



Extension Agronomy

eUpdate

12/07/2018

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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1. Sulfur deficiency in wheat.....	3
2. Kansas disease summary for 2018 - Corn, soybeans, and sorghum	7
3. The creeping trends of a changing climate	15
4. Kansas weather summary for November - Cold and dry.....	19
5. Save the Date: K-State Soybean Schools scheduled for late January.....	25
6. Winter Forage Conference highlights pasture, rangeland, and forage insurance - Dec.	
11.....	27

1. Sulfur deficiency in wheat

In recent years, sulfur (S) deficiency in wheat has become common in many areas of Kansas, particularly in no-till wheat. The likely reasons for this is a reduction in sulfur additions to the crop from atmospheric deposition (there is less S in the air now) and cooler soil temperatures as a result of no-till which slows S mineralization in the soil. Some crops in the rotation, such as soybean, can also take up significant amounts of S resulting in an S deficit for the following wheat crop.

Historically, S deficiency was most common on high-yielding crops grown on irrigated, sandy soils low in organic matter and subject to leaching. However, due to reasons discussed above, an increasing number of finer-textured soils have shown S deficiency in recent years.

Identification of S deficiency

The photos below are good representations of S deficiency in wheat. Generally, S-deficient wheat is yellow and stunted and is observed in patches in the field, especially in areas where there has been previous soil erosion or soil movement (Figure 1). The patchy S-deficient areas of the field are often found on hilltops or sideslopes where erosion has occurred and soil organic matter is reduced, or where leaching is more pronounced. Wheat in areas where topsoil was removed or significant cuts were made (i.e. terraced or leveled fields) also commonly shows symptoms.



Figure 1. Patches of sulfur deficiency in a wheat field. Photo by Dave Mengel, K-State Research and Extension.

Sulfur deficiency in growing crops is often mistaken for nitrogen (N) deficiency. However, unlike N deficiency where older leaves show firing and yellowing, with S deficiency, the pale yellow symptoms

often appear first on the younger or uppermost leaves. Wheat plants with S deficiency eventually become uniformly chlorotic (yellow leaf tissue; Figure 2).



Figure 2. Close-up of sulfur deficiency in wheat. The wheat is exhibiting yellowing (chlorosis) which is a sign of insufficient sulfur. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Sulfur deficiencies in wheat have been showing up early in the spring, shortly after green-up, before organic S is mineralized from soil organic matter, and before wheat roots can grow into the subsoil to utilize any available S (sulfate) accumulations. Deficiencies of S are often difficult to identify because the chlorosis is not always obvious. Crops lacking S also may be stunted, thin-stemmed, and spindly. In the case of wheat and other cereal grains, maturity is delayed. Winter annual weed competition is also enhanced due to the slower growth and lack of good tillering.

At present, many fields in north central and northeast Kansas have an established history of S deficiency for wheat. In this situation, rather than waiting for symptoms to appear in the spring, farmers may want to consider a winter topdress application of S as a preventive measure.

Forms of sulfur in soil

The majority of S in soils is present in organic forms in surface soils and as sulfate (SO_4^{2-}), an inorganic form. Sulfate is relatively soluble, so it tends to leach down into the subsoil. In many of our Kansas soils, it will accumulate in the B horizon (subsoil) in two forms. Clay surfaces and coatings will retain some sulfate, and sulfate will also be present in the subsoil of many Kansas soils as gypsum (calcium sulfate).

Testing soil for sulfur

A soil test for available sulfate-S in the soil profile is available. For proper interpretation of this test, soil organic matter, soil texture, the crop to be grown, and the expected yield level all need to be considered. Accurate estimates of S needs cannot be made from a surface sample alone. Since sulfate is mobile, sampling to a 24-inch depth is important. However, due to the relatively high demand for S during the rapid vegetative growth phase of wheat, and relatively shallow rooting by the wheat crop at this time, the S measured in the deeper, subsoil levels by the test may not be available to wheat in the early spring, especially where soils are cold.

Choosing a fertilizer material

There are many S-containing fertilizer materials. Several dry materials are available that can be blended with dry phosphorus or nitrogen fertilizers for winter/spring topdressing. However, some of these products are best used in preplant applications.

Dry S-containing fertilizers:

- Elemental S (typically 90-95 percent S) is a dry material marketed by several manufacturers. Before it becomes available for plant uptake, elemental S must first be oxidized by soil microorganisms to sulfate. This can be a slow process when surface-applied. As a result, elemental S is not well suited for corrective applications to S-deficient wheat in the spring, due to the time required for oxidation to sulfate.
- Ammonium sulfate, AMS (21-0-0-24S) is a dry material that is a good source of both N and S. However, it has high acid-forming potential and soil pH should be monitored. Ammonium sulfate is a good source to consider for either preplant or topdressing to correct existing sulfur deficiencies.
- Gypsum (analysis varies) is calcium sulfate and is commonly available in a hydrated form containing 18.6 percent S. This material is commonly available in a granulated form that can be blended with other materials. Since it is a sulfate source, it would be immediately available and is another good source for spring topdressing. However, gypsum is not as water soluble as many fertilizer materials such as ammonium sulfate.
- New N-P-S products such as Microessentials, 40-rock and others that are typically ammonium phosphate materials formulated with S, and in some cases micronutrients such as zinc. In most of these products the S is present as a combination of elemental S and sulfate.

Liquid S-containing fertilizers:

- Ammonium thiosulfate, ATS, (12-0-0-26S) is the most popular S-containing product used in the fluid fertilizer industry as it is compatible with N solutions and other complete liquid products.

- Potassium thiosulfate, KTS, (0-0-25-17S) is a clear liquid product that can be mixed with other liquid fertilizers.

Topdressing with thiosulfate and UAN can be done early, before Feekes 5 growth stage (green up), and at temperatures below 70 degrees F. Be aware that some leaf burn may be expected with some of these liquid fertilizers. These products would be good sources for pre-plant application as well.

For more information see *Sulfur in Kansas*, K-State publication: MF-2264, <http://www.ksre.ksu.edu/bookstore/pubs/MF2264.pdf>

For estimations of required application rates of S see *Soil Test Interpretation and Fertilizer Recommendations*, K-State publication MF-2586
<http://www.ksre.ksu.edu/bookstore/pubs/mf2586.pdf>

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2. Kansas disease summary for 2018 - Corn, soybeans, and sorghum

Here is a summary of the most prevalent diseases in corn, soybeans, and grain sorghum in Kansas during the 2018 growing season.

