late January and early February 2017 to provide in-depth training targeted for sorghum producers and key stakeholders. The schools will be held at four locations around the state. The one-day schools will cover a number of issues facing sorghum growers: weed control strategies; production practices; nutrient fertility; and insect and disease management.

The dates and locations of the K-State Sorghum Production Schools are:

Jan. 31st – Colby: City Limits Convention Center, 2227 S Range Ave
Kurt Sexton, Thomas Co. Extension, kurtsexton@ksu.edu, 785-460-4582

Feb. 1st – Wichita: Sedgwick Co. Extension Center, 7001 W 21st St N
Zach Simon, Sedgwick Co. Extension, zsimon@ksu.edu, 316-660-0100

Feb. 2nd – Concordia: Cloud County Community College, 2221 Campus Drive
Kim Kohls, River Valley Extension District, kclarson@ksu.edu, 785-243-8185

Feb. 3rd – Iola Riverside Park New Community Building, 600 S. State St
Carla Nemecek, Southwind Extension District, cnemecek@ksu.edu, 620-365-2242

More information on the final program for each Sorghum School will be provided in future issues of the Agronomy eUpdate.

Lunch will be provided courtesy of Kansas Grain Sorghum Commission. There is no cost to attend, but participants are asked to pre-register by Jan. 27. Online registration is available at: [K-State Sorghum Schools](#)

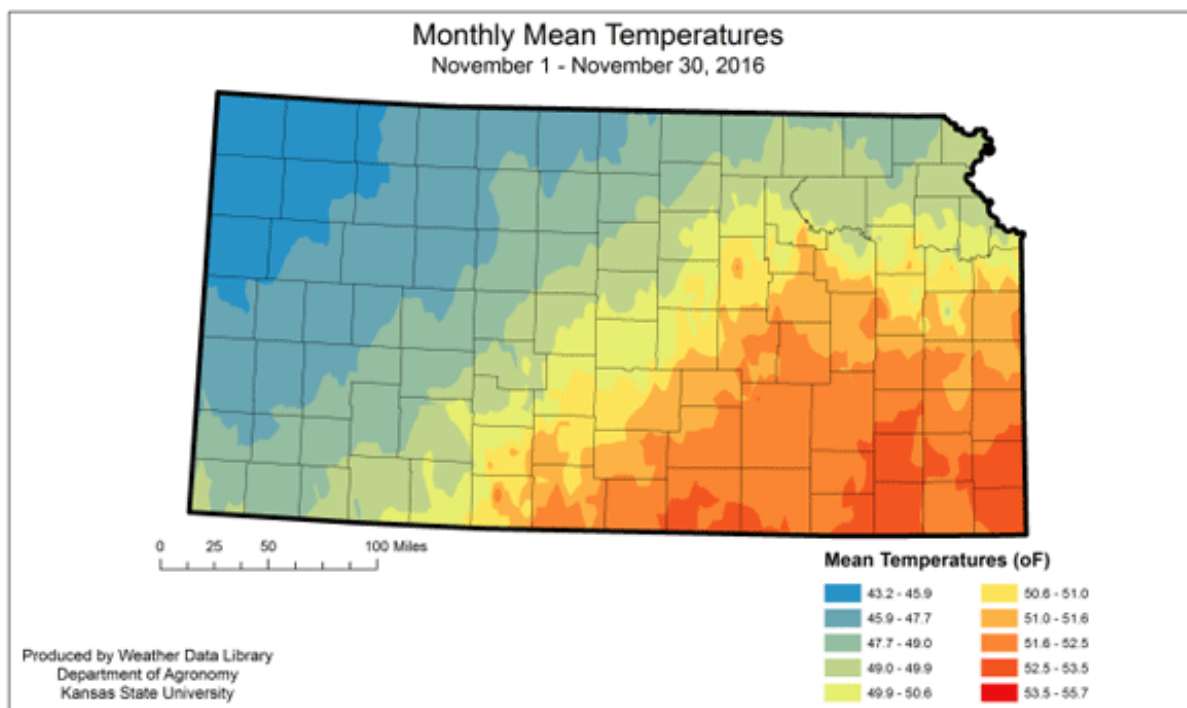
You can also preregister by emailing or calling the nearest local Research and Extension office for the location you plan to attend.

