Issue 961

K-STATE Research and Extension

Extension Agronomy

eUpdate

06/15/2023

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. Be aware of herbicide spray drift in wheat

Late rains across Kansas have caused some farmers to reconsider the yield potential of portions of their wheat crop. Some wheat is being terminated with herbicides, but neighboring wheat may be headed for harvest. Other farmers are spraying sorghum that has been planted into wheat that has already been terminated. These scenarios set up conditions where herbicide drift could damage the wheat farmers are taking to harvest. This article discusses crop injury caused by some of the herbicides that may be used in these situations.

Glyphosate. Injury resulting from glyphosate drift may appear a few days after application. One common symptom on grasses is a chlorotic band across the leaves that were in the plant's whorl when the drift occurred. If the wheat is heading, just the portion of the plant above the flag leaf may turn white, while the rest of the plant stays green. This may not occur in all tillers as minor differences in the growth stage can influence the symptoms (Figure 1).

Figure 1. White heads caused by glyphosate drift. Photo by Dallas Peterson, K-State Research and Extension.

Atrazine. Atrazine drift on wheat will appear as necrosis where the spray contacts the leaf and may progress to chlorosis/necrosis that starts at the leaf tip and expands down the outer edge of the leaf (Figure 2).

Figure 2. Chlorosis at leaf tips and margins about 2 weeks after a low rate of atrazine was applied. Photo by Sarah Lancaster, K-State Research and Extension.

Group 1 (ACCase-inhibiting) herbicides. These are products such as clethodim (Select Max, others) or quizalofop (Assure II, others). Injury from one of these herbicides will take a week or more to appear. You may see a chlorotic band across the leaves that were in the whorl of the plant. It's also important to remember that a Group 1 herbicide will have plant-back restrictions for corn or grain sorghum that will vary depending on the product and rate that is used, as well as the hybrids that will be planted. If Co-Axium wheat was planted, quizalofop may cause a limited response (Figure 3).

Figure 3. Wheat head trapped in the boot about two weeks following application of a low rate of Assure II. Also note the chlorosis on the leaves. Photo by Sarah Lancaster, K-State Research and Extension.

Group 14 herbicides. These are products like saflufenacil (Sharpen, Verdict) or flumioxazin (Valor, others). Injury symptoms associated with saflufenacil or flumioxazin will develop within hours of application. They will include water-soaked speckles that become necrotic (Figure 4).

Figure 4. Wheat plants with necrotic speckles caused by simulated Sharpen drift (left) and Valor drift (right). Photos by Sarah Lancaster, K-State Research and Extension.

When terminating failed wheat near a wheat field that will be harvested, there are a few things that can reduce the likelihood of spray drift.

1. **Monitor wind speed and direction**. Choose a time when the wind is blowing within labeled speeds away from the sensitive crop.
2. **Lower the spray boom**. Reducing the distance droplets are suspended in the air will reduce the interaction with wind and the chance for movement.
3. **Change nozzles.** Choose a drift-reduction nozzle with the largest practical nozzle orifice size to create larger droplets.
4. **Consider a high-quality, label-approved drift reductant**. These adjuvants generally increase the viscosity of the spray solution, preventing the formation of smaller droplets.

For more detailed information, see the "2023 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/CHEMWEEDGUIDE.pdf or check with your local K-State Research and Extension office for a paper copy.

Additional information about herbicide injury can be found in the KSRE publication C715 "Herbicide Mode of Action" at https://bookstore.ksre.ksu.edu/pubs/C715.pdf.

The use of trade names is for clarity to readers and does not imply endorsement of a particular product, nor does exclusion imply non-approval. Always consult the herbicide label for the most current use requirements.

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2. Herbicide applications and high temperatures

Warmer temperatures are in the forecast for the latter part of June across Kansas. For July, the Climate Prediction Center is calling for an increased probability of warmer-than-normal temperatures statewide. If you are planning herbicide applications, here are some things to consider when applying herbicides during hot weather.

