Issue 624

Extension Agronomy

eUpdate

04/07/2017

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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eUpdate Table of Contents | 04/07/2017 | Issue 624

1. Weed control strategies in grain sorghum

Severe grass and broadleaf weed pressure will reduce grain sorghum yields and can make harvest very difficult. Good crop rotation and herbicide selection are essential components of managing weeds in grain sorghum.

Controlling weeds prior to planting: Burndown and soil-applied residuals

In a wheat-sorghum-fallow rotation, it is essential that broadleaf and grassy weeds do not produce seed during the fallow period ahead of grain sorghum planting. Always control those summer annual weeds after wheat harvest soon enough to prevent seed production. It is equally important that winter annual grasses and broadleaf weeds are not allowed to head/flower in spring, producing seed before the sorghum is planted. Most winter annuals produce seed in April and early May.

If you are anticipating problems with glyphosate-resistant pigweeds, it may be very important to include in the April burndown treatment a soil residual product. This can help minimize pigweed (Palmer amaranth and waterhemp) emergence in late April and May, prior to planting sorghum. A pound of atrazine may provide the needed protection unless the pigweed population is atrazine resistant. Atrazine + chloracetamide herbicides can be used effectively, however.

The Valor label allows the use of 2 oz product/acre applied 30 days or more prior to sorghum planting. It is essential that at least one inch of precipitation fall during the window between Valor application and sorghum planting. Valor will control glyphosate-resistant and triazine-resistant pigweeds as it has a different mode of action than glyphosate and atrazine.

An effective burndown prior to planting is essential if any weeds have emerged. Sorghum should always be planted into a weed-free seedbed. The addition of a dicamba product or 2,4-D with glyphosate generally will control broadleaf and grass weeds effectively, provided an earlier burndown treatment has been applied in March or April. There is a waiting period of 15 days between application and sorghum planting when using 8 fl oz of Clarity. Current 2,4-D labels do not address a waiting period ahead of planting sorghum; however, for corn or soybeans a 7-day waiting period is required for 1 pint or less of 2,4-D ester when used in the burndown.

In sorghum, the best choice of herbicides will depend on the weed species present. Broadleaf weeds generally can be controlled with a combination of preemergence and postemergence applied herbicides. With the development of herbicide-resistant weeds, however, complete weed control is becoming increasingly difficult.

Control of pigweeds in sorghum is an increasing concern across the state. Using a soil-applied chloracetamide herbicide with atrazine (such as Bicep II Magnum, Bicep Lite II Magnum, Outlook + atrazine, Degree Xtra, Fultime NXT, or generic equivalents of these products) will greatly enhance controlling pigweeds. Some of the broadleaf escapes producers can expect when using the chloracetamide/atrazine mixtures are devilsclaw, puncturevine, velvetleaf, morningglory, and atrazine-resistant kochia.

The addition of 10 oz of Verdict, which is a mix of 2 oz of Sharpen and 8.3 oz of Outlook, with a chloracetamide/atrazine herbicide can help control triazine-resistant pigweeds and kochia, and control large-seeded broadleaf weeds such as velvetleaf, morningglory, sunflower, and others. The chloracetamide/ atrazine herbicides will do a very good job of controlling most annual grassy weeds.

Using a product such as Lumax EZ or Lexar EZ, which contains mesotrione (Callisto), preemergence will help control triazine-resistant pigweeds and kochia. With the lower price of generic herbicides, these treatments are becoming very economical.

A weakness of all soil-applied programs is that precipitation is required for activation. Without activation, poor broadleaf and grass control can be expected. Once precipitation is received, the herbicides are activated and weed control measures are in place. Weed escapes prior to this activation will need to be controlled with postemergence applied herbicides.

Grass control

Grass control in sorghum can be a difficult task in some cases. If a field has severe shattercane or longspine sandbur pressure, planting grain sorghum is not recommended. For other annual grassy weeds, it will be important to apply one of the chloracetamide herbicides. Grasses that emerge before the soil-applied herbicides are activated will not be controlled. There are no herbicides currently labeled for postemergence grass control in conventional grain sorghum. Although atrazine and Facet L have grass activity and can control tiny grass seedlings, it's generally not a good practice to depend on these herbicides for grass control. Facet L is the new liquid formulation of quinclorac (previously Paramount 75 DF) and has excellent activity on field bindweed.

A new technology for grass management is Inzen sorghum, a non-GMO type of sorghum. Growing Inzen sorghum will allow the use of nicosulfuron (an ALS grass herbicide) applied postemergence to control labeled annual grasses when they are small. This technology will likely not be commercially available until the 2019 growing season at the earliest, however. An article titled "Status of new ALS-resistant Inzen sorghum technology" in Agronomy eUpdate No. 621, March 24, 2017, provides a current update on this topic.

Postemergence options

Postemergence broadleaf herbicides for sorghum are most effective when applied in a timely manner. Weeds that are 2-4 inches tall will be much easier to control than weeds that are 6-8 inches tall, or larger. Controlling weeds in a timely manner will result in less weed competition with the crop compared to waiting too long to control the weeds. Atrazine combinations with Huskie, Banvel, 2,4-D, Buctril, or Aim (or generic versions of these herbicides) can provide excellent broad-spectrum weed control.

Figure 1. Atrazine + 2,4-D ester applied too late to provide adequate Palmer amaranth control. The application was made to 20” Palmer amaranth and 20” sorghum on July 6. Photo by Curtis Thompson, K-State Research and Extension.

Huskie should be applied at 12.8 to 16 fl oz/acre with 0.25 to 1.0 lb of atrazine, NIS 0.25% v/v or 0.5% v/v HSOC (high surfactant oil concentrate), and spray grade ammonium sulfate at the rate of 1 lb/acre to sorghum from 3-leaf to 12 inches tall. Huskie alone, without atrazine, can now be applied to sorghum up to 30 inches tall prior to flag leaf emergence, however it will be less effective. Huskie is effective on kochia, pigweeds, and many other broadleaf weed species. Huskie is most effective on small weeds. The larger pigweed and kochia get, the more difficult they are to control. Temporary injury to sorghum is often observed with Huskie.

The presence of certain weed species will affect which postemergence herbicide programs will be most effective. See the grain sorghum section in the K-State *2017 Chemical Weed Control Guide* (SRP 1132) to help make the selection.

The crop stage at the time of postemergence herbicide applications can be critical to minimize crop injury. Delayed applications to large sorghum increase the risk of injury to the reproductive phase of grain sorghum, thus increasing crop injury and yield loss from the herbicide application. Timely applications not only benefit weed control, but can increase crop safety. Always read and follow label guidelines.

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2. Corn planting in Kansas: Status as of early April

Precipitation during the past week slowed down any initial progress in corn planting across the state. Soil temperatures for the week of March 31- April 6 remained similar as compared to the week before (March 26-31) – with temperatures slightly above to well below 55 F depending on the area of the state (Fig. 1). In addition, over the last week soil temperatures at the 2-inch depth decreased by 1 to 7 degrees F in many parts of the state (Fig. 2).

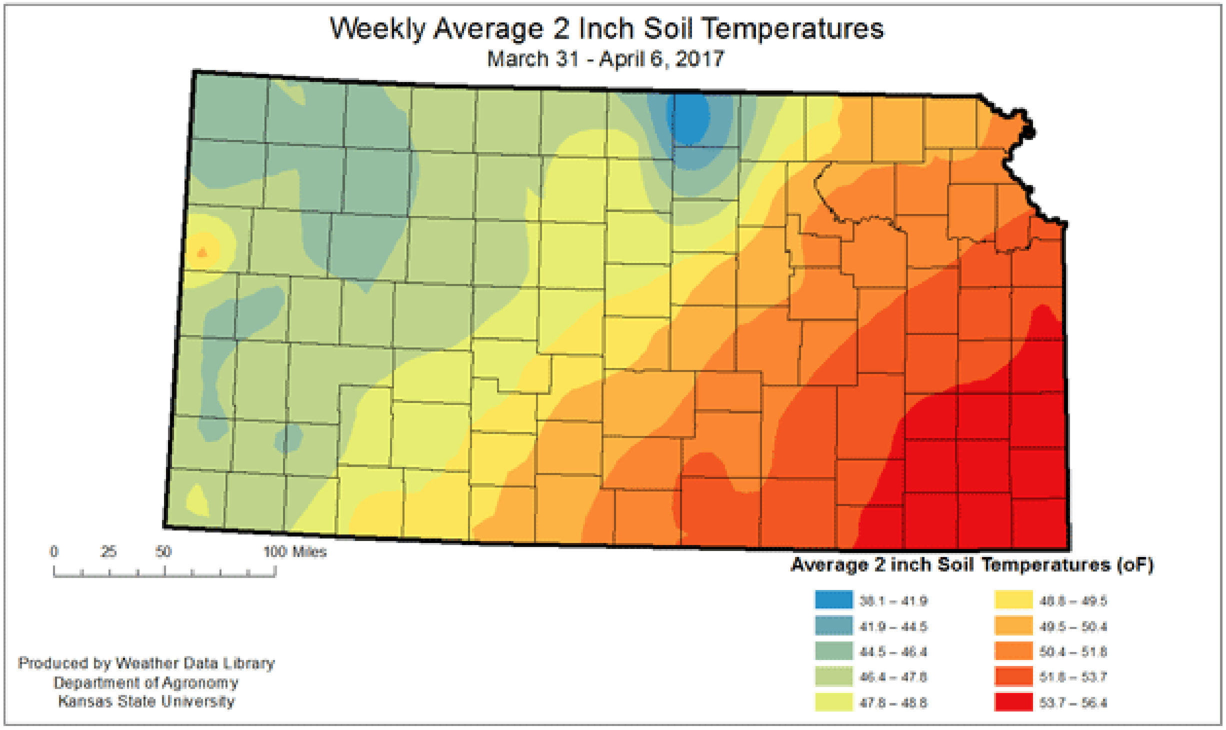

Figure 1. Average soil temperatures at 2-inch depth for the week of March 31-April 6, 2017.