Corn Diseases

Early- to mid-season drought followed by heavy rainfall in August and early September led to an interesting complex of problems for the 2018 Kansas corn crop. In many parts of the eastern half of the state, drought was so severe that fields failed to set ears. For those that did, *Aspergillus* ear rot infection was common (Figure 1), with incidence levels ranging from zero to over 80% in one Miami County field. Many aflatoxin tests were above the 20-ppm level considered safe for human consumption, but well below the maximum usage rate of 300 ppm. A Kansas State University veterinarian indicated there was some aflatoxicosis reported in Kansas livestock. Late-season rains allowed for the development of *Fusarium* ear rot, which produces the mycotoxin, fumonisin. While levels were generally below those considered safe for cattle, veterinarians reported some fumonisin-related deaths in horses and hogs.



Figure 1. *Aspergillus* ear rot has a characteristic yellow-green color (left) and *Fusarium* ear rot often has a distinctive starburst pattern (right). Photo provided by Doug Jardine, K-State Research and Extension.

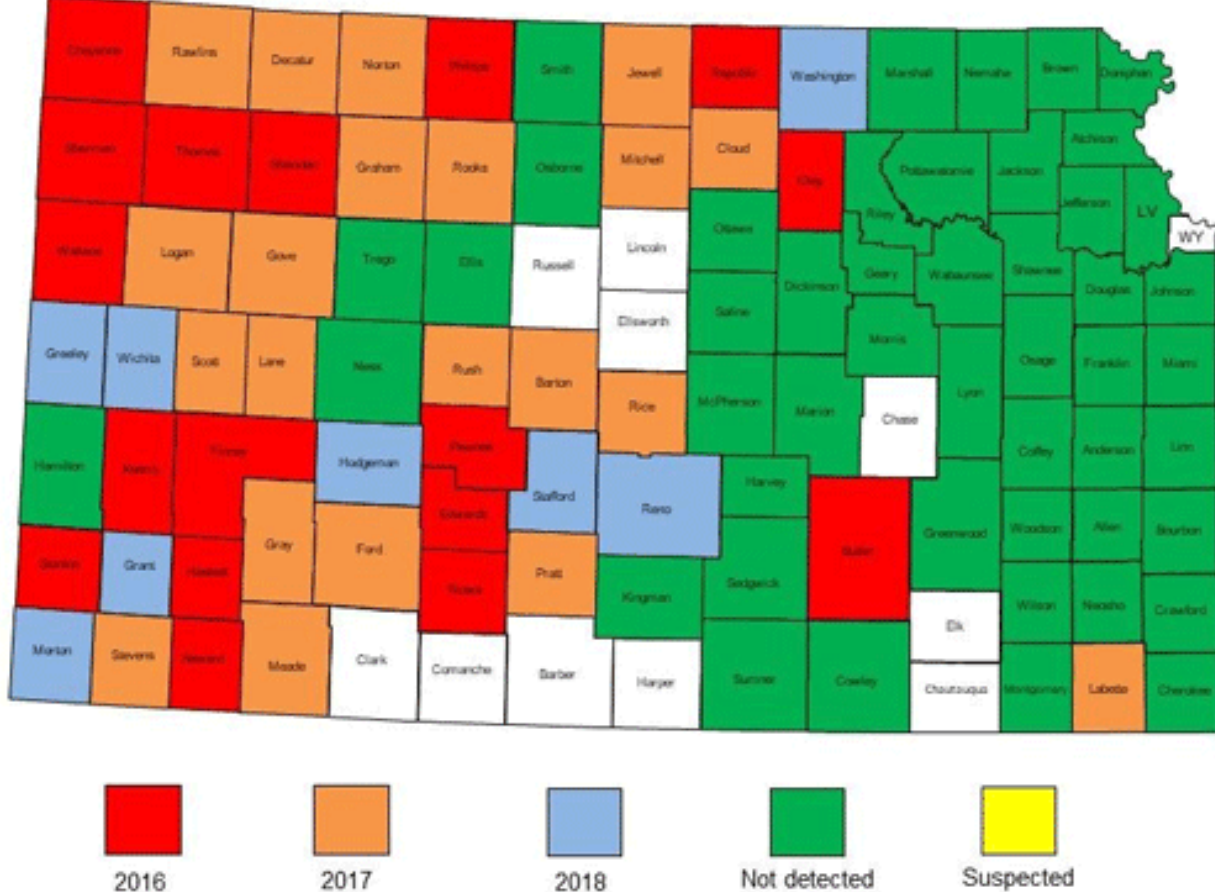
Gray leaf spot levels in 2018 were generally below treatable levels at tasseling, when fungicide decisions needed to be made, but increased rapidly in late-season when cloudy weather with frequent heavy rains occurred. Overall, losses were near the long-term average.

Eight new counties were added to the list of counties confirmed to have bacterial leaf streak, bringing the state's total to 46 (Figure 2). A few cases of Goss's bacterial blight and *Diplodia* ear rot were also reported from western Kansas. On a positive note, southern rust incidence and severity

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Stalk rot losses were above-average in 2018. *Fusarium* stalk rot was by far the predominant disease found in grower fields, but charcoal rot and anthracnose stalk rot were all reported in various reporting districts, especially in the eastern half of the state where weather patterns were most favorable for stalk rot development (Figure 3).