1. **Heat or drought stress slows plant growth processes.** This is especially important for systemic herbicides such as glyphosate and grass-killing herbicides like clethodim (Select) or quizalofop (Assure). As temperatures increase above 85°F, many plants begin to slow or stop metabolic processes that move herbicides throughout the plant. Notable exceptions to this rule are HPPD-inhibiting herbicides like Callisto or Balance Flexx. Palmer amaranth plants are able to overcome applications of these herbicides when applied at high temperatures (90°F and greater).

Management: In general, applying systemic herbicides early in the morning, after plants have had a chance to recover from heat stress, will give the best chance for the herbicide to reach the active site and effectively kill weeds.

2. **Leaves change in response to heat**. In order to prevent water loss, plant cuticles become waxier in response to heat or drought stress. The greater wax content makes it more difficult for water-based spray solutions to penetrate the plant. In addition, the leaf angle of many plants changes in response to heat or drought stress (Figure 1). Often, this results in less herbicide contacting the leaf surface to enter the plant.

Figure 1. Velvetleaf usually changes leaf angles at night, but the leaves on these plants are vertical in response to high temperatures. Photo by Sarah Lancaster, K-State Research and Extension.

Management*:* Using maximum labeled rates of herbicides and surfactants can help get more spray solution into the plant, increasing effectiveness. Spraying during the cooler parts of the day will reduce the impact of altered leaf angle.

3. **Crop response to foliar-applied, non-translocated herbicides is greater in hot temperatures.** When applied in hot, humid conditions, contact herbicides, such as Cobra, Liberty, or Reflex will likely result in greater foliar injury to crops, but also greater weed control (Figure 2).

Figure 2. Contact herbicides can cause bronzing of soybean leaves when applied post-emergence. The photo was taken one week after an application that included flumiclorac (Resource, Perpetuo, and others). Photo by Sarah Lancaster, K-State Research and Extension.

Management: If possible, postpone the application of these herbicides if temperatures are over 90°F. If weed size requires immediate herbicide application, reduce the rate of herbicide and adjuvant, and apply later in the day, when the air temperature will decrease after application.

4. **Herbicide volatility increases with high temperatures and low humidity**. Herbicides in group four, such as dicamba and 2,4-D are prone to volatility, which means the herbicide becomes a vapor and can move long distances with slight breezes. Volatility of these herbicides increases as temperature rise above 60°F and is greatest at temperatures above 90°F.

Management: Avoid applying these herbicides when temperatures are over 90°F. This may occur during morning or late afternoon hours when temperature inversions are likely to occur. Herbicides should not be sprayed during inversions when small spray droplets can become trapped in a layer of cooler air near the earth's surface. Use larger spray droplets to reduce evaporation, which can be accomplished by reducing spray pressure or increasing the nozzle orifice size.

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requirements.

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3. Cut-off dates approaching for XtendiMax, Engenia, and Tavium applications

Farmers planning to apply XtendiMax, Engenia, or Tavium to their dicamba-resistant soybean have about two weeks remaining to make those herbicide applications. These are the only dicamba-containing products labeled for over-the-top use in dicamba-resistant soybean and cotton. One of the requirements added to these labels in 2021 was a cut-off date for applications. **The last day these products can legally be applied to soybean is June 30.** The cut-off date for cotton is July 30.

For those making over-the-top applications of dicamba in the coming days, remember the restrictions listed below are included on the labels to reduce off-target movement.

- It can only be applied by certified applicators with dicamba-specific training.
- Spray records must be created within 72 hours of application and kept for 2 years.
- Only approved tank-mix partners listed on the company website can be used.
- An approved volatility reduction agent *and* an approved drift reduction agent must be included in the tank mix.
- Only approved nozzles listed on the company website can be used.
- Maximum boom height is 24 inches.
- Maximum ground speed is 15 miles per hour.
- Only apply when wind speeds at boom height are 3 to 10 miles per hour.
- Do not apply if a run-off-producing rain event is forecast in the next 48 hours.
- Do not apply if sensitive crops are downwind.
- Maintain a 240-foot downwind buffer.
- The Bulletins Live Two website must be consulted to ensure no endangered species will be affected by the application.