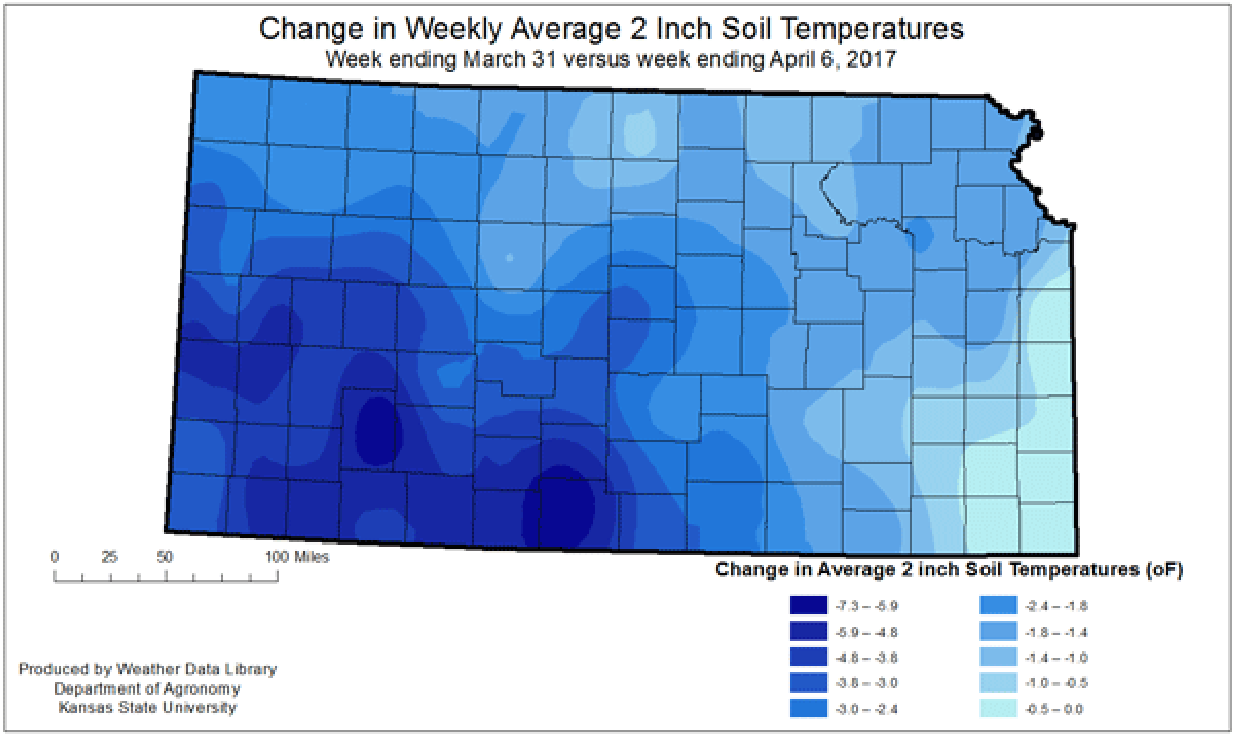

Figure 2. Changes in weekly average soil temperatures at 2-inch depth for the week ending April 6 vs. the week ending March 31.

The past 2-week precipitation summary is presented in Figure 3. Cumulative precipitation for the last 2 weeks was heavily focused on the eastern central part of the state, with total precipitation values higher than 6-inches in some areas. Several parts of the state have received more than 1 inch of precipitation over the past 2 weeks, with lower precipitation amounts in NC and NW Kansas.

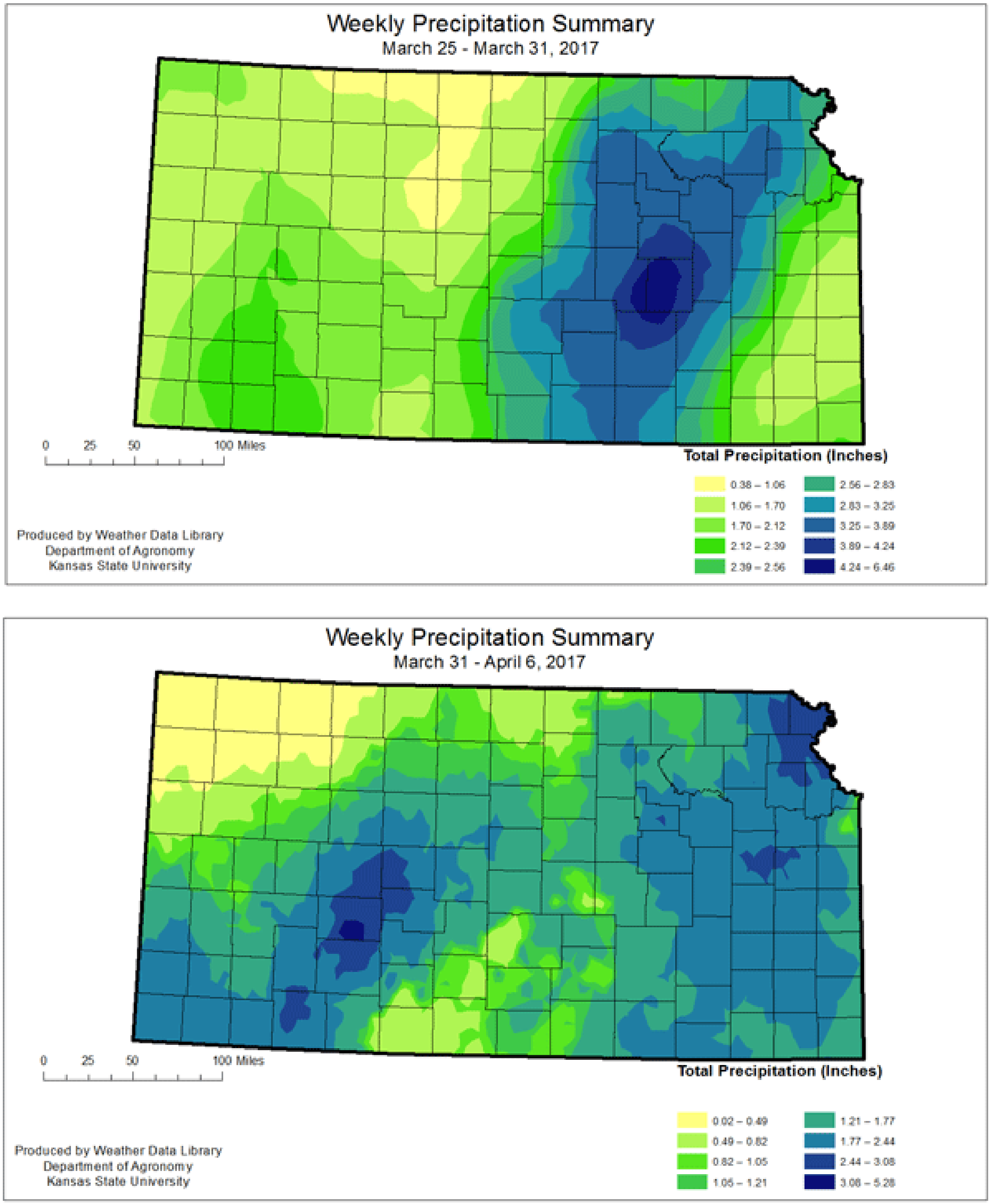

Figure 3. Weekly precipitation summary for the week of March 25-31 and March 31 - April 6, 2017.

The precipitation outlook for the medium-term outlook (8-14 day, April 14-20) calls for above-normal probabilities for precipitation for the entire state, as well as for most of the Corn Belt region (Fig. 4).