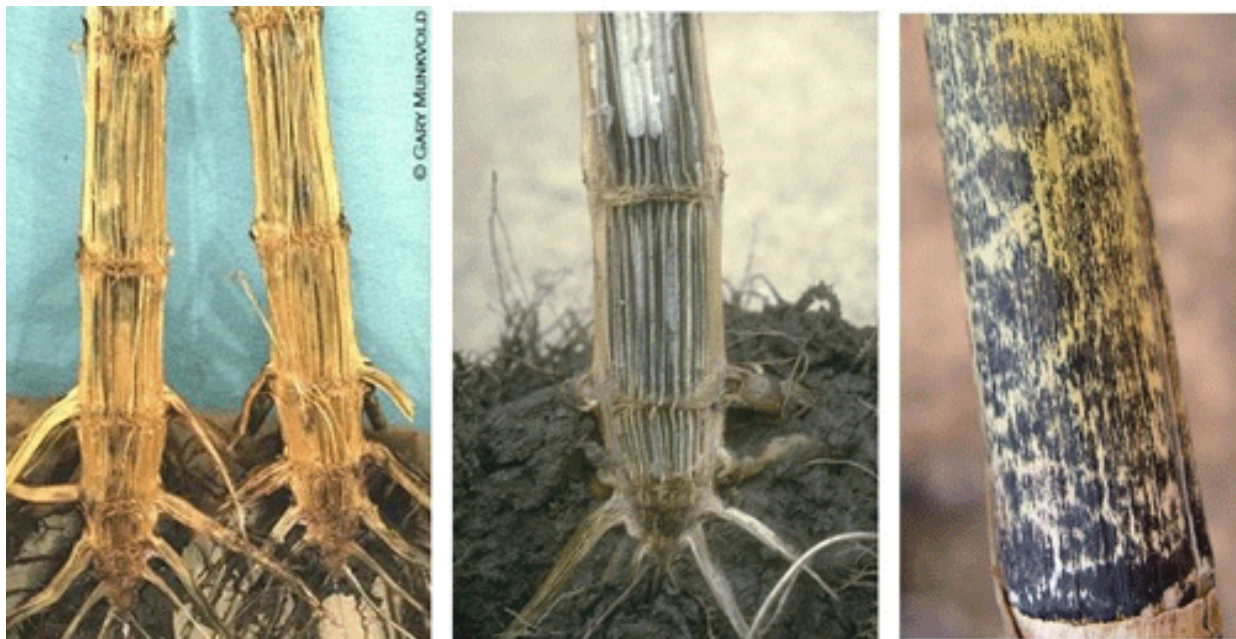


Figure 3. Fusarium stalk rot (left), charcoal rot (middle), and anthracnose stalk rot (right). Photo credits Gary Munkvold, Iowa State University (left), Doug Jardine, K-State (middle), Pioneer Seeds (right).

Soybean diseases

The mid-season drought made conditions favorable for charcoal rot, but late-season rains allowed the avoidance of that problem but created several more. Heavy August rains caused the development of late-season *Phytophthora* root rot problems, which resulted in premature death in many fields (Figure 4). This premature death likely reduced yields by 10 percent or more in affected fields (Figure 5).



Figure 4. A north central Kansas soybean field where drier terrace tops remained healthy while areas between terraces died prematurely from *Phytophthora* root rot. Photo by Doug Jardine, K-State Research and Extension.



Figure 5. Phytophthora infected roots (right) from a center pivot irrigated field in north central Kansas and healthy roots (left) from the non-irrigated corner of the same field. Photo by Doug Jardine, K-State Research and Extension.

The late-season rains also brought on sudden death syndrome symptoms, but because of the lateness and the adoption of ILeVO seed treatment, losses were below long-term averages. Frogeye leaf spot developed in September and later-planted fields of susceptible varieties that were not treated with a fungicide likely suffered yield losses (Figure 6).



Figure 6. Frogeye leafspot lesions. Photo by Doug Jardine, K-State Research and Extension.

The most serious problem in the 2018 Kansas soybean crop developed late in the year. August and October rains allowed the development of several late-season stem and pod diseases, including pod and stem blight, purple seed stain, and anthracnose (Figure 7). Because these diseases reduce seed quality, many loads of soybeans were docked heavily at elevators or simply refused.



Figure 7. Pod and stem blight (left), purple seed stain (middle), and anthracnose (right) are late-season diseases that reduce yield and quality. Photos by J.B. Sinclair, University of Illinois (left); Doug Jardine, K-State (middle); Darren Mueller, Iowa State University.

Sorghum Diseases

The 2018 Kansas sorghum crop was healthier than any in recent memory. Sooty stripe levels were high in a few south-central Kansas fields, but generally less than in the past two years (Figure 8).



Figure 8. Sooty stripe developing in the lower canopy of grain sorghum. Photo by Doug Jardine, K-State Research and Extension.

Late-season rains caused an increase in head molds, but overall, incidence was relatively low. Like corn, the most significant sorghum disease in 2018 was Fusarium stalk rot. Reports of late-season lodging were few, however.

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3. The creeping trends of a changing climate

This article concludes a 4-part series focusing on agriculture, climate, and change. The first three articles in the series, "Is Kansas agriculture likely to be affected by a changing climate?", "A brief on global research on drought monitoring", and "Water, temperature, and crop productivity research" can be found on the [eUpdate website](#) in Issues 710, 712, and 713, respectively.

Like the proverbial frog in the heating pot of water, we may not notice the creeping trends of a changing climate. Farmers in the semi-arid Central High Plains encounter dramatic year-to-year fluctuations in weather patterns, which tend to overwhelm the long-term trends. We are just learning how to recognize and interpret long-term climate signals, such as the El Nino-Southern Oscillation (fluctuations in the surface temperatures of the equatorial Pacific Ocean). *What has to be done to ensure global food security in the face of these changes?*

Semi-arid cropping systems include 19.5 million acres of winter wheat production in regions such as the western U.S., Argentina, western and central Asia (Figure 1); here the evaporative demand for water can exceed annual precipitation by three to five times.

Is there opportunity to increase crop productivity, given limited and untimely water supply? Two approaches include: improving crop water productivity and increasing stress tolerance of critical processes such as ovule fertilization by pollen.