For more detailed information, see the "2023 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://www.bookstore.ksre.ksu.edu/pubs/CHEMWEEDGUIDE.pdf or check with your local K-State Research and Extension office for a paper copy.

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4. Kansas Mesonet animal comfort forecast product now available

It has been a year since a major cattle loss event occurred in southwest Kansas. This marked a time when producers were caught off guard by a sudden transition from cool/wet to hot conditions. As a result, the Kansas Mesonet has been coordinating with producers and researchers to provide a forecast product that will predict loss potential in the future.

Temperatures across Kansas are anticipated to increase substantially in the coming week compared to the recent cool/wet conditions. While this won't bring 2022-like temperature swings, the new product will hopefully help decision-makers analyze the increased risk and take mitigation actions. Additionally, this product will remain useful even into the cold season and provide guidance for upcoming weather changes.

Current Animal Comfort

The Kansas Mesonet focuses on observations and recording historical data to build climate records. Mesonet has long provided current animal comfort indices derived from Mader et al. 2010 on their website (https://mesonet.k-state.edu/agriculture/animal/current). This product remains available to users and will continue to collect data (Figure 1). Unfortunately, for decision-makers, real-time data means that loss could already be occurring. Therefore, the need to provide advanced notice existed and couldn't be captured on this website.

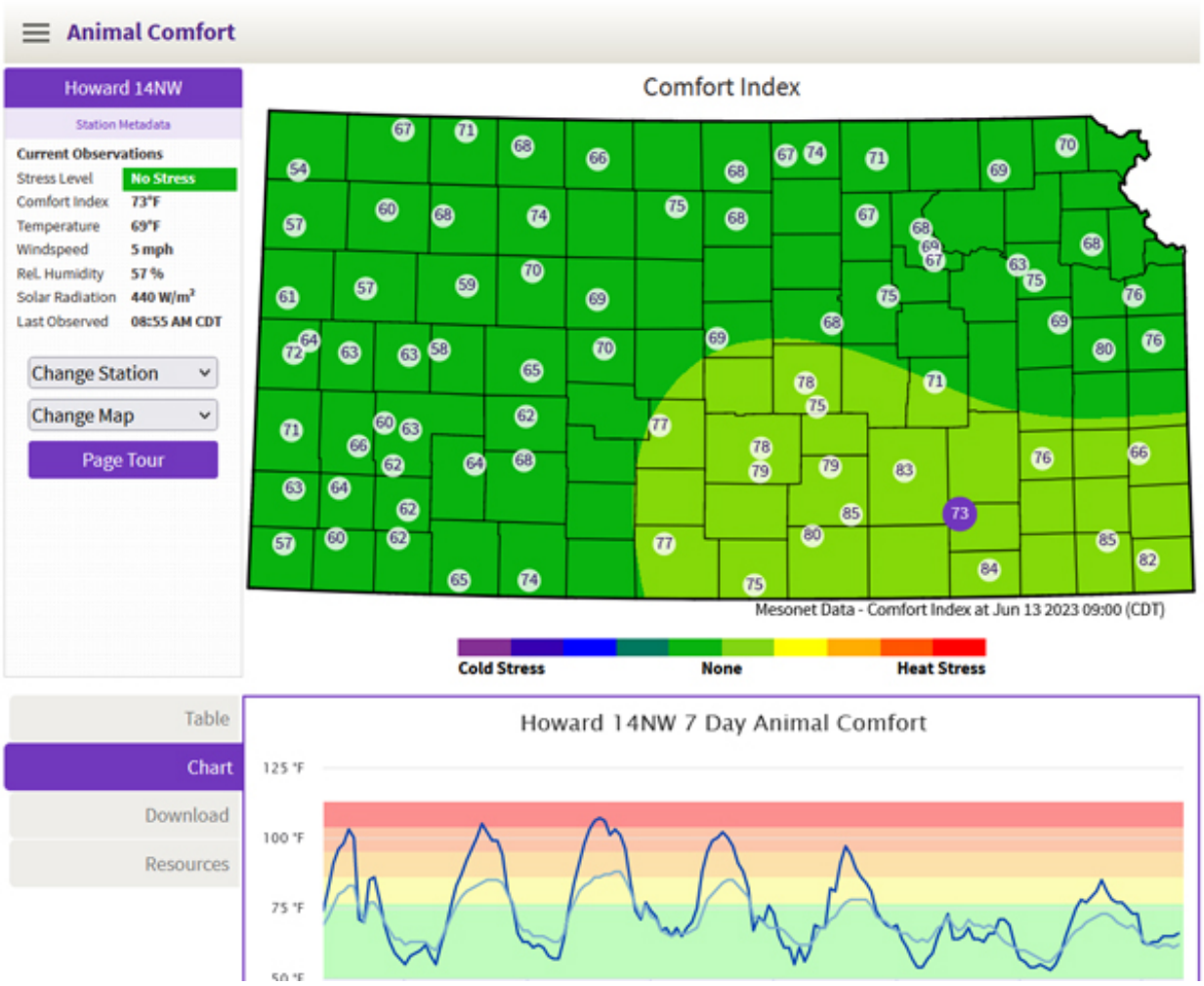

Figure 1. Real-time Animal Comfort data available on the Kansas Mesonet website (https://mesonet.k-state.edu/agriculture/animal/current**).**

Forecasting Animal Comfort

Since the June 2022 event, Mesonet staff coordinated with a group of producers and researchers to evaluate the feasibility of a forecast product. As a result of this collaboration, the Mesonet started incorporating the National Weather Service (weather.gov) data into the equation used on the current comfort product. The outcome is an hourly view of forecasts for the next seven days for each Mesonet station location. These forecasts can now be found online here: https://mesonet.ksu.edu/agriculture/animal/forecast. Both current and forecast products can also be found via the ☒ menu under “Agriculture” -> “Animal Comfort” (Figure 2).