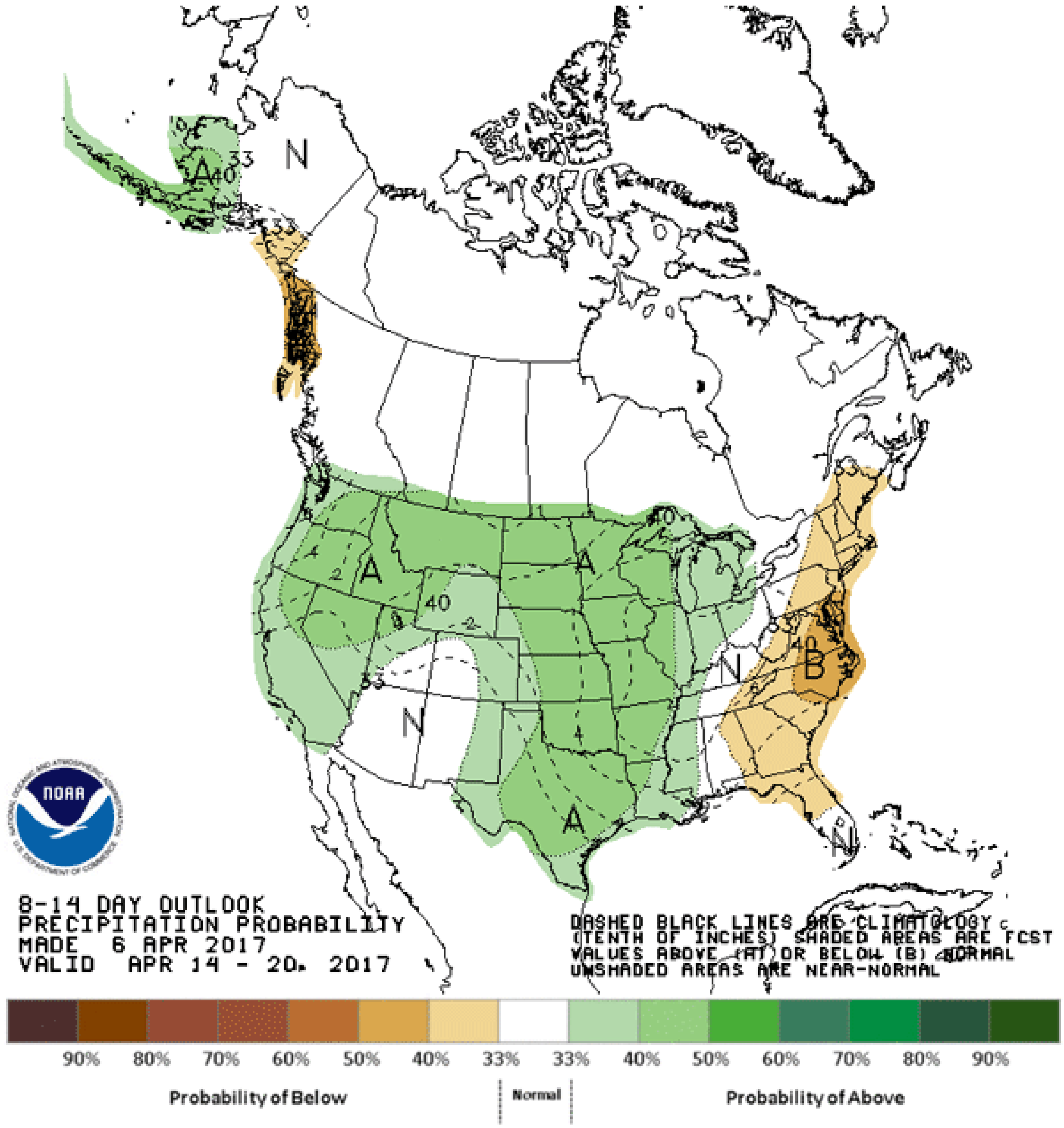

Figure 4. 8-14 Day Outlook Precipitation Probability from NOAA.

In the shorter term, next week's outlook is still dry for many sections of the state but with some probabilities of precipitation by the middle of next week.

As a reminder, soil conditions at planting have a large impact on emergence uniformity and early-season growth of corn. Lack of uniformity in emergence can greatly impact corn potential yields.

It looks possible or even likely that wet conditions seem will be affecting early planting of corn in many areas of the state for a while yet. If possible, wait and plant under more uniform soil temperature and moisture conditions to guarantee a more uniform early-season stand of plants.

More information about planting status of summer row crops will be provided in upcoming issues of the Agronomy eUpdate. Stay tuned!

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3. Early reports of stripe rust and leaf rust in wheat

Stripe rust: There have been some early reports of stripe rust in Kansas this week. The K-State Extension Team has been out scouting to help document its distribution in the state. To date, most of the reports of stripe rust have come from southeast Kansas where the crop is at boot and heading stages of growth (Figure 1). There have been a few reports of stripe rust in the south central region of the state. Wheat in this part of the state is at flag leaf emergence and approaching boot stages of growth. The disease is mostly in the lower or middle canopy at the moment but there are few reports of stripe rust in the upper canopy in the southeast.

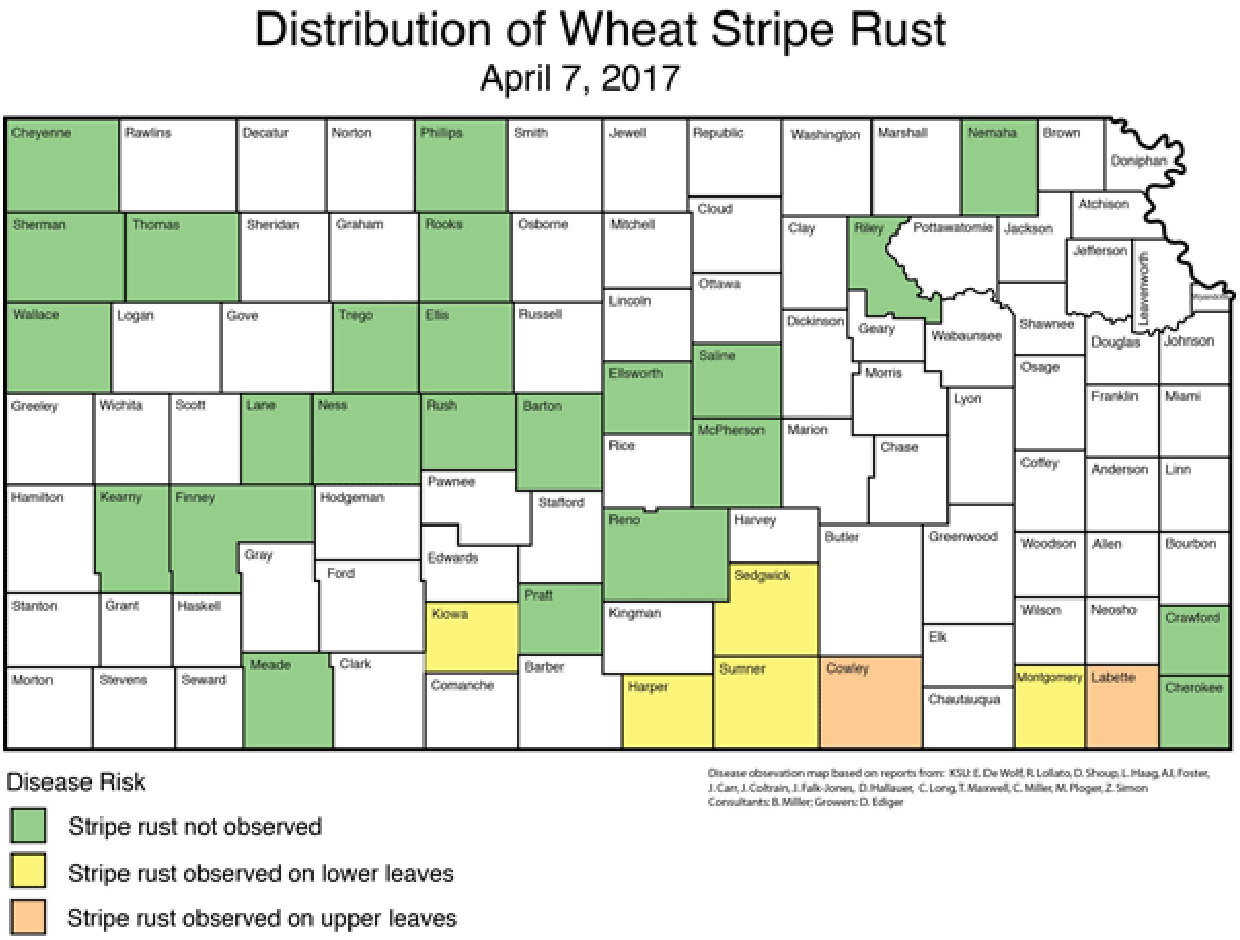

Figure 1

Outlook for severe stripe rust: The recent period of cool temperatures and frequent rainfall has been highly conducive for the continued spread of the disease. We will likely see more signs of disease continuing to show up over the next 14 days. What happens after this first wave of infections is critical to the development of an epidemic. The risk of severe disease and yield loss will increase if we get into another period of cool temperatures (44-55 degrees F) and frequent rains. Temperatures above 60 F at night often slow the development of stripe rust.

Leaf rust: We continue to hear reports of leaf rust in Oklahoma and Texas. The disease has caused some problems for growers in Texas and there are multiple reports of low to moderate levels of leaf rust in central Oklahoma as far north as Stillwater. We also received a report of leaf rust in wheat south of Wichita this week. We are still gathering information about this field but it appears that leaf rust is on the move in the state also.

Suggested action: It is critical that growers intensify their efforts to scout for stripe rust and leaf rust. Scouting priorities should include seed production fields, and general production fields with good yield potential that are planted to susceptible wheat varieties. Fields with stripe rust on the flag leaf or the leaf just below it (F-1) are at risk for serious yield loss and would be a candidate for fungicide application.

Information on fungicide options can be found at:
http://www.bookstore.ksre.ksu.edu/pubs/EP130.pdf

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4. Drought-tolerant corn hybrids: Yield benefits

In recent years, drought conditions have raised questions about the utilization of corn as the main crop for maximizing yield production per unit of available water in dryland environments.