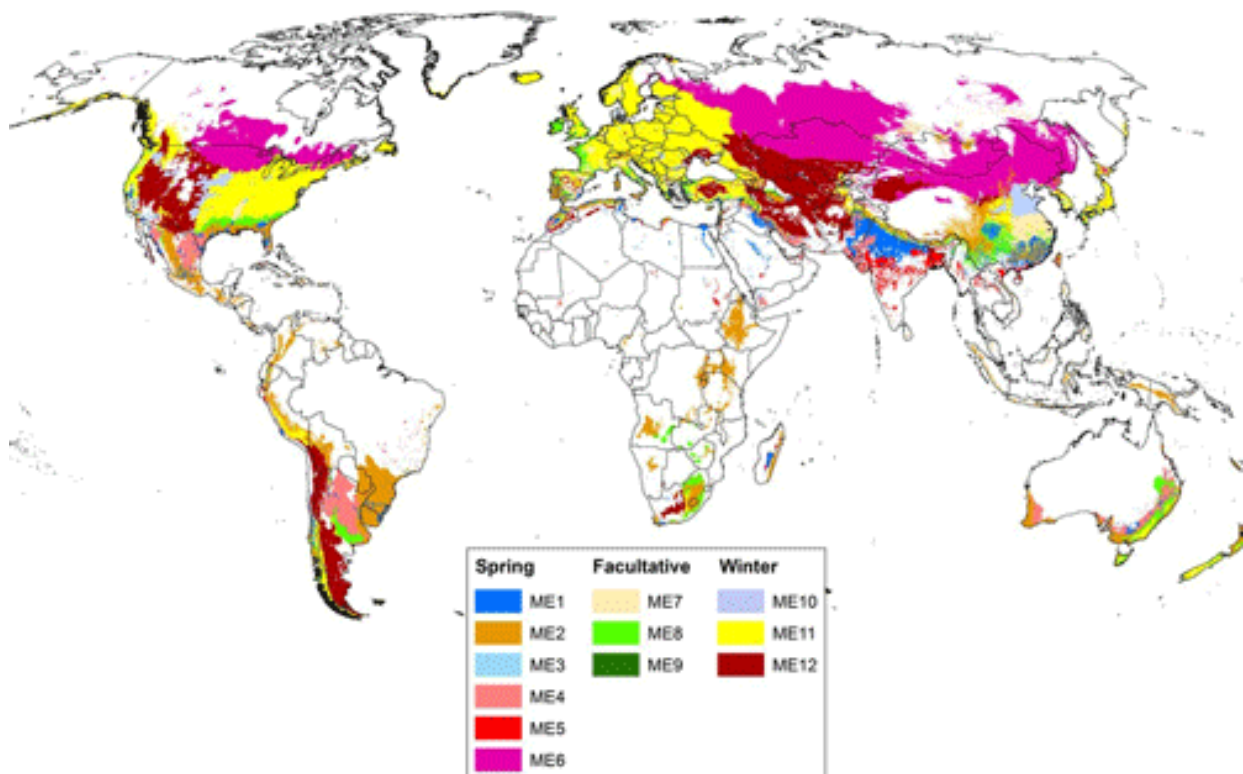


Figure 1. Mega-environments (ME) identified by the International Maize and Wheat Improvement Center (CIMMYT). The water-limited ME12 includes 19.5 million acres of winter wheat production, sustaining over 140 million persons. Sonder, Kai, 2016

The fundamentals of carbon-water exchange, which underlie crop water productivity, are ‘managed’ by leaf stomata—openings that allow carbon dioxide (CO₂) entry to leaf biochemistry as well as the exit route for water vapor diffusing into the atmosphere. This linked diffusion of CO₂ and water vapor supports the theory that the carbon-water exchange rate is closely regulated, affected by biochemistry and atmospheric humidity.

Greenhouse and field studies (Xin et al., 2009; Narayanan et al., 2013) indicate that sorghum cultivars do differ in carbon-water exchange rates (Figure 2) with parallel differences in radiation use efficiency (Figure 3). Current results from Eastern Colorado indicate corn requires approximately 2,500 gallons of water per bushel. Improving crop water productivity may reduce this water requirement (Mowitz, 2012). This evidence supports accelerated investigations into the mechanisms driving differences in plant carbon-water exchange rates as well as development of high-throughput screening tools to identify desirable germplasm.

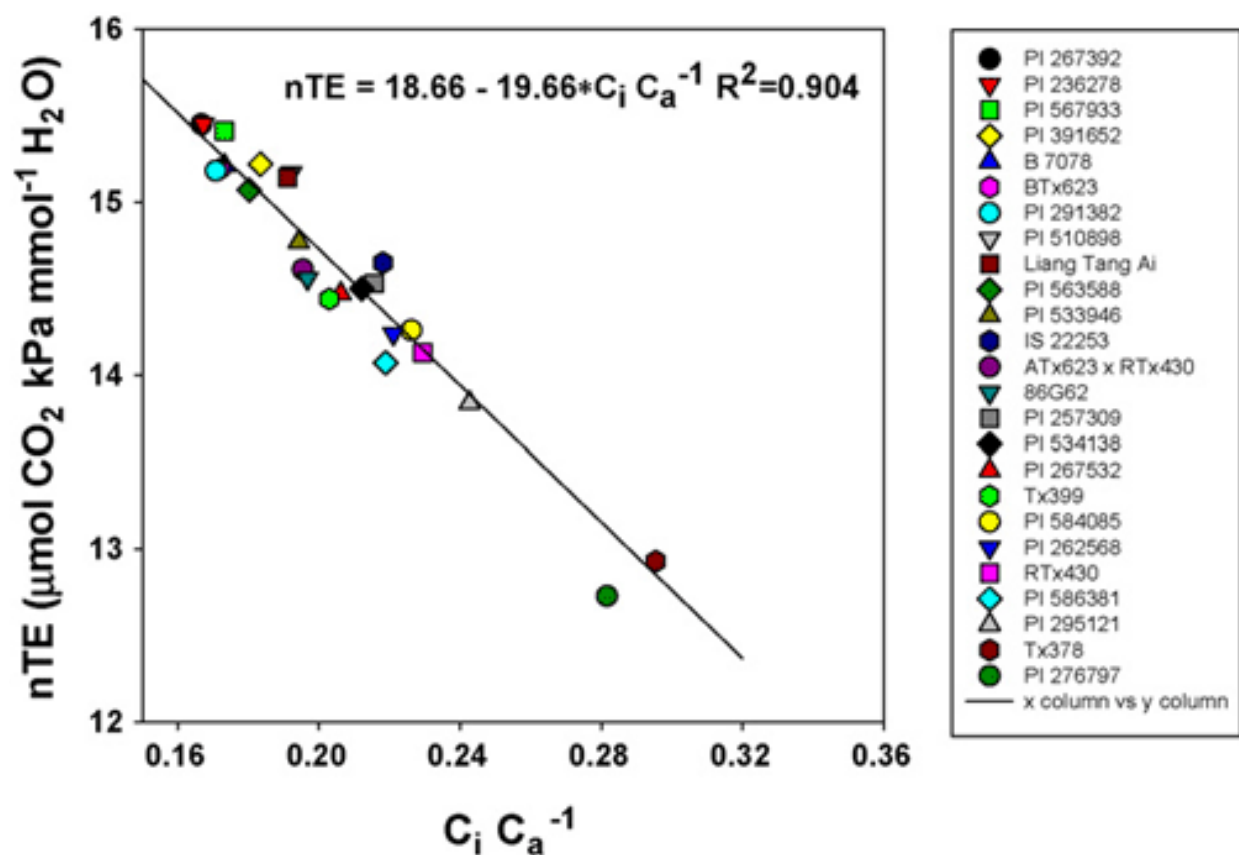


Figure 2. Evidence that sorghum cultivars can differ in the carbon-water exchange rate. Here, instantaneous transpiration efficiency (nTE), normalized by vapor pressure deficit (VPD)—a measure of atmospheric aridity, is shown in relation to the ratio of leaf internal CO₂ concentration to air (C_i/C_a). This scaling relationship taken from Xin et al., 2009.