Figure 2. Screenshot of the new Mesonet Animal Comfort Forecast product https://mesonet.ksu.edu/agriculture/animal/forecast/.

This new product focuses on the producer's location, placing forecast charts above the statewide maps. These charts provide interactive hourly forecast data, similar to the "Hourly Forecast" product from the National Weather Service
(
https://forecast.weather.gov/MapClick.php?lat=37.2036&lon=-98.3863&unit=0&lg=english&FcstType=graphical).

The most significant change is the data displayed on the left where the peak values for the day (maximum) and night (minimum) can be found highlighted by their specific category (Figure 2). Overnight conditions are critical for cattle/livestock to recover, especially during periods of hot weather, similar to what is forecasted in the coming week. This provides a quick glimpse of the seven-day period that can advise producers of any periods during which they should be concerned.

Important note: The National Weather Service forecasts the hourly average values rather than extremes. In addition, fluctuations in cloud cover (affecting solar radiation) and wind speed have a large effect on the comfort level. Producers should recognize that localized conditions may be significantly warmer/colder than the predicted comfort index.

Categorical Changes

After feedback from users, we have simplified the categories from the original page, focusing on periods of concern from extreme heat or cold. While we cannot make assumptions on an animal's age, type, color, prevention plan, or health, we can make some basic estimates of peak levels that

provide heightened risk, especially if extreme conditions have a rapid onset.

We now have a single **"Comfortable**" level that suggests there are very low amounts of atmospheric stress upon outdoor animals. When temperatures start to climb, we have a period of **"Heat Caution"** before reaching 105° F, a point when deaths potentially exceed 5% (Mader et al. 2010). Animal comfort indices above this value (the **"Heat Danger"** level) occur routinely every summer across the state. However, by peak summer, producers have typically taken mitigation measures and, when combined with higher animal endurance, likely won't result in losses. This is especially true when temperatures fall overnight to enable animal recovery. Concerns should increase if nightly temperatures remain high or cattle are not adjusted to the heat. This was especially the issue last June and must be considered in the shoulder seasons. While this tool provides guidance, it is up to the producer to be able to monitor their animals and know when they should be concerned.