Non-transgenic, conventionally bred, "drought-tolerant" (DT) corn hybrids from Pioneer and Syngenta were released to the market with the expectation of increasing corn production in water-limited regions. Monsanto also released biotech transgenic DT hybrids.

Overall, the information from seed companies indicates that DT hybrids could provide from 2 to more than 15 percent yield increase over "competitor hybrids" in non-limiting and water-limiting environments, respectively.

K-State research conducted over the 2012-2015 growing seasons across the state has recently been summarized, and this summary will soon be available in a new K-State Research and Extension publication (see the statements at the end of this article). The objective of this article is to present an overview of the DT vs. non-DT responses to management practices such as plant population and irrigation.

The information below is intended to provide some guidance to farmers, consultants, and agronomists in making the right decision for selecting corn hybrids. In addition, we hope to develop a better understanding of the kinds of environments in which DT hybrids could be most likely to result in a yield benefit. These hybrids are generally targeted for water-limited environments in the Western Great Plains.

Results

Our research compared DT hybrids from diverse companies with a standard non-DT counterpart of similar maturity. The tests also evaluated the yield response to varying plant population and irrigation levels.

At the plant scale, our analysis did not reveal any change in the plant response to plant population between DT and non-DT hybrids. This indicates no need to change plant population when using DT hybrids. This conclusion was briefly introduced in an article on corn seeding rates in the eUpdate dated March 14, 2014 (Agronomy eUpdate 445).

We also analyzed yields at the plot level for DT vs. comparable non-DT hybrids with similar maturity. The information presented in the figure below (Fig. 1) depicts the association of the yields for the DT vs. non-DT corn hybrids: Yellow points = research plots (2012-2013); blue points = on-farm plots; green points = 2014; red points = 2015 growing season plots.

Overall, the analysis found a yield benefit of 3 percent for DT vs. non-DT hybrids under diverse environments and stress conditions across Kansas during the 2012-2015 seasons. In absolute terms, the yield advantage of using DT hybrids was around 5 bushels per acre compared to the non-DT material. Similar yield trends were observed in research plots and on-farm demonstration plots. A great proportion of DT and non-DT yields were similar -- within a 5% confidence interval as highlighted in Figure 1 -- except in low-yielding and high-yielding environments. In low yielding-environments, DT out-yielded non-DT corn hybrids more often compared to the situation in higher-yield environments.

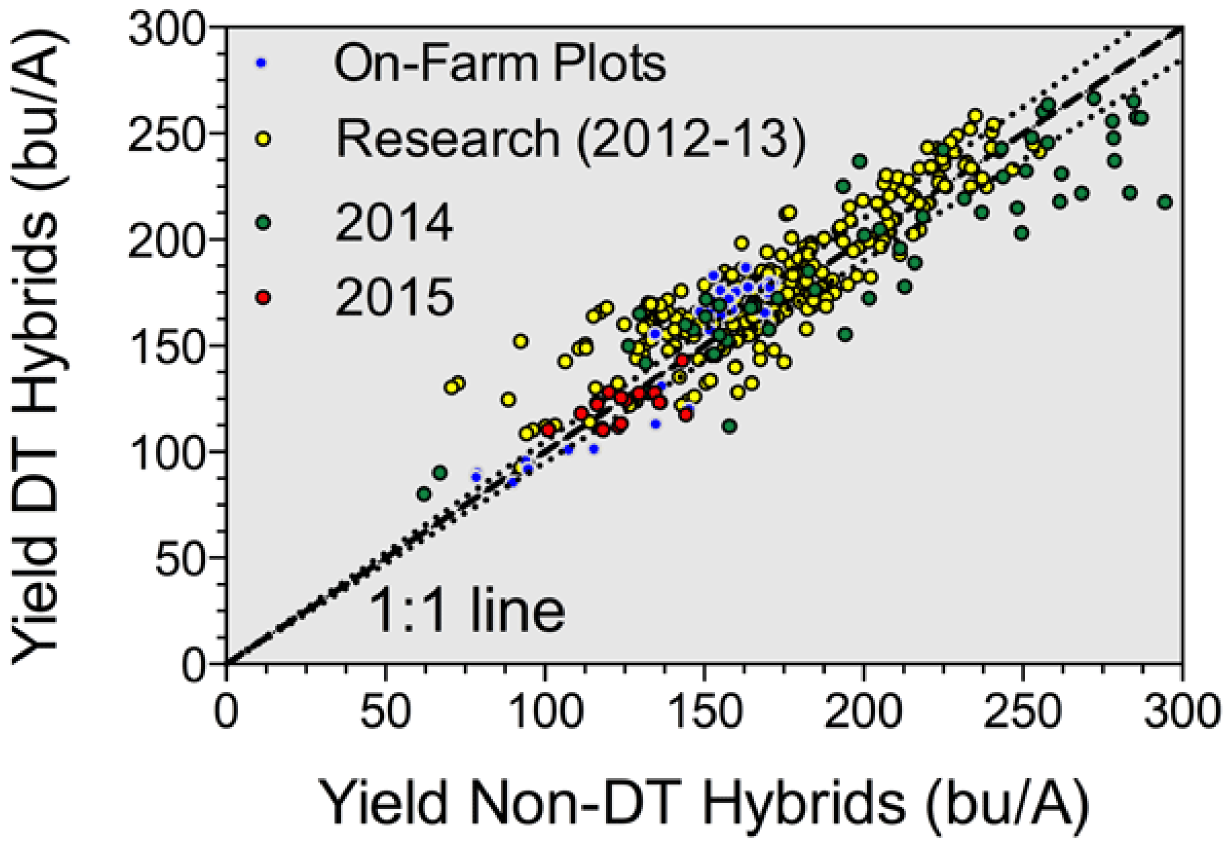

Figure 1. Yield for the DT versus non-DT corn hybrids across site-years for the 2012, 2013, 2014, and 2015 growing seasons.

DT vs. non-DT corn hybrids: Yield Environment Analysis

The analysis of information across diverse yield environments allows us to more clearly understand where there would be a yield advantage from planting DT hybrids. It is clear from Figure 2 that the yield advantage of DT corn hybrids increases as the yield potential of the crop decreases. This graph shows that there is basically no yield difference between DT and non-DT hybrids when yields are around 170 bushels per acre or greater. The yield advantage for DT hybrids gradually increases as the yield of the regular hybrids decreases from 170 bushels per acre.

It is important to note however, that these are generalized relationships, and that there are varied responses at each yield level. Some individual points show no difference between DT vs. non-DT hybrids at yields around 100 bushels per acre. Other points show a 30-bushel-per-acre yield advantage for non-DT hybrids at 160 to 170 bushels per acre, and still others show a 60-bushel-per-acre yield advantage for DT hybrids when non-DT hybrid yields were near 70 bushels per acre. On the opposite side of the yield environments, under high yield environments (>220 bushel-per-acre), individual points show a 30 to 60-bushel-per acre yield advantage for non-DT hybrids when DT hybrid yields were above 220 bushels per acre. How individual hybrids respond to a specific environment is influenced by a number of factors, including the timing and duration of the stress.

One more technical clarification is important to note. The linear response and plateau (LRP) function model fitted in Figure 2 (adjusted to the 2012-2013 data), presented an R^2 of 0.26 units, which can be interpreted to indicate that this model is accounting for only slightly more than one-fourth of the total variation presented in the data. Even when including observations from studies conducted in the last two years (2014-2015), the trend observed in the DT yield advantage versus the non-DT yield values (Fig. 2) is not being modified. From all these years of data collection and analysis we can conclude that there are many management factors involved in the yield results, which makes it difficult to separate out the effect of hybrid alone.