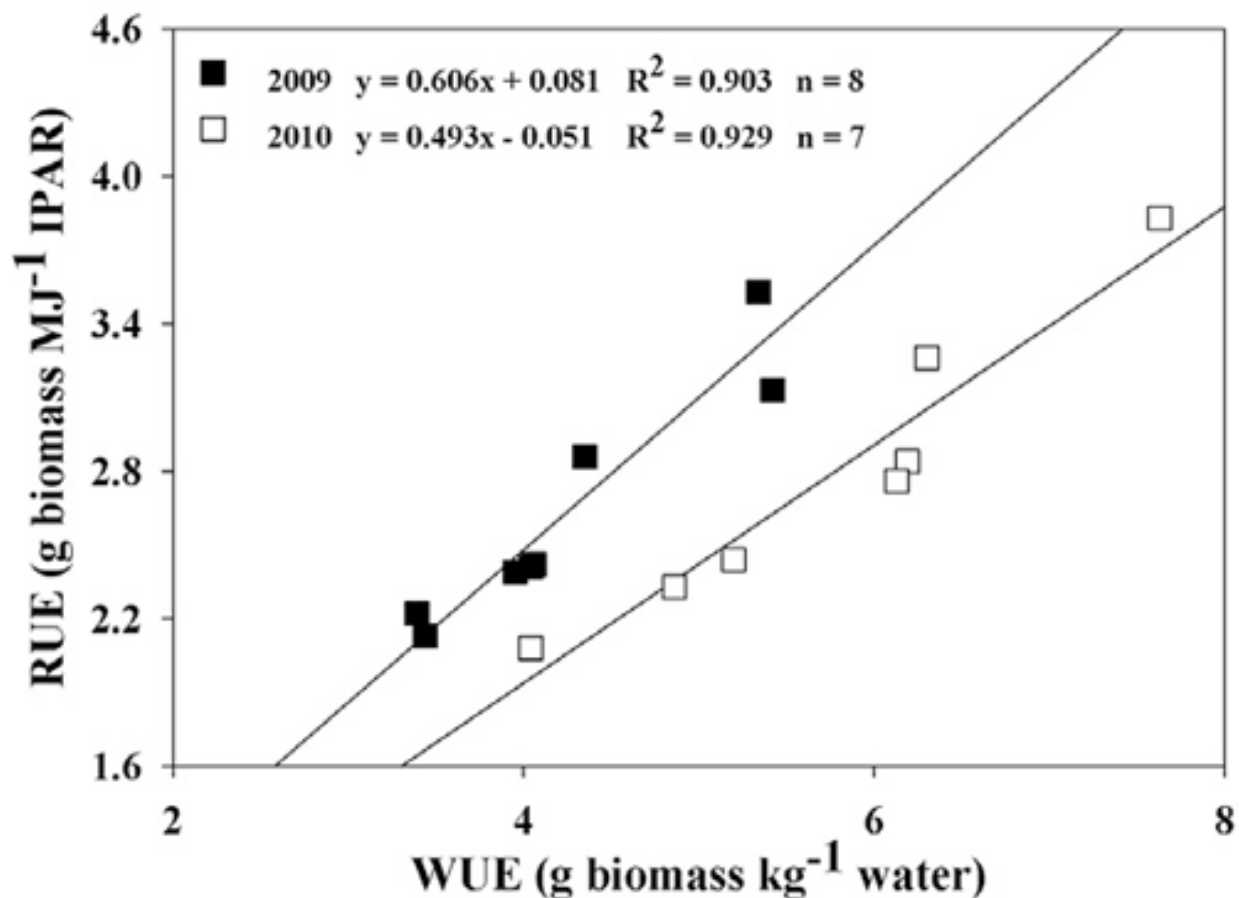


Figure 3. Field evidence that sorghum cultivars differ in biomass productivity in relation to use of water and radiation. Relationships are shown between water use efficiency (WUE) and radiation use efficiency (RUE) among sorghum genotypes; WUE was derived as the slope of the regression of aboveground biomass on cumulative water use, while RUE was derived as the slope of the regression of aboveground biomass on cumulative intercepted photosynthetically active radiation (IPAR). From Narayanan et al., 2013.

Our grain farmers need effective conversion of biomass—improved by WUE and RUE—into grain. Heat stress and water deficits impair pollen development and fertilization of ovules, resulting in the ‘seed-set’ required for grain production, according to studies conducted by researchers at the [Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification](#) (Dr. Vara Prasad, Director). Species of *Aegilops*, a relative of wheat, provide sources of genetic traits conveying heat and drought tolerance to pollen development and ovule fertilization (Pradhan et al, 2012). Scientists in the [Wheat Genetics Resource Center](#) are systematically integrating these traits with elite breeding lines, developing wheat varieties with increased stress tolerance.

Sustaining the increased crop productivity to provide global food security will require continued innovation, collaboration, and vision.