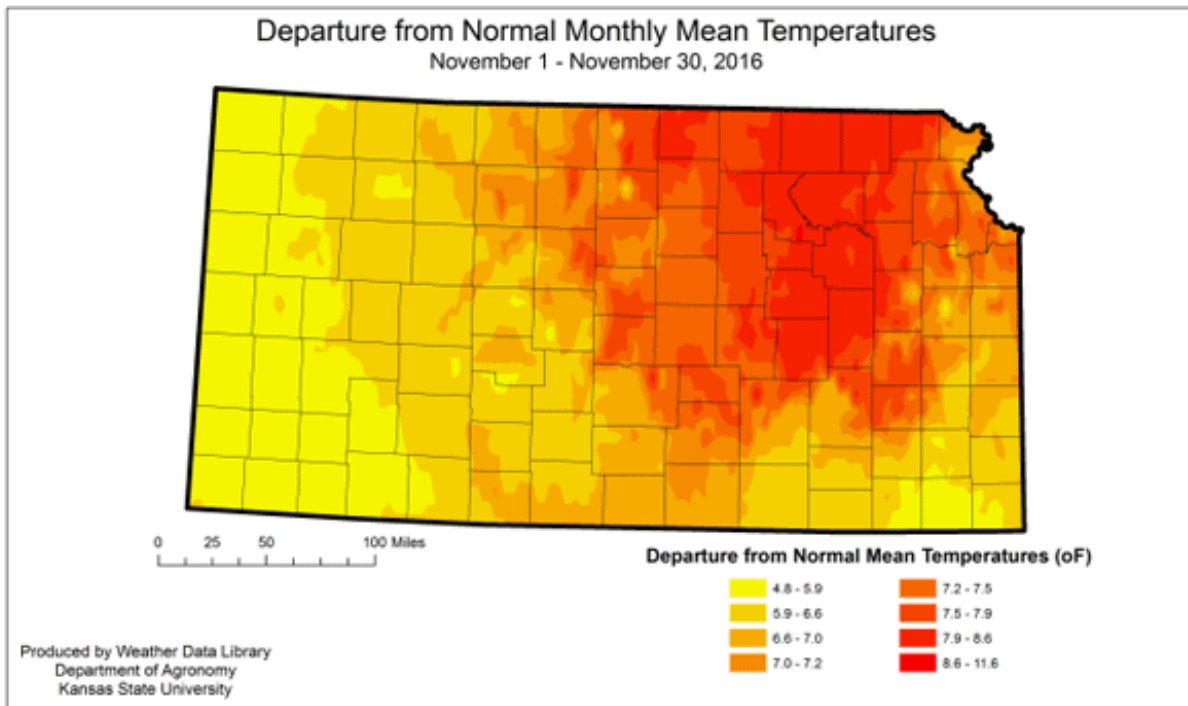
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Pat Damman, Kansas Grain Sorghum Commission
pat@ksgrainsorghum.org

8. November weather summary for Kansas: A warm month

Temperatures in Kansas were warmer than normal in November. The statewide average temperature was 49.4 degrees F, or 7.3 degrees warmer than normal. This was the 2nd warmest November since 1896. The Southwest Division was closest to normal for the month. The average in that division was 48.9 degrees F, or 6.5 degrees warmer than normal. The greatest departure was in the Northeast Division where the average temperature was 49.7 degrees F, or 8.0 degrees warmer than normal. There were 170 new daily record high temperatures set in the month. Of those, 13 set new record highs for November. Ashland, in Clark County, had the highest reading for the month, with 93 degrees F reported on the first of the month. Despite the record warmth, there were two new record low minimum temperatures set. There were 74 new record warm minimum temperatures set, of which 6 were records for the month. The coldest temperature recorded for the month was 8 degrees F at Oakley 19 SSW, Logan County, on the 20th.

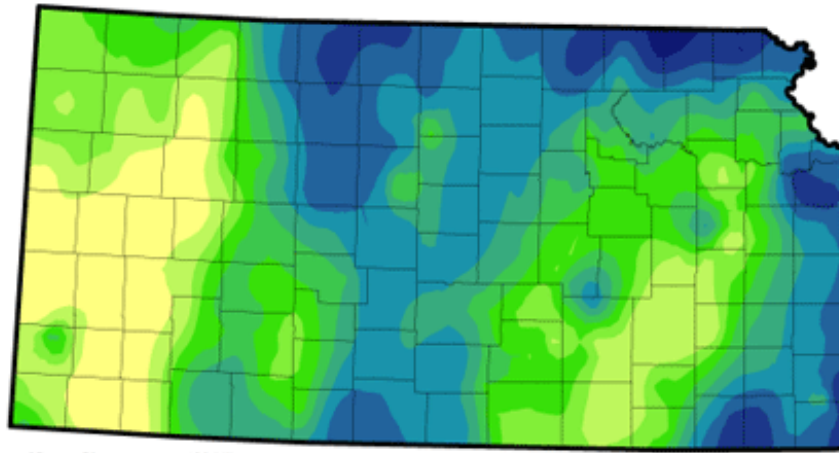




Statewide average rainfall for November continued the trend of the dry fall and was well below normal. The statewide average was 0.42 inches, or 32 percent of normal. The West Central and East Central Divisions vied for lowest percent of normal. The West Central Division had 0.10 inches, or 12 percent of normal; and the East Central division had 0.30 inches, or 13 percent of normal. The North Central Division came closest to normal with an average of 0.73 inches, or 59 percent of normal. This November ranks as the 30th driest in the 122 years of record. The wettest November on record occurred in 1909, when the statewide average total was 4.68 inches. The driest November occurred in 1989 when the statewide average was zero inches. Despite the dry pattern there were 26 new record daily rainfall totals. The greatest 24-hour total recorded at a CoCoRaHS station was 1.58 inches at Seneca 0.5 N, Nemaha County, on the 23rd. The greatest 24-hour report for a National Weather Service station was 0.43 inches at Olathe Johnson Co Exec Ap, Johnson County, on the 2nd. The greatest monthly totals: 2.25 inches at Fostoria 7 NW, Pottawatomie County (NWS) and 1.61 inches at Seneca 9.0 N, Nemaha County (CoCoRaHS).