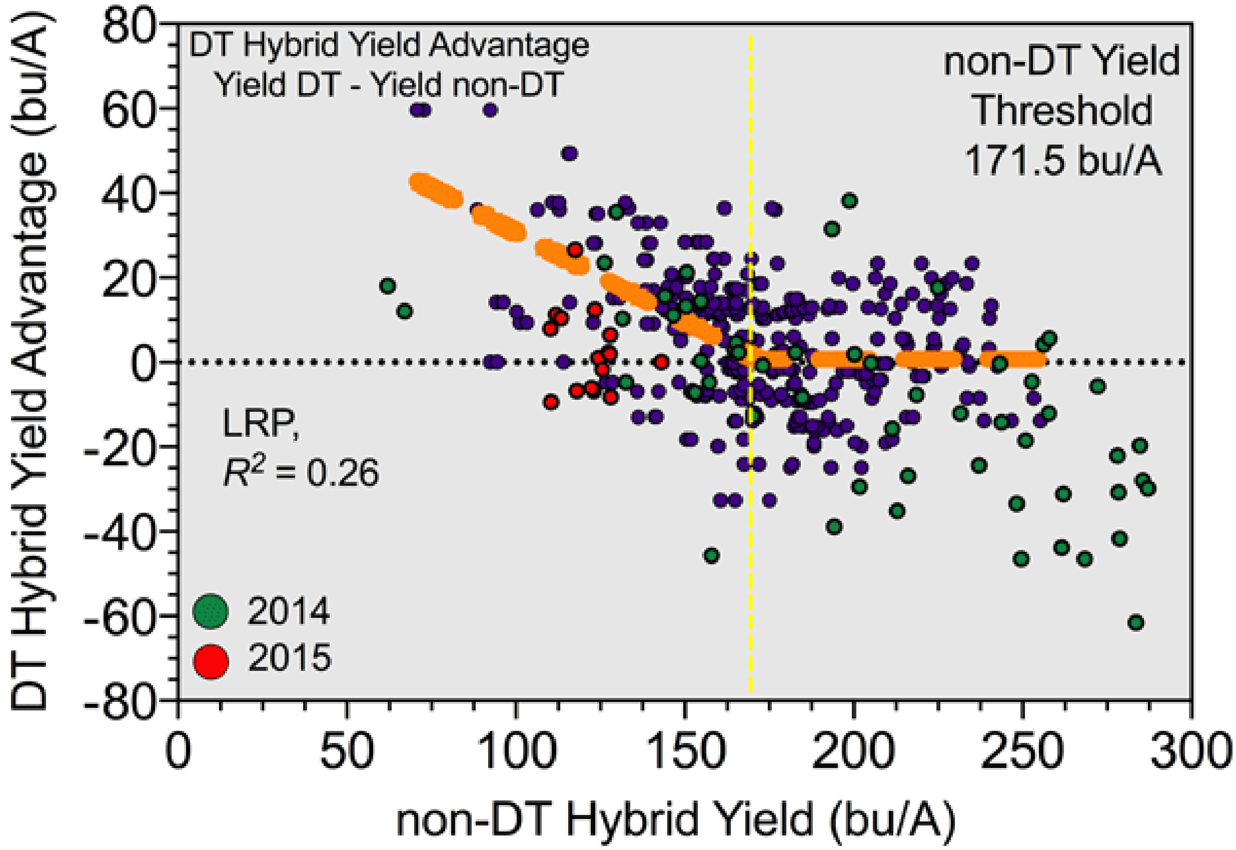

Figure 2. Yield advantage for DT compared to non-DT corn hybrids in the same environment and at the same population, ranging from low-yielding environments to high-yielding environments across site-years for the 2012, 2013, 2014, and 2015 growing seasons.

Still, we need to be cautious using and interpreting this information. More experiments and research data need to be collected, and a deeper understanding is needed to more properly analyze the main causes of the yield differences of DT vs. non-DT corn genotypes. Potential interpretations offered for the yield advantage for the DT corn hybrids in certain environments are:

- Slower vegetative growth, saving water for reproductive stages (stress avoidance)
- Greater root biomass with superior water uptake
- Differential regulation in the stomata opening, controlling water and CO_2 exchange processes
- Other potential physiological modifications

New K-State Research and Extension publication

A new publication titled *Drought-tolerant corn hybrids: Yield benefits* will soon be published by K-State Research and Extension. This publication is supported by Kansas Corn Commission.

This publication presents research information conducted by K-State Research and Extension to evaluate drought-tolerant hybrids in a wide range of production environments. We will let you know in a future issue of the Agronomy eUpdate when this publication is available.

K·STATE Research and Extension — Corn Fact Sheet Series

Drought-Tolerant Corn Hybrids: Yield Benefits

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Summary

General observations:

1) Performance of individual hybrids within DT and non-DT types may vary. Some non-DT hybrids can perform nearly as well as the DT hybrids even in stressful conditions, and DT hybrids have the potential to yield with non-DT hybrids when water isn't limiting.

2) The advantage of the DT hybrids became more evident when the water stress increased to the point of leaves rolling most days.

3) From the information at hand, it is reasonable to expect a DT hybrid to serve as a type of insurance policy to sustain yield potential under water-limited environments. It also appears that there is no yield penalty associated with DT hybrids if water-limiting conditions do not occur.

Lastly, it is critical to understand that these corn genetic materials will not produce yield if the environment is subjected to terminal drought. We cannot expect them to thrive when moisture is severely limited, especially in dryland systems. As properly and explicitly stated by all seed companies, these DT materials have demonstrated the ability maintain yields to a certain degree in water-limited situations, and those yield differences will likely be in the order of 5 to 15 bushels per acre (depending on the environments and crop practices), when compared with a similar maturity non-DT corn hybrid.

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5. Wheat growth stage update and risk of freeze damage: April 7, 2017

The 2017 Kansas wheat crop continues to develop fast with the warming temperatures and available moisture. Our estimates of crop development for different portions of the state are given in Figure 1.

The most advanced fields in far southeast corner of the state are between boot and flowering, and the majority of wheat in that region is already at or past flag leaf emergence (Fig. 1). The majority of the fields in south central Kansas as well as those fields that emerged last fall in southwest Kansas and the majority of fields in the central portion of the state, are past the second node and approaching flag leaf emergence. Northern Kansas and northwest Kansas are slightly behind in development as compared to the rest of the state, as would be expected based on temperature accumulation. The majority of the fields in those areas are now at the jointing growth stage or slightly past it.

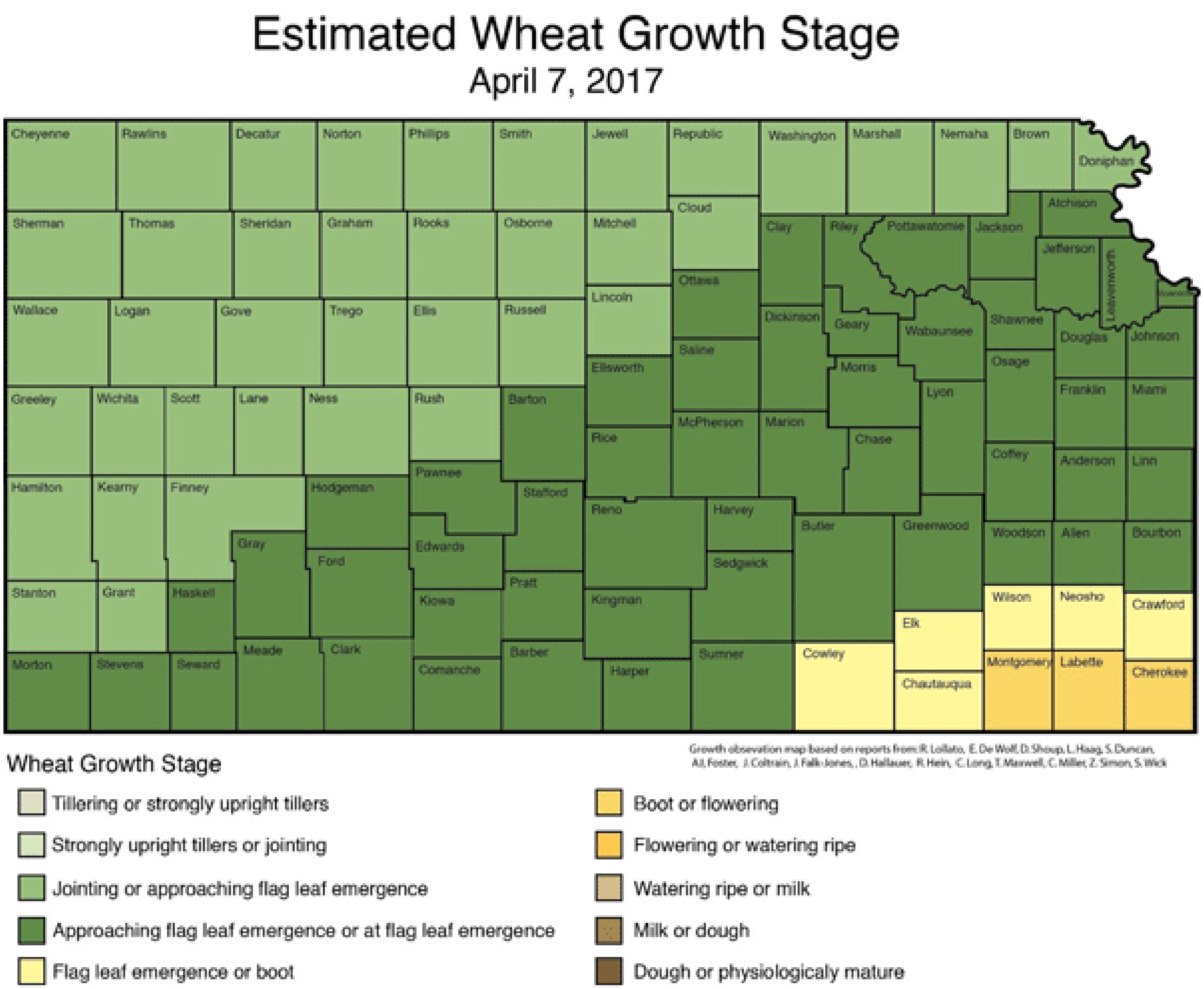

Figure 1. Estimated wheat growth stage as of April 7, 2017. Growth stage is estimated for each county based on temperatures accumulated in the season and adjusted by observations of crop stage by K-State personnel. Local growth stage may vary with planting date and variety.

Risk of freeze injury from the temperatures in early morning hours of April 7

The risk of damage to wheat is a function of the stage of crop development, the minimum temperature, and the duration of time spent at potentially damaging temperatures.

Minimum temperatures during the morning of April 7th, 2017 reached anywhere from 27 to 41 degrees F across the state (Figure 2). Low temperatures were above 32 F in the majority of the state, although there were some areas in eastern and north central Kansas that got below freezing. Fields that are near boot, heading, or flowering stages of growth are at greater risk of freeze injury in the coming weeks. Generally, temperatures below 28-30°F can cause damage to booting or heading and flowering wheat, respectively.