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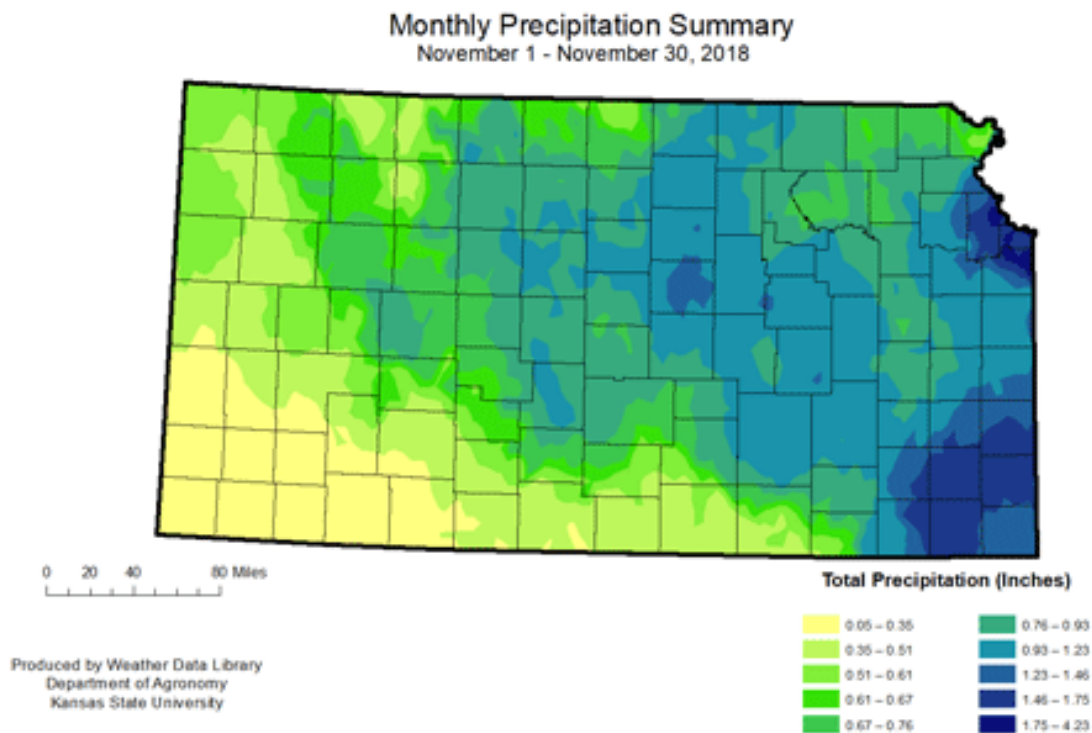
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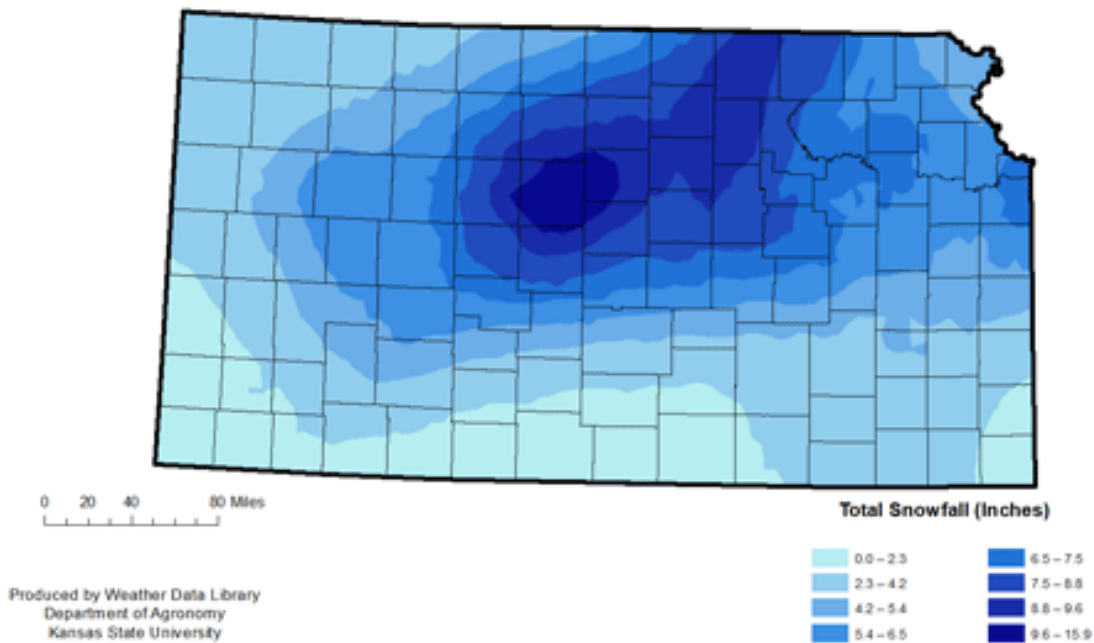
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4. Kansas weather summary for November - Cold and dry

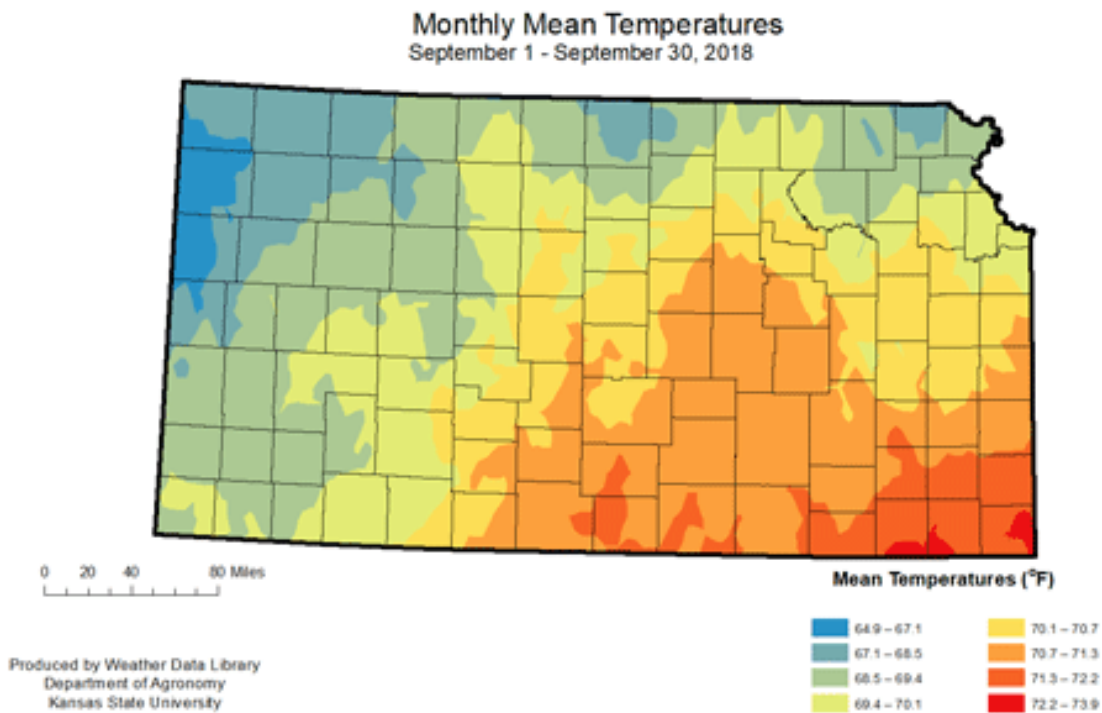
November was drier-than-normal across most of Kansas, providing a welcome relief to the very wet conditions in October. State-wide average precipitation was 1.26 inches, 89 percent of normal. The Southwest Division was the driest with an average of 0.35 inches. That is a deficit of 0.31 inches, or 53 percent of normal. The North Central Division was the wettest with an average of 1.99 inches, or 180 percent of normal. There were 8 new daily record rainfall totals, none of which set new records for any day in November. The highest 24-hour rainfall total for a National Weather Service (NWS) Cooperative station was 2.00 inches at Leavenworth 3SW, Leavenworth County, on November 26. The greatest 24-hour rainfall total for a Community Collaborative Rain, Hail and Snow (CoCoRaHS) network station was 1.28 inches at Courtland 0.1 SSE, Republic County, on the 27th. The greatest monthly precipitation totals for November: 4.23 inches at Leavenworth 3SW, Leavenworth County (NWS) and 2.05 inches at Erie, Neosho County (CoCoRaHS). Not all precipitation was in the form of rainfall. A total of 240 stations reported snowfall in November, with monthly totals ranging from trace amounts in southern Kansas to 17.3 inches at the CoCoRaHS station of Morrowville 4.8 SSW, Washington County.