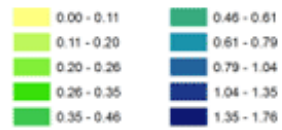
Monthly Precipitation Summary

November 1 - November 30, 2016



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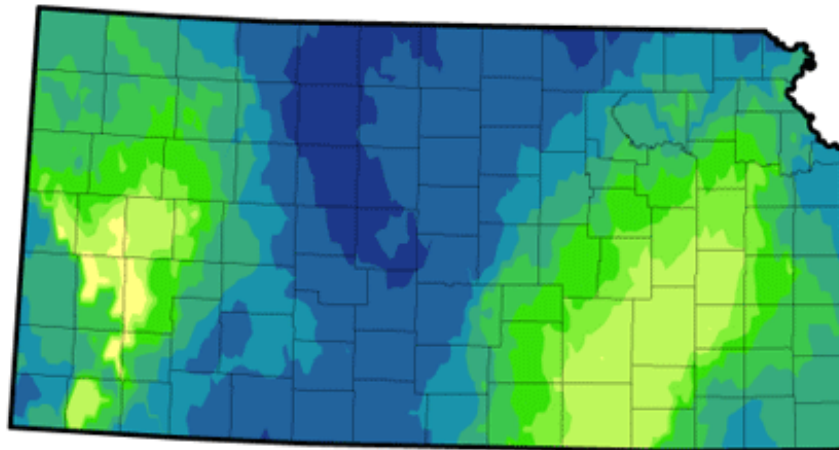
Total Precipitation (Inches)



Produced by Weather Data Library
Department of Agronomy
Kansas State University

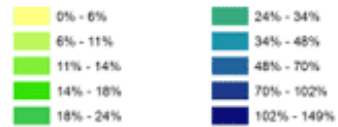
Percent of Normal Monthly Precipitation

November 1 - November 30, 2016



0 25 50 100 Miles

Percent of Normal Precipitation (100=Normal)

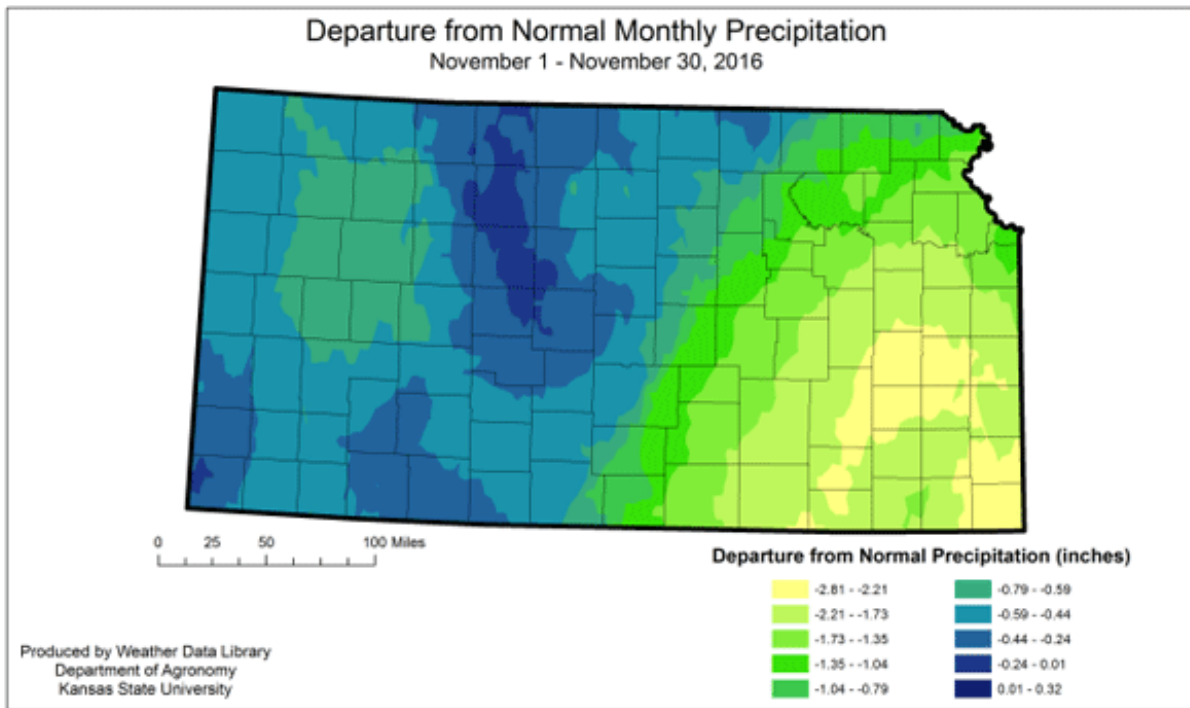


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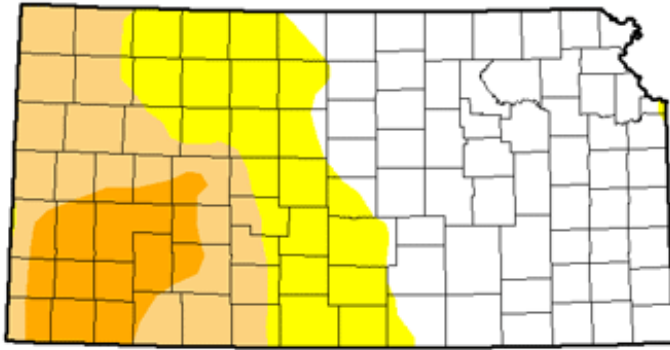