Based on the minimum temperatures observed, and on the estimated wheat growth stages across Kansas, the southeast corner of the state was the region exposed to the greatest risk freeze damage potential. In southeast Kansas, the wheat is further along in development and many fields are past boot and reaching heading (Figure 1). That's also the region with some of the lowest minimum temperatures across the state (Figure 2). These temperatures were measured at weather stations, and temperatures might actually have reached lower values in some fields or portions of fields, depending on the micro-climate and relief in each field. Below, we discuss some of the expectations and possible symptoms based on the growth stage of wheat following the cold temperatures from April 7.

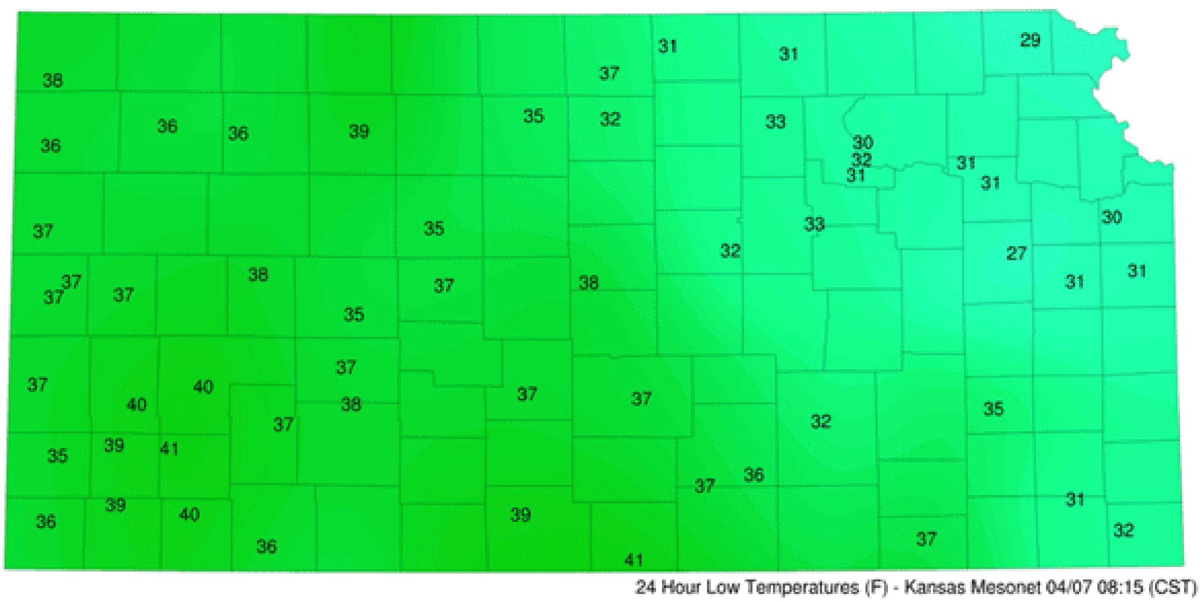

Figure 2. Minimum temperatures during the 24-hour period of April 6-7, 2017. Source: Kansas Weather Data Library.

Wheat at boot stage – Temperatures needed to sustain damage when the wheat is at boot stage are generally about 28F or less. The temperatures measured at the weather stations in southeast Kansas (31 and 32 F) were most likely not low enough to cause damage to wheat at boot stage. Still, if temperatures reached the 28-degree threshold in particular fields due to individual micro-climate or field position on the landscape, some damage is possible to be sustained. Freeze injury symptoms to wheat at boot stage would include heads trapped inside the boot (heads cannot emerge from the whorl), which might result in twisted heads emerging from the side of the boot (Figure 3), yellow or white heads after head emergence indicating that heads were killed (Figure 3), or male floret sterility.

Figure 3. The twisted spike on the right was trapped in the boot and split out the side of the sheath. The awns of the middle spike were damaged while it was still in the boot stage. The spike on the left had partially emerged when freezing occurred so only the upper portion of the spike was damaged. Source: K-State Research and Extension publication C646.

<u>*Wheat between heading and flowering stages –*</u> These are the most sensitive stages to freeze injury. Temperature thresholds for cold damage at these stages is about 30F, which is still below the temperatures measured at the weather stations. Still, just as described for wheat at boot stage, individual field micro-climates might have resulted in lower temperatures and the crop might have sustained some freeze damage in some fields. The magnitude of the actual damage will depend on several factors and will be individual to each field. Symptoms include floret sterility (Figure 4), leaf desiccation or drying, bleaching of the awns (Figure 3), and damage to the lower stem. As wheat flowering begins in the middle of the head and proceeds to the top and bottom, a freeze event occurring during flowering might only partially damage the wheat heads. Thus, depending on flowering and freezing time, the center of the wheat head might be more affected than the top and

bottom, or vice-versa, with grain developing normally in portions of the head not affected by the freeze damage.

Figure 4. After a freeze, affected anthers will become twisted and shriveled, although they will still hold their normal green color (left panel). After 3 to 5 days, affected anthers will become whitish-brown (right panel). Source: K-State Research and Extension publication C646.

For more information on symptoms of freeze to wheat, see "Spring Freeze Injury to Kansas Wheat", K-State Research and Extension publication C646, available at: http://www.ksre.ksu.edu/bookstore/pubs/C646.pdf