Monthly Snowfall Summary November 1 - November 30, 2018



Despite some warm periods, November temperatures were cooler-than-normal. State-wide average temperature for the month was 37.5 degrees F, which is 5.0 degrees cooler-than-normal. In fact, all divisions were cooler-than-normal. The Northeast Division had the largest departure, with an average of 35.1 degrees F, or 7.1 degrees cooler-than-normal. The West Central Division came closest to normal with an average of 37.6 degrees F or 2.7 degrees cooler-than-normal. The variability showed in the range of temperatures. The warmest maximum temperature was 82 degrees F at Yates Center, Woodson County, on the 13th. The coldest minimum temperature at a NWS station was 1 degree F, recorded at Greensburg, Kiowa County, also on the 13th. There were no record daily high maximum temperatures for November, and 90 record daily low maximum temperatures. On the minimum temperature side, there was one record high minimum compared to 59 record low minimums.



Severe storm reports were limited to extreme southeastern Kansas in November. There was one hail report and six reports of wind damage. Severe winter weather was the main feature, with blizzard-conditions across most of the central and northern areas of the state on November 25-26. Sadly, there was one fatality when a stranded motorist attempted to walk to safety and died from exposure.

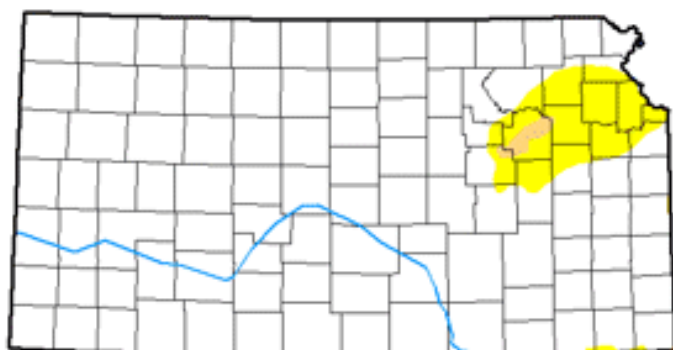
Despite the lower-than-normal precipitation, cooler-than-normal temperatures resulted in little change to the drought conditions. The area of Kansas that was drought free moved to 93 percent at the end of November. Moderate drought and abnormally dry conditions linger in the eastern parts of the state.

U.S. Drought Monitor Kansas

November 27, 2018

(Released Thursday, Nov. 29, 2018)

Valid 7 a.m. EST



Author:
Richard Heim
NCEI/NOAA



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

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	93.34	6.19	0.46	0.00	0.00	0.00
Last Week m-20-2018	93.48	6.06	0.46	0.00	0.00	0.00
3 Months Ago 08-28-2018	45.57	28.84	10.81	8.54	5.50	0.75
Start of Calendar Year 01-02-2018	0.00	67.30	23.95	8.75	0.00	0.00
Start of Water Year 09-25-2017	78.54	6.66	5.07	4.06	5.29	0.38
One Year Ago m-28-2017	52.88	31.79	15.33	0.00	0.00	0.00

Intensity:

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

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

The December outlook has increased chances for above-normal precipitation across most of the state. However, given the low normal precipitation at this time of the year, continued improvement is likely to be slow. The temperature outlook is for warmer-than-normal temperatures across all but the western edges of Kansas.

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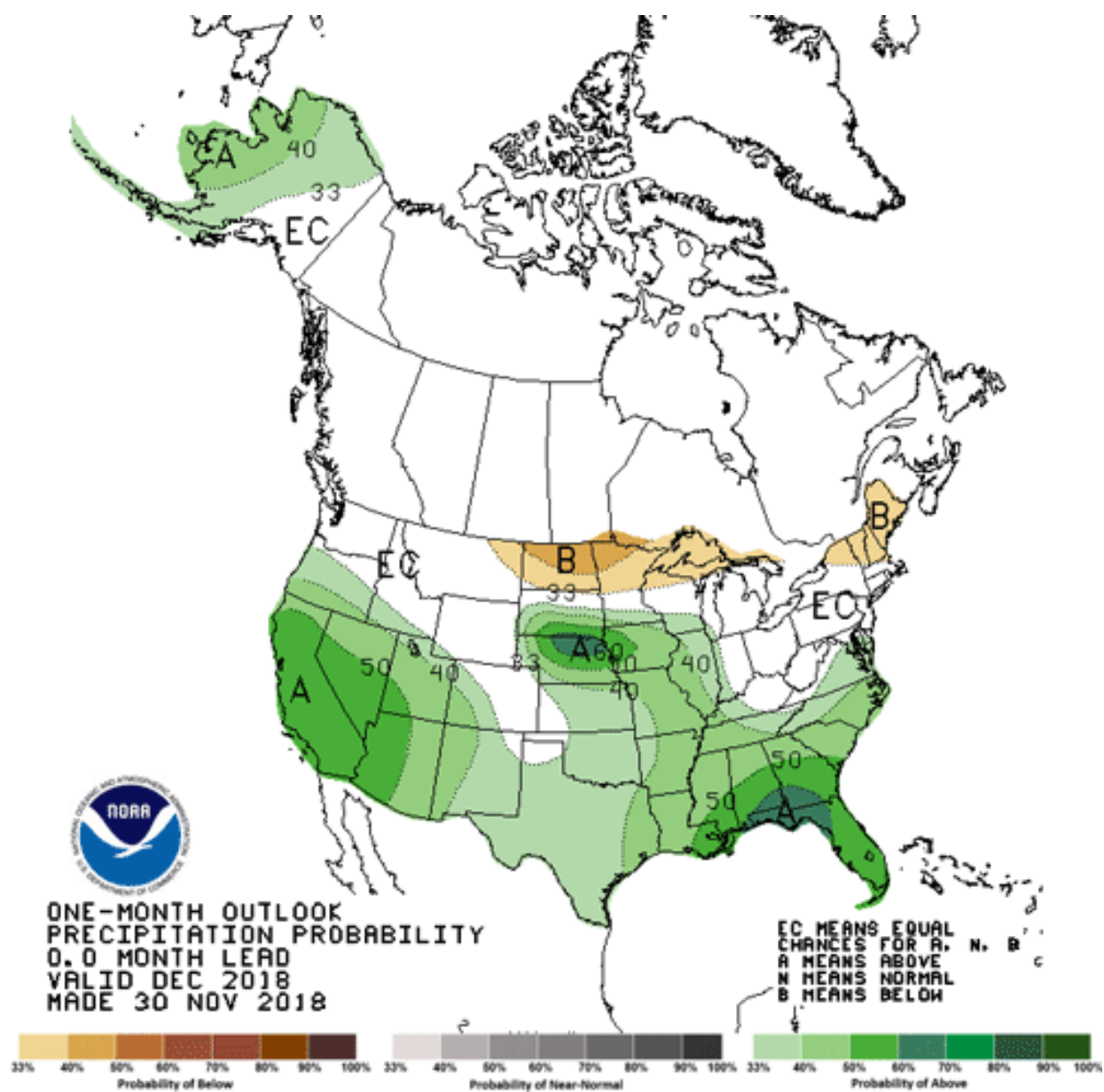