Severe weather wasn't as much of a factor as last month, although there was one tornado reported in Riley County, just north of the Manhattan airport. Fortunately there were no deaths or injuries reported with the storm. There were no hail reports and only 4 damaging wind reports in the month.

Above-normal temperatures coupled with below-normal precipitation resulted in expansion of moderate drought in western Kansas, with an area of severe drought in southwest Kansas. As we move into the drier part of the year, even above-normal precipitation is not likely to result in significant improvement. By the same token, the rate of deterioration is likely to slow.

U.S. Drought Monitor Kansas

November 29, 2016
(Released Thursday, Dec. 1, 2016)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	47.46	22.03	20.00	10.50	0.00	0.00
Last Week 11/22/2016	61.91	11.39	26.69	0.00	0.00	0.00
3 Months Ago 9/28/2016	94.79	4.24	0.97	0.00	0.00	0.00
Start of Calendar Year 12/2/2015	97.84	2.16	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2015	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 12/1/2015	46.33	49.16	4.51	0.00	0.00	0.00

Author:
Richard Heim
NCEI/NOAA



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

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.

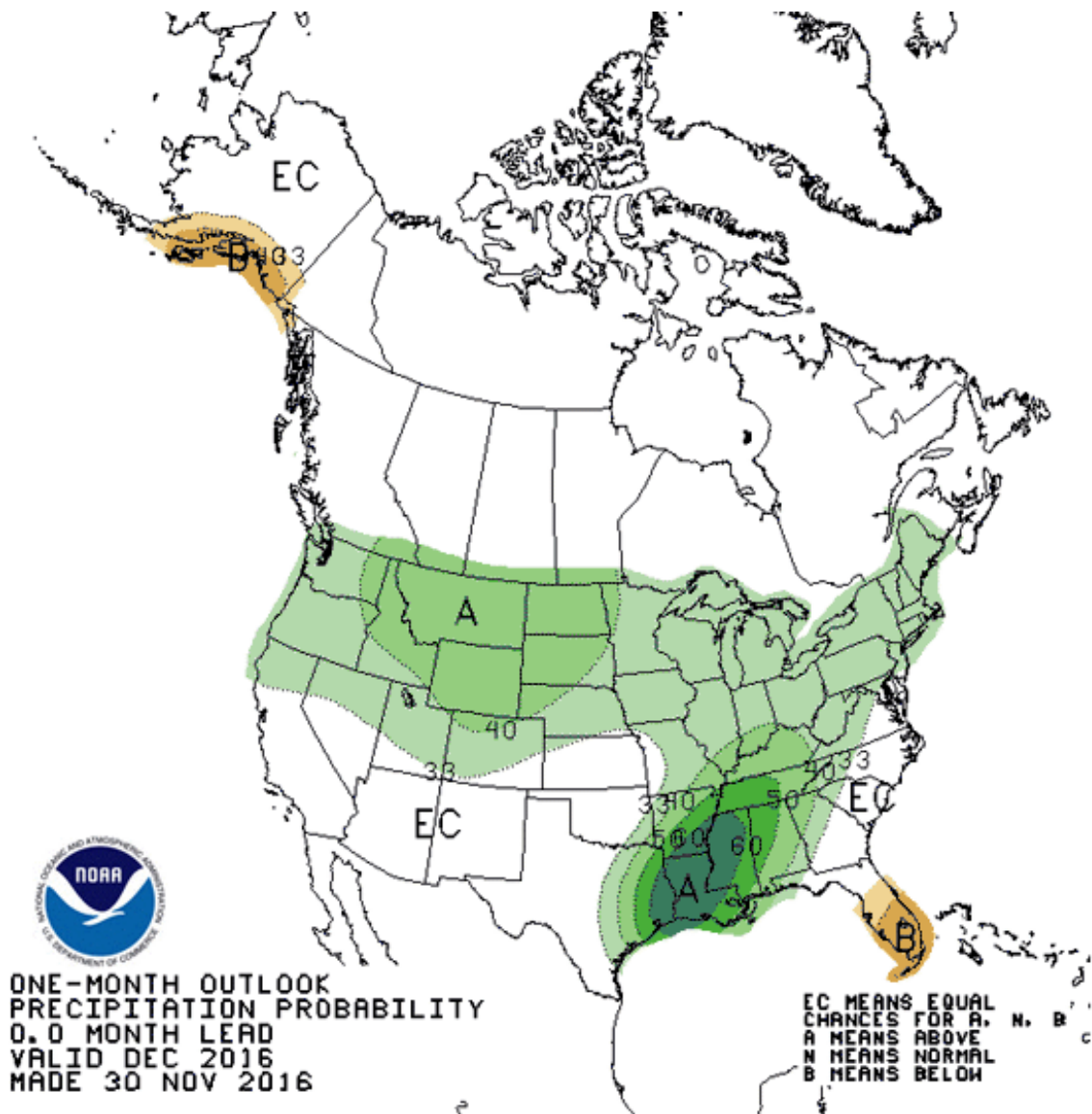


Table 1

November 2016

Kansas Climate Division Summary

Division Total	Precipitation (inches)			Temperature (°F)			Monthly Extremes	
	November 2016		2016 Jan through Nov		Ave	Monthly Extremes		
	Dep. ¹	% Normal	Total	Dep. ¹	% Normal	Dep. ¹	Max	Min