What makes this animal comfort index more versatile than the Temperature Humidity Index (THI) which is often used in livestock health management, is that it can handle cold factors as well. Values below -20° F have been associated with increased loss, especially in young cattle. This threshold is when the "Cold Danger" level is exceeded on the website. While this won't happen in the summer, producers can still utilize the cold spectrum during the fall/spring calving season. Once again, large fluctuations in stress levels when animals are not adapted to the cold are very important.

The Future

This new product is the result of feedback from producers. We are striving to provide tools that improve field decisions and enhance Kansas agriculture. A huge thanks to all those who assisted in this project. If you feel additional changes could be made in the future, please don't hesitate to reach out to the authors!

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References

Mader, T.L., Johnson, L.J., & Gaughan, J.B. (2010). A comprehensive index for assessing environmental stress in animals. Journal of animal science, 88 6, 2153-65

5. Spring rainfall summary and the summer outlook for Kansas

The National Centers for Environmental Information (NCEI) released the monthly climate statistics for the month of May on June 8. These statistics include precipitation data for all states, climate divisions, and counties in the United States. When combined with March and April, these three months together comprise meteorological spring. In this report, we take a look at precipitation totals across Kansas in the past three months.

Divisional precipitation statistics for Kansas' nine climate divisions are shown in Table 1. The state averaged 5.47 inches or 63% of the normal amount of 8.69 inches. All divisions were below normal for spring. Northwest and southwest were closest to their 3-month normals, with departures from normal of less than 0.15 inches. Both central and south central Kansas were quite dry; each had slightly less than half their normal precipitation. Southeast Kansas had the largest departure from normal at - 6.34 inches, which was just over half their usual spring precipitation.

Compared with previous years, it was the 13th driest spring on record for Kansas, dating back to 1895, when NCEI began tracking climate normals. It was a top 10 driest spring in four divisions: central (6th), south central (8th), north central (9th), and southeast (9th). Both northwest and southwest KS ranked at 64th driest out of 129 years, so both were close to the median seasonal precipitation for spring.

Table 1. Divisional precipitation data for Kansas' nine climate divisions for March-May, 2023. 'Dep.' represents departure from normal. Normals are based on the period 1991-2020.

Division	Total Precipitation (inches)	Departure (inches)	% of Normal	Rank (Driest)
Northwest	6.01	-0.10	98	64
North Central	4.20	-4.09	51	9
Northeast	7.84	-2.79	74	35
West Central	4.44	-1.32	77	38
Central	4.25	-4.56	48	6
East Central	7.34	-4.19	64	20
Southwest	5.30	-0.14	97	64
South Central	4.19	-4.86	46	8
Southeast	6.51	-6.34	51	9
STATE	5.47	-3.22	63	13

Since NCEI also calculates normals for each county, we can get an even better idea of how locations within each climate division fared. The ten wettest and driest counties in the state this past spring are listed in Table 2. Nine of the ten wettest counties are in the eastern part of the state, which should come as no surprise, as eastern Kansas on average receives more precipitation than the rest of the state. One county in the west did make the top 10 wettest counties: Rawlins, where over 8.5 inches of rain fell on average. This was the only one of the top 10 counties whose precipitation amount was above normal, so even the wettest counties in the state were below normal except for one. Only 14

counties in the state had above-normal precipitation for spring. Morton County had the highest percentage of normal with 145%. Rawlins County had the second-highest percentage at 142% (Table 3). All ten of the driest counties were in central Kansas, with Rooks County the driest, where less than 3 inches fell for the 3-month period. Departures from normal in these ten counties ranged from 3.8 to almost 7.2 inches below normal. Harvey County had the lowest percent of normal for spring, with just 32% of normal. Sedgwick County was second lowest at 33%.