Table 1. Kansas Climate Summary										
November 2018										
	Precipitation (inches)						Temperature (°F)			
	November 2018			2018 through November					Monthly Extremes	
Division	Total	Dep. ¹	% Normal	Total	Dep. ¹	% Normal	Ave	Dep. ¹	Max	Min
Northwest	0.59	-0.23	72	22.82	2.03	110	36.1	-2.9	68	5
West Central	0.63	-0.16	80	24.25	4.11	120	37.8	-2.7	70	3
Southwest	0.35	-0.31	53	24.96	5.73	130	38.9	-3.9	74	3
North Central	1.99	0.76	162	31.68	4.52	117	36.1	-5.1	67	6
Central	1.86	0.62	150	31.75	3.39	112	37.7	-5.1	69	5
South Central	0.87	-0.62	58	34.77	4.57	115	39.4	-5.2	71	1
Northeast	1.77	0.00	100	32.83	-0.95	97	35.1	-7.1	65	7
East Central	1.75	-0.42	81	30.82	-5.70	84	37.1	-6.5	68	8
Southeast	1.85	-0.74	71	38.64	-1.04	97	39.5	-6.3	82	6
STATE	1.26	-0.16	89	30.45	2.10	107	37.5	-5.0	82	1
1. Departure from 1981-2010 normal value										
2. State Highest temperature: 82 °F at Yates Center, Woodson County, on the 13th.										
3. State Lowest temperature: 1 °F at Greensburg, Kiowa County, on the 13th.										
4. Greatest 24hr: 2.00 inches at Leavenworth 3SW, Leavenworth County, on the 26th (NWS); 1.28 inches at Courtland 0.1 SSE, Republic County, on the 27th (CoCoRaHS).										
Source: KSU Weather Data Library										

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5. Save the Date: K-State Soybean Schools scheduled for late January



A series of nine K-State Soybean Production Schools will be offered in late January to provide in-depth training targeted for soybean producers and key-stakeholders. The schools will be sponsored by the Kansas Soybean Commission.

The schools will cover a number of issues facing soybean growers including: irrigation, weed control, crop production practices, nutrient management and soil fertility, insects, and disease management. More information on specific speakers and topics will be provided in future eUpdate issues as agendas are finalized.

The dates are set and specific locations have been chosen with Schools located across the state.

Wichita, KS

January 15 (Tuesday) from 8:30 am to 1:00 pm (Jackie Fees, jfees@ksu.edu)

Parsons, KS

January 15 (Tuesday) from 3:00 to 7:00 pm (James Coover, jcoover@ksu.edu)

Paola, KS

January 16 (Wednesday) from 8:30 am to 1:00 pm (Katelyn Barthol, kbarth25@ksu.edu)

Holton, KS

January 16 (Wednesday) from 3:00 to 7:00 pm (David Hallauer, dhallaue@ksu.edu)

Hugoton, KS

January 24 (Thursday) from 8:30 am to 12:30 pm (Ronald Honig, rhonig@ksu.edu)

Scott City, KS

January 24 (Thursday) from 3:00 to 7:00 pm (John Beckman, jbeckman@ksu.edu)

Hoxie, KS

January 25 (Friday) from 8:30 am to 12:30 pm (Keith VanSike, kvan@ksu.edu)

Great Bend, KS

January 25 (Friday) from 3:00 to 7:00 pm (Stacy Campbell, scampbel@ksu.edu)

Beloit, KS

January 28 (Monday) from 9:00 am to 1:00 pm (Sandra Wick, swick@ksu.edu)

Lunch will be provided courtesy of the Kansas Soybean Commission. There is no cost to attend, but participants are asked **to pre-register by 1 week prior to the date they plan to attend**. Online registration is available at K-State Soybean Schools (<http://bit.ly/KSUSoybean>) or by emailing/calling the nearest local K-State Research and Extension office for the location participants plan to attend.

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6. Winter Forage Conference highlights pasture, rangeland, and forage insurance - Dec. 11

Kansas State University and the Kansas Forage and Grassland Council (KSFGC) will hold its Winter Forage Conference and KSFGC Annual Meeting on Tuesday, December 11, 2018, at the Anderson Building on the Lyon County Fairgrounds, Emporia, Kansas. Registration begins at 9:00 a.m. and the conference kicks off at 9:30 a.m.

“Making Pasture, Rangeland and Forage Insurance Work for You!” will be a one-hour, sponsored workshop, featuring Dr. Monte Vandever, Kansas State University, Extension Ag Economist and Jason Timmerman with the Silveus Insurance Group. “There’s been some recent policy changes that folks should be aware of, but Pasture, Rangeland and Forage Insurance can be a great risk management tool for grass and forage managers and we’re delighted to have these two knowledgeable speakers at the conference,” said Mark Nelson, KSFGC Executive Secretary-Treasurer.

Other program highlights include a farmer panel discussing Flint Hills Alfalfa Management, along with presentations by Dr. Dale Blasi on feed and forage quality testing and utilizing test results, Alan Tachman on fall burning for sericea control, and Dr. Leah Tsoodle on the Flint Hills Pasture Report.

Conference Registration is \$45 per farm (plus \$15 for each additional farm member), which includes the noon meal, subscriptions to both Progressive Forage Grower and Hay & Forage Magazines, along with membership to KSFGC, the American Forage and Grassland Council, and the National Alfalfa and Forage Alliance. If you’ve already renewed your KSFGC membership, admission is free.

Farmers and ranchers can learn more and register online at <https://ksfgc.org/wkfc/>. You can also RSVP and pay at the door by contacting either: Franklin County Extension at (785) 229-3520 or dhibdon@ksu.edu, or Lyon County Extension at (620) 341-3220 or brees@ksu.edu. To assist with planning and meal counts, please pre-register or RSVP by December 7, 2018, although walk-ins on December 11 will be welcome.

Please direct any question to Mark Nelson at info@ksfgc.org or 785-587-6103

The Kansas Forage and Grassland Council serves as an umbrella organization providing education and programs to strengthen the forage industry in Kansas. Member dues support educational meetings, such as this conference, along with other forage initiatives such as the FFA Forage Proficiency Award, the State Fair Market Alfalfa Show and support for the KSU Forage Judging Team.