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Northwest	0.24	-0.57	27	19.55	-1.26	93	45.6	7.0	91	8
West Central	0.10	-0.67	12	18.80	-1.36	92	47.1	7.1	92	9
Southwest	0.21	-0.44	31	20.13	0.88	103	48.9	6.5	93	9
North Central	0.73	-0.49	59	30.55	3.39	112	48.6	7.9	88	18
Central	0.60	-0.62	53	30.72	2.32	108	49.8	7.5	92	15
South Central	0.44	-1.04	32	34.67	4.43	113	51.2	7.2	88	15
Northeast	0.89	-0.86	52	34.82	0.99	102	49.7	8.0	83	23
East Central	0.30	-1.84	13	35.31	-1.27	95	50.8	7.7	84	22
Southeast	0.50	-2.07	18	42.27	2.52	106	52.5	7.2	85	20
STATE	0.43	-0.97	32	29.75	1.36	103	49.4	7.3	93	8

1. Departure from 1981-2010 normal value

2. State Highest temperature: 93 oF at Ashland, Clark County, on the 1st.

3. State Lowest temperature: 8 oF at Oakley 19SSW, Logan County, on the 20th.

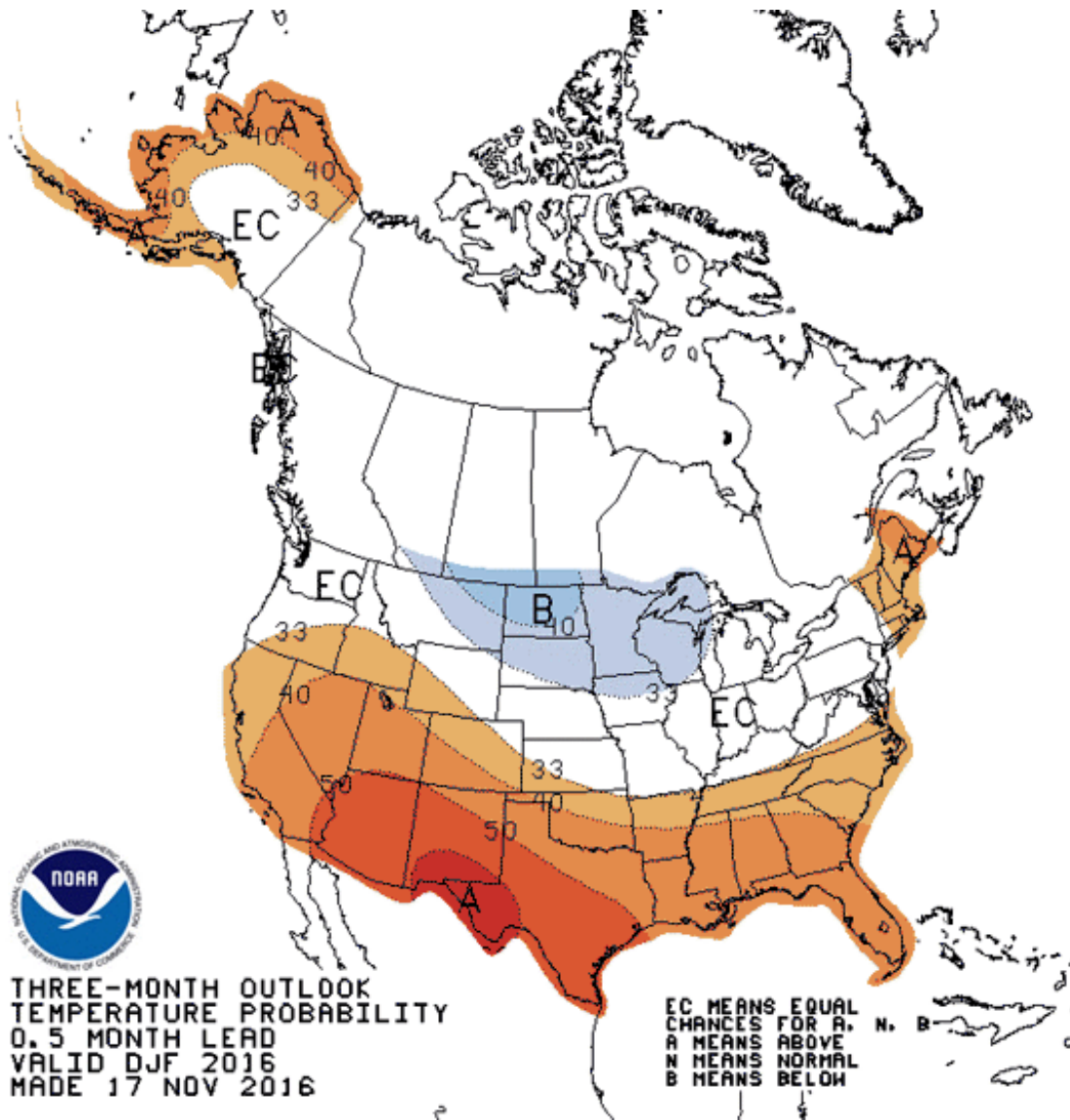
4. Greatest 24hr: 1.43 inches at Olathe Johnson Co Exec Ap, on the 2nd (NWS); 1.58 inches at Seneca 0.5 N, Nemaha County, on the 23rd (CoCoRaHS).