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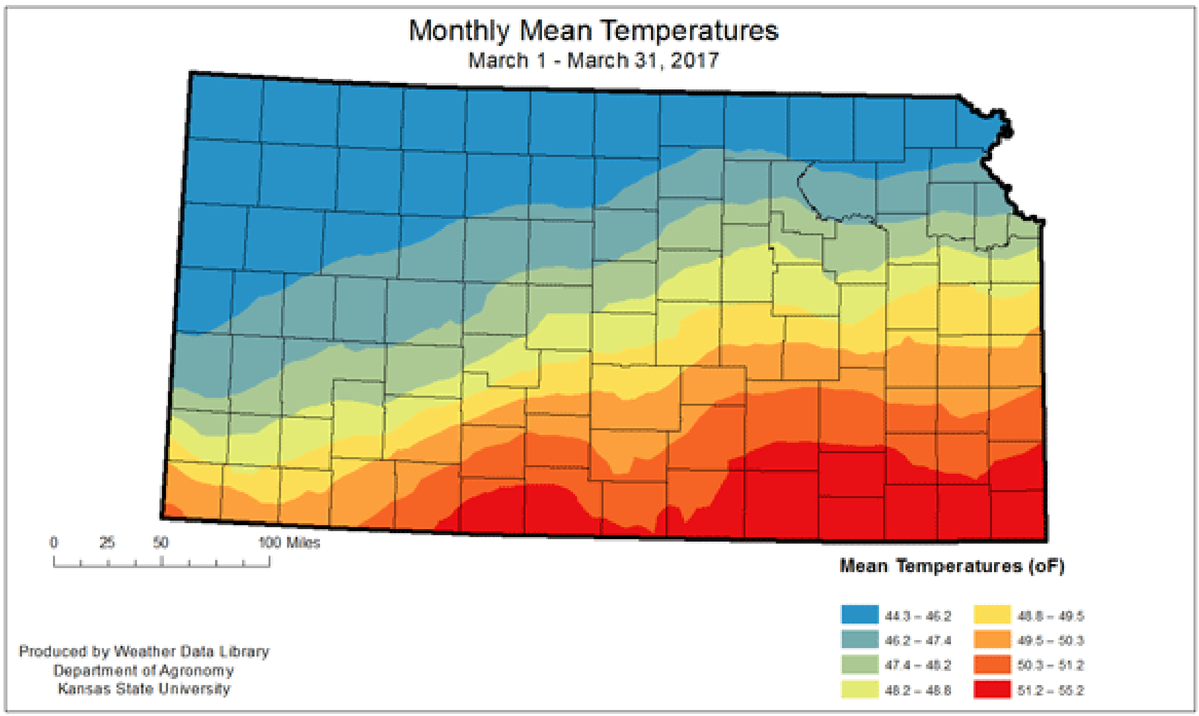
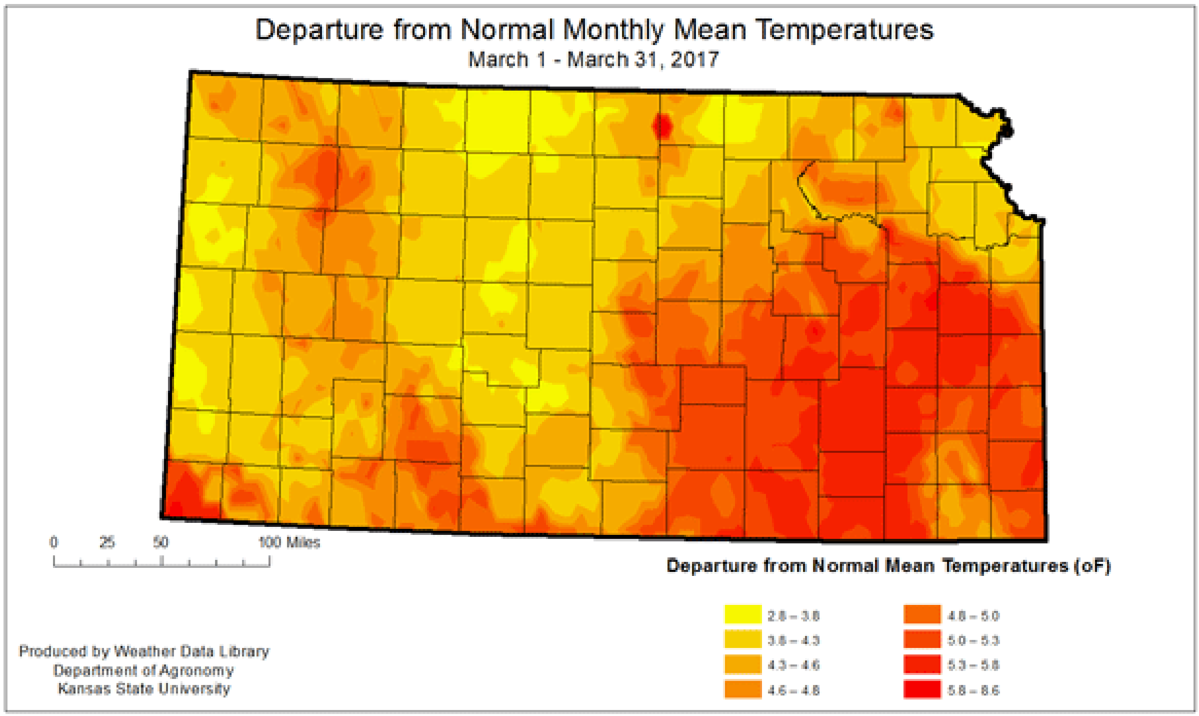
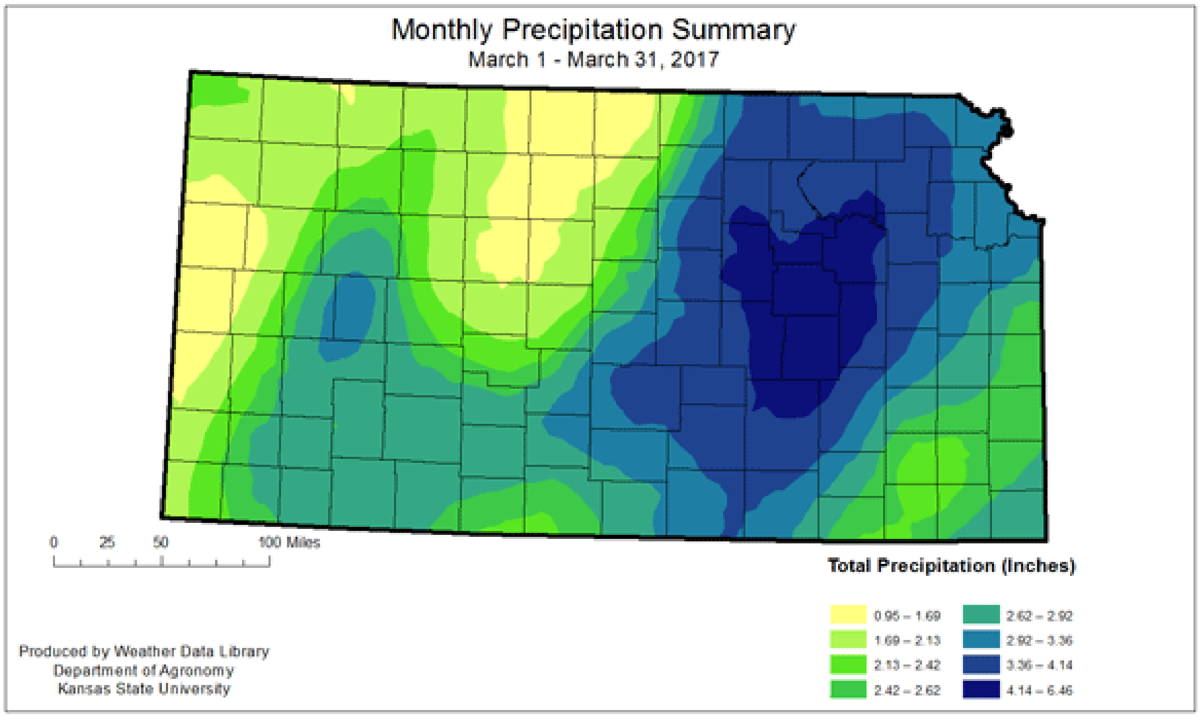
6. Kansas weather summary, March 2017: Beneficial end to the month

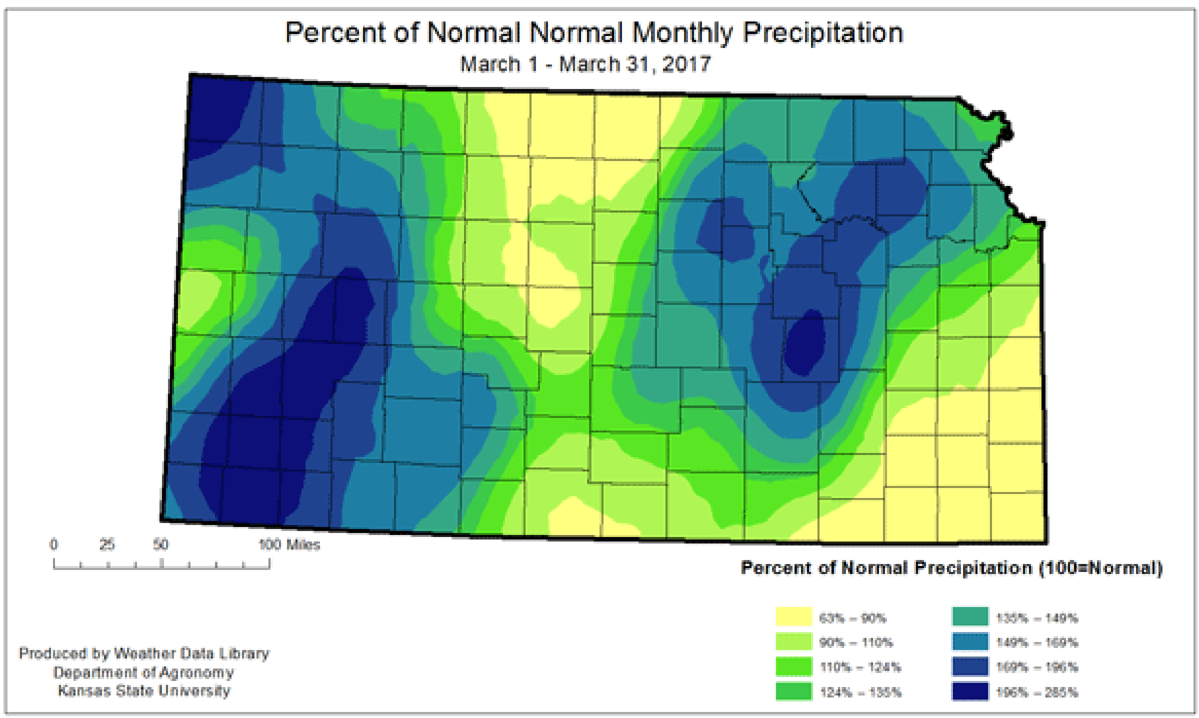
Much of March was warm and dry in Kansas. The statewide average temperature was 47.7 degrees F, which was 4.4 degrees warmer than normal. That places this March as the 17th warmest since 1895. The warmest temperatures were recorded on the 20th of the month. On that day Coldwater, Comanche County, set the warmest reading for the month at 99 degrees F., while many locations had readings in the 90s. There were 134 new daily record maximum temperatures this month and 66 occurred on the 20th. Of those new records, 14 set new daily record maximums for March. Overall, the Southwest Division showed the greatest departure from normal with an average of 49.2 degrees F, and a departure from normal of 5.2 degrees. The Northeast Division, which averaged 46.0 degrees F, was the closest to normal and was still 3.4 degrees warmer. Not surprisingly, there were no record cold minimum temperatures. However, despite the warmth there were 9 new record low maximum temperatures across the state. The lowest temperature reported was 9 degrees F at Wallace, Wallace County, on the 2nd. There were 70 record warm minimum temperatures reported during March.





The warmer-than-normal temperatures were accompanied by much drier-than-usual conditions, until the last week of the month. The last seven days pushed many locations above normal in precipitation for March. The statewide average precipitation was 2.28 inches, or 141 percent of normal. This ranks as the 14th wettest March since 1895. All divisions were above normal for the month. The Northwest Division was the driest with an average of 1.41 inches, which was 107 percent of normal. The Southwest Division had the greatest percent of normal, with an average of 3.30 inches or 244 percent of normal. The greatest 24-hour precipitation total for a National Weather Service (NWS) station was 3.07 inches at Peck 2S, Sumner County on the 29th. The greatest 24-hour precipitation total for a Community Collaborative Rain Hail and Snow (CoCoRaHS) station was 5.71 inches at El Dorado 7.9 NNW, Butler County, also on the 29th. The stations with the greatest monthly totals: 6.46 inches at Tallgrass National Prairie Park, Chase County (NWS); 7.21 inches at Hutchinson 3.6 NE, Reno County (CoCoRaHS). While snow wasn't a huge factor, there were still some snow events during the month. The greatest snowfall total for March at a National Weather Service station was 3.6 inches at Hoyt 2S, Jackson County. The greatest snowfall total for the month at a CoCoRaHS station was 2.1 inches at McFarland 0.1 SE, Wabaunsee County.

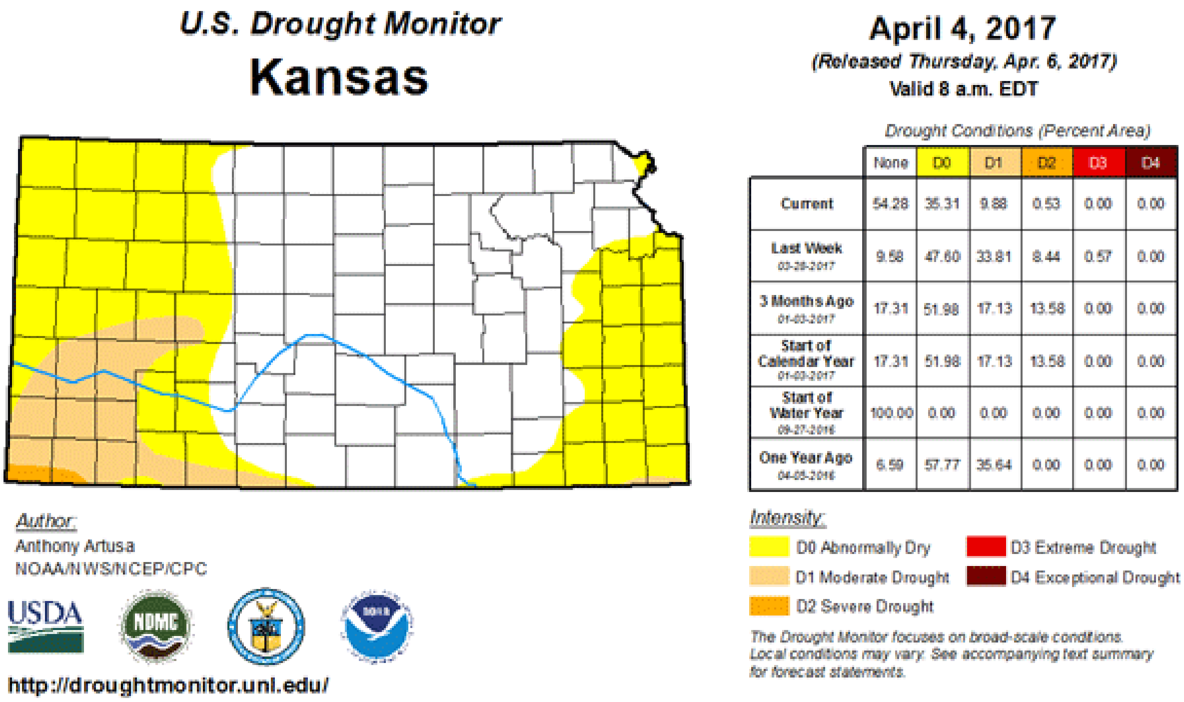




The month was more active in terms of severe weather events. There were 10 reports of tornadoes, 56 hail, and 67 high wind events. The most damaging feature was wildfires, with more than 500,000 acres burned in Clark County alone.

Higher-than-normal precipitation resulted in improving conditions in the U.S. Drought Monitor. The biggest improvement was in the southwest, where extreme drought was removed entirely.

Unfortunately, the updated April outlook is neutral, and continued normal rainfall is critical to sustain this improvement.



	None	D0	D1	D2	D3	D4
Current	54.28	35.31	9.88	0.53	0.00	0.00
Last Week 03-28-2017	9.58	47.60	33.81	8.44	0.57	0.00
3 Months Ago 01-03-2017	17.31	51.98	17.13	13.58	0.00	0.00
Start of Calendar Year 01-03-2017	17.31	51.98	17.13	13.58	0.00	0.00
Start of Water Year 09-27-2016	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 04-05-2016	6.59	57.77	35.64	0.00	0.00	0.00

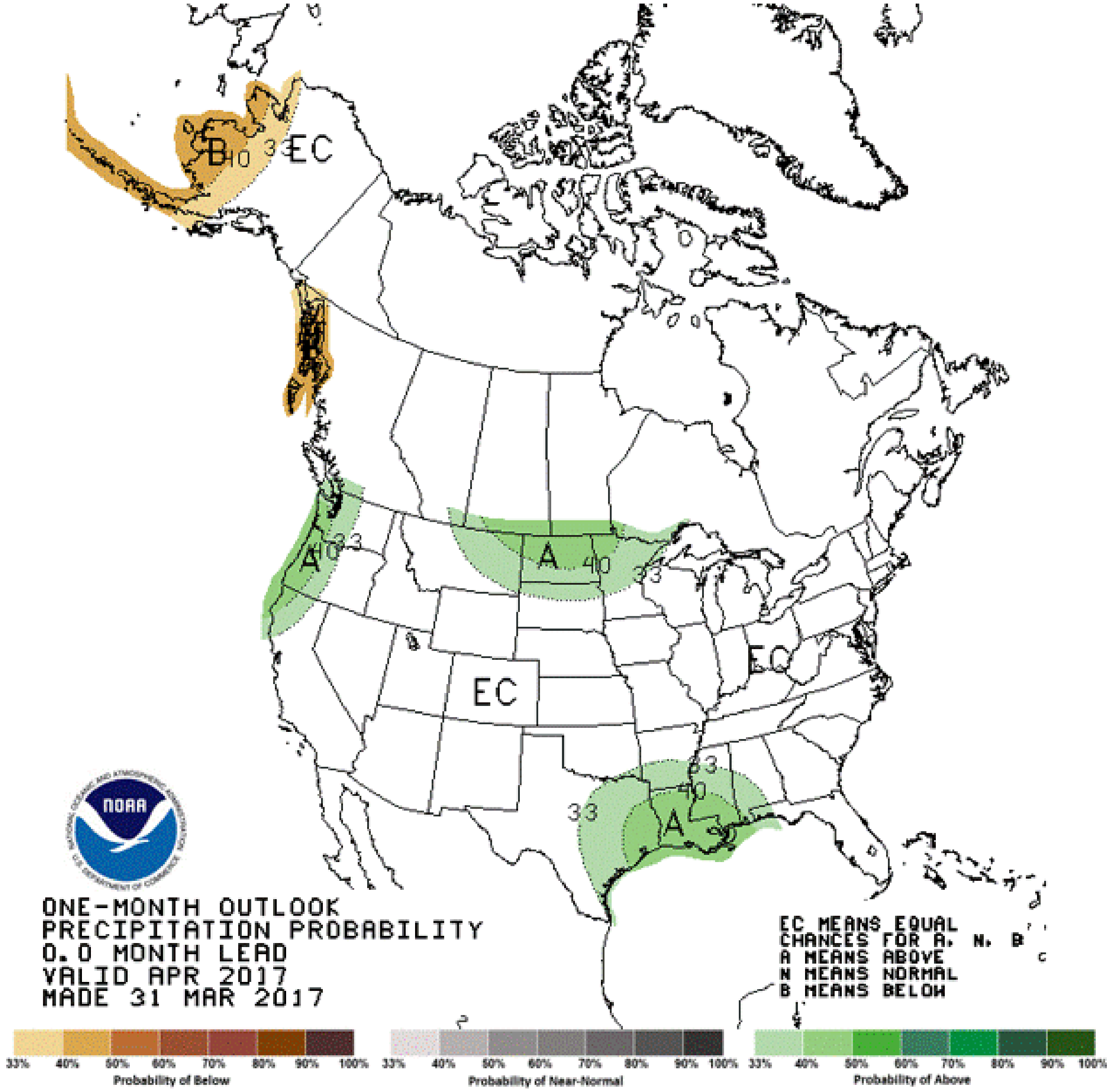


Table 1

March 2017

Kansas Climate Division Summary

	Precipitation (inches)						**Temperature (°F)**			
	March 2017			**2017 Jan. through March**					**Monthly Extremes**	
Division	**Total**	**Dep.** [1]	**% Normal**	**Total**	**Dep.** [1]	**% Normal**	**Ave**	**Dep.** [1]	**Max**	**Min**
Northwest	1.41	0.10	107	2.30	0.00	99	44.4	4.2	91	12
West	2.30	0.90	163	3.19	0.69	127	46.2	4.6	94	11

Central Southwest	3.30	1.94	244	5.08	2.70	212	49.4	5.2	96	10
North Central	2.43	0.41	118	3.83	0.36	108	45.9	3.7	92	15
Central	3.18	0.93	140	4.86	0.91	121	48.1	4.4	93	17
South Central	3.30	0.67	127	6.77	2.15	147	49.8	4.3	94	16
Northeast	2.91	0.63	128	4.24	0.03	103	46.0	3.4	90	17
East Central	2.95	0.30	111	4.39	-0.53	89	48.5	4.7	90	18
Southeast	3.10	0.08	105	5.79	-0.21	99	50.7	4.9	90	19
STATE	2.82	0.70	141	4.65	0.80	127	47.7	4.4	99	9

1. Departure from 1981-2010 normal value

2. State Highest temperature: 99 oF at Coldwater, Comanche County, on the 20th.

3. State Lowest temperature: 9 oF at Wallace, Wallace County, on the 2nd.

4. Greatest 24hr: 3.07 inches at Peck 2S, Sumner County on the 29th (NWS); 5.71 inches at El Dorado 7.9 NNW, Butler County, on the 29th (CoCoRaHS).

Source: KSU Weather Data Library

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