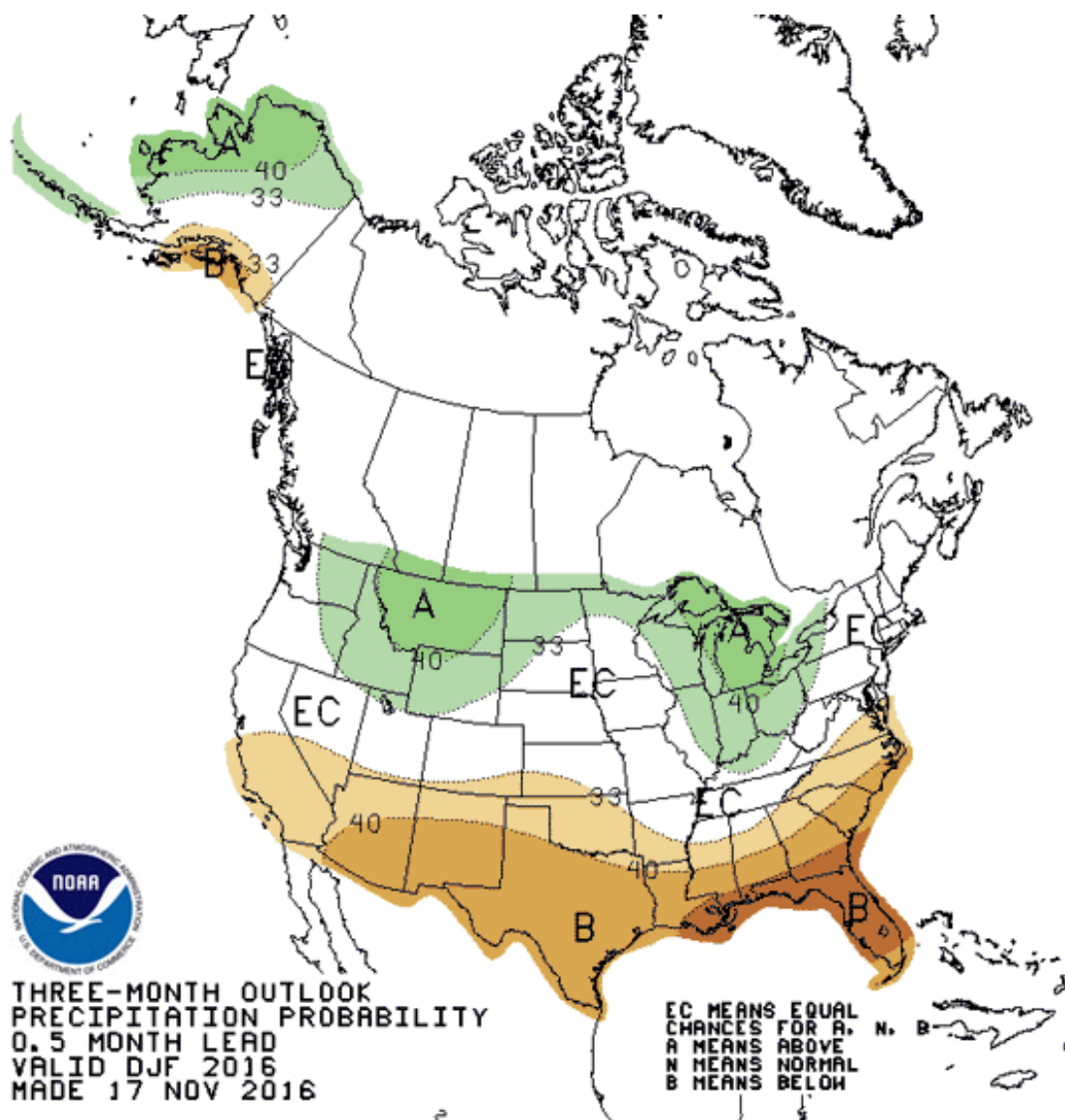
Source: KSU Weather Data Library

Mary Knapp, Weather Data Library

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Now that some seasonal weather has arrived, people are interested in the Winter Outlook. Below are the Climate Prediction Center's outlooks for temperature and precipitation during the winter season -- December through February.





The temperature outlook is neutral, with a slight tendency towards warmer-than-normal temperatures in southwest Kansas. That tendency increases as you move farther south and west in the Plains. It is important to remember that this is the 3-month average. There could be significant cold periods and still have an overall warmer-than-normal winter. One difficulty with that pattern is that neither crops nor livestock develop strong winter hardiness and can be more severely affected by the occasional extreme cold snap.

For precipitation, the outlook is also neutral. It is equally likely to have above- or below-average precipitation over the period. Winter is normally the driest time of the year for most of the Plains. Southeast Kansas is an exception, with a more even distribution across the year. It is also worth noting that neither the temperature nor the precipitation outlook predicts the degree to which conditions will vary. A tenth of a degree warmer than normal would validate the outlook as much as 10 degrees warmer. A hundredth of an inch greater than normal would have a similar result in the precipitation outlook. Significantly wetter conditions, similar to last winter, would be needed to improve the drought conditions in the western Plains.

The major force driving the current outlook is the ENSO signal. At this time it has a weak La Niña

pattern – that is, cooler-than-normal waters in the Pacific along the Equator. During a La Niña winter there is typically a more zonal flow across the continental U.S., with the polar jet steering systems across the Northern Plains. Given the weak nature of the La Niña, other factors may have a stronger influence. Two patterns that deserve attention are the North Atlantic Oscillation (NAO) and the Eastern Pacific Oscillation (EPO). Both are comparisons of high and low pressure in the respective basins.

When the NAO is negative (with a weak gradient between high pressure in the subtropics and low pressure over Iceland), the east coast of the U.S. tends to have stronger cold outbreaks, with more snow. Some of that can clip the eastern Plains region. When the EPO is in the negative phase (with strong pressure to the north and low to the south), as it is currently, there tends to be increased cooling in the Central and Eastern US.

Unfortunately, both the NAO and EPO conditions can change rapidly, and forecasts for these patterns are not as well developed as for the ENSO. That makes it difficult to gauge their impacts on an extended basis.

Mary Knapp, Weather Data Library
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Very cold winter days are upon us! However, it isn't always the temperature that gives the air that nip. The "feel like" temperature is usually influenced by the wind as well. We call this the wind chill. This article will provide a quick background on wind chill and how you can access current wind chill data on the Kansas Mesonet webpage.

What is the wind chill?

When temperatures drop below 50 degrees F and wind speeds are greater than 5 mph, the "Feels Like" temperature is lower than the actual temperature. Wind chill can be computed two ways: 1) using the chart below, or 2) mathematically. As the wind increases and/or the temperature decreases, wind chill values decrease. This means that despite it being 0 degrees F on a very cold morning, when factoring in the wind (say 20 mph), it can feel like a much colder temperature (in this example -22 degrees F).

This colder "feel" temperature can not only make you feel chilled quicker, it can also lead to other problems such as frostbite much quicker. Estimations of frostbite issues at 0 degrees F with no wind is 30 minutes, while 0 degrees F and 55mph winds can cause it in less than 10 minutes when exposed. Wind chills can be determined by the following chart from the National Weather Service (found at <http://www.nws.noaa.gov/om/winter/windchill-images/windchillchart3.pdf>):

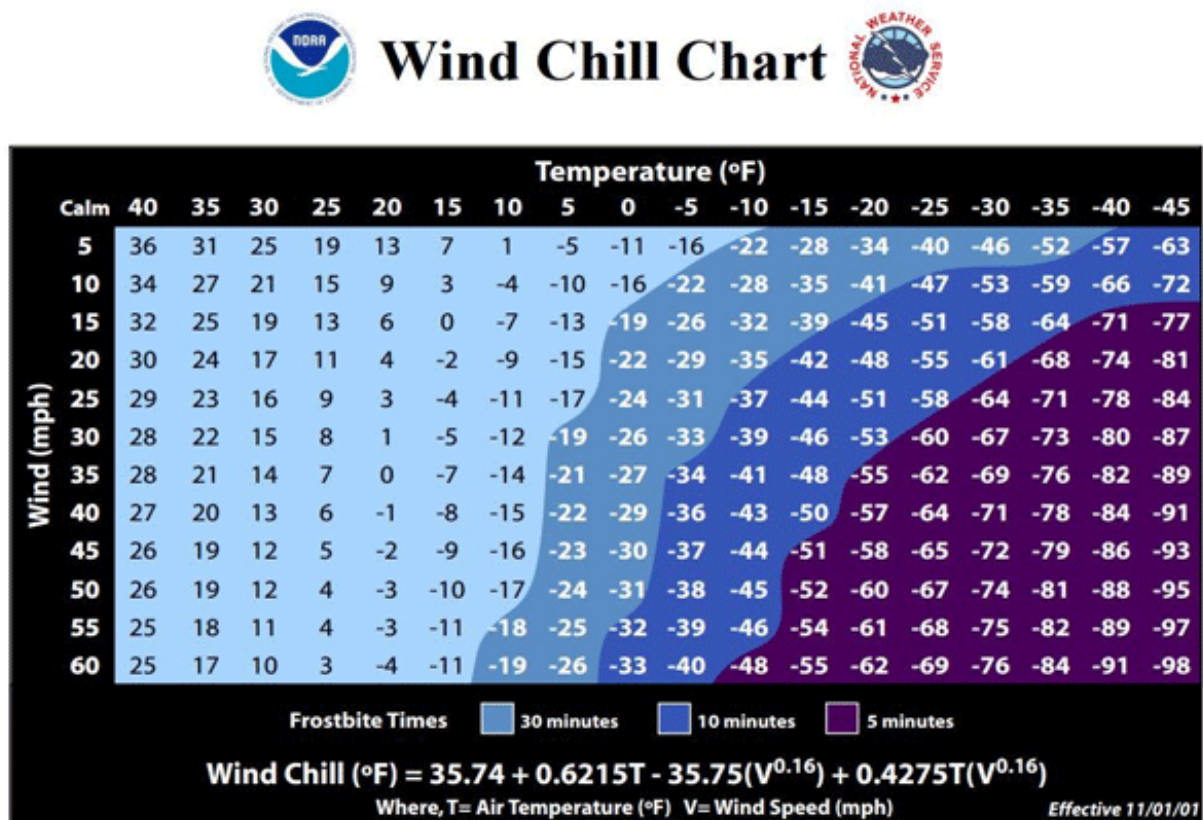


Figure 1. Wind chill chart from the National Weather Service.

Where can you access wind chill data?

The Kansas Mesonet makes viewing the wind chill very easy! We have put together a webpage that displays a gradient map that depicts the current wind chill at: mesonet.ksu.edu/weather/wind_chill

It is also accessible by clicking banner on the Kansas Mesonet's front page. The map defaults to the current wind chill, but also has a selection at the top where you can change the map to view temperature and wind speed/direction. Since these are the two ingredients for the wind chill, it tells the story in its entirety. The table below the map also displays the wind chill, temperature, and wind data for each station in sortable columns. By clicking the column headings, that particular column will sort from lowest to highest values. Click it again and it will reverse. You can also select a specific station either on the map or in the data table and it will display the specific information for that location.

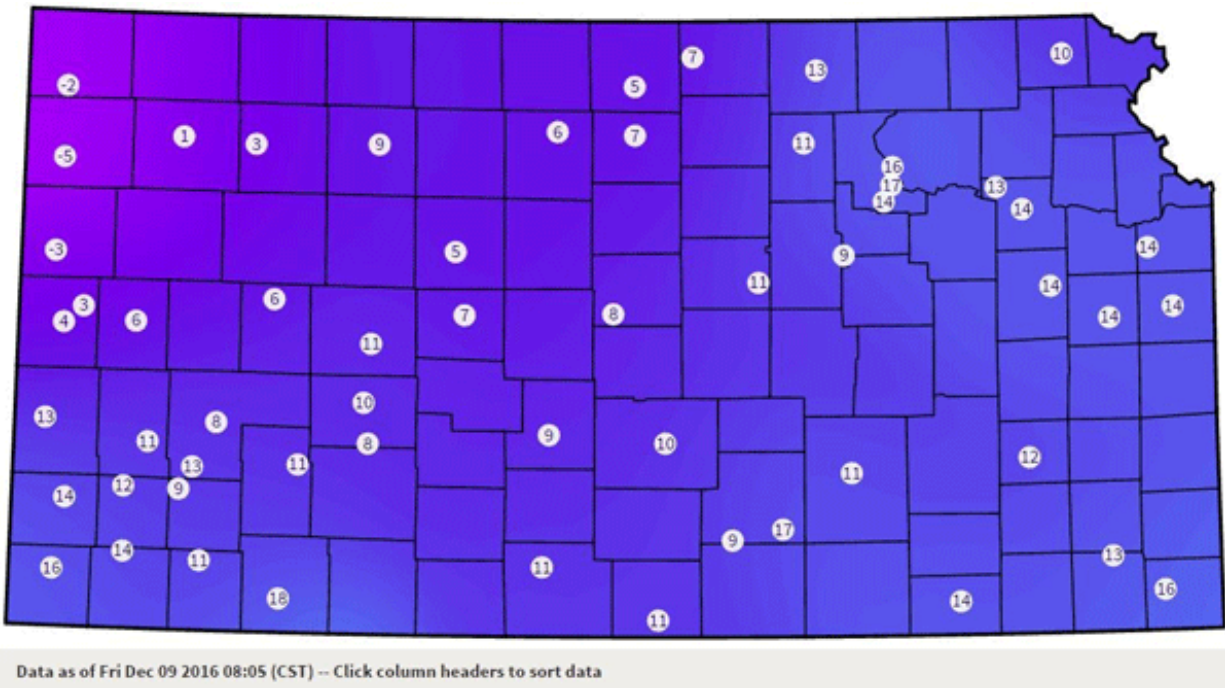


Figure 2. Map of wind chills as of 12/9/16 at 8:05am.

Still looking for the number of hours below 32 degrees F or 24 degrees F maps/data?

Winter wheat and cover crop producers still have an interest in the cold temperatures too. The freeze monitor data is still available on our webpage. You can access it through the menu in the top left (Weather -> Freeze Monitor) or at: mesonet.ksu.edu/freeze