Table 2. Top 10 wettest and driest counties in Kansas during spring 2023. All rainfall values are inches.

	Wettest			Driest		
Rank	Total Precip.	County	Dep.	Total Precip.	County	Dep.
1	11.04	Douglas	-0.32	2.88	Rooks	-4.43
2	9.98	Franklin	-1.82	3.15	Mitchell	-4.90
3	9.82	Jefferson	-1.32	3.25	Osborne	-4.32
4	9.48	Leavenworth	-1.86	3.28	Harvey	-7.01
5	9.05	Shawnee	-2.11	3.51	Sedgwick	-7.16
6	9.00	Labette	-5.28	3.52	Reno	-5.89
7	8.67	Wilson	-4.22	3.54	Kingman	-6.30
8	8.59	Atchison	-2.37	3.61	Edwards	-3.82
9	8.53	Rawlins	+2.53	3.64	McPherson	-6.28
10	8.49	Cherokee	-6.25	3.66	Pawnee	-3.87

Table 3. Top 10 highest and lowest percentages of normal spring precipitation by county. All rainfall values are inches.

Rank	Highest Percent of Normal Precip.		Total Precip.	Lowest Percent of Normal Precip.		Total Precip.
1	145	Morton	6.09	32	Harvey	3.28
2	142	Rawlins	8.53	33	Sedgwick	3.51
3	134	Stanton	5.78	36	Kingman	3.54
4	132	Stevens	6.23	36	Butler	4.15
5	128	Hamilton	5.72	37	McPherson	3.64
6	123	Grant	5.75	37	Reno	3.52
7	120	Kearny	5.96	39	Mitchell	3.15
8	118	Cheyenne	6.27	39	Rooks	2.88
9	112	Decatur	7.17	40	Marion	4.17
10	107	Thomas	6.21	42	Sumner	4.56

When we rank each county against its own precipitation totals for all past springs back to 1895, we see a couple of superlatives with respect to spring 2023's precipitation (Table 4). Almost one-quarter

of Kansas' 105 counties (26 total), had a top 10 driest spring. Of these 26, two had their driest spring in 129 years of record keeping: Butler and Harvey Counties. McPherson, Marion, Reno, and Sedgwick County all had their second driest spring on record. Seven additional counties finished in the top 5. The highest ranking on the list of wettest springs is Rawlins County, where spring 2023 was its 19th wettest on record. Only six counties finished in the top third of their wettest springs.

Will summer turn out the same way spring has? Kansas has seen some good rainfall across much of the state so far in June (Figure 1). A few locations have already exceeded their normal May precipitation, while others are lagging behind. There are still a couple weeks of June remaining. After a dry spring, a wet summer would be good news for the state!

Table 4. List of counties where a top 10 driest spring was observed in 2023.

Driest Rank	County	Total Precip. (inches)	Departure (inches)
1st	Butler	4.15	-7.33
	Harvey	3.28	-7.01
2nd	McPherson	3.64	-6.28
	Marion	4.17	-6.36
	Reno	3.52	-5.90
	Sedgwick	3.51	-7.16
4th	Coffey	6.16	-5.66
	Kingman	3.54	-6.30
	Lyon	6.04	-5.23
	Mitchell	3.15	-4.90
	Morris	4.70	-6.11
	Saline	4.08	-5.52
5th	Bourbon	6.13	-7.29
	Rooks	2.88	-4.44
6th	Allen	6.44	-6.55
	Chase	5.57	-5.64
	Dickinson	4.87	-5.22
	Osborne	3.25	-4.32
8th	Greenwood	6.16	-5.79
9th	Chautauqua	5.84	-7.00
	Cowley	5.49	-6.70
	Sumner	4.56	-6.40
10th	Crawford	7.21	-7.01
	Neosho	7.03	-6.65
	Smith	3.69	-3.96
	Woodson	6.70	-5.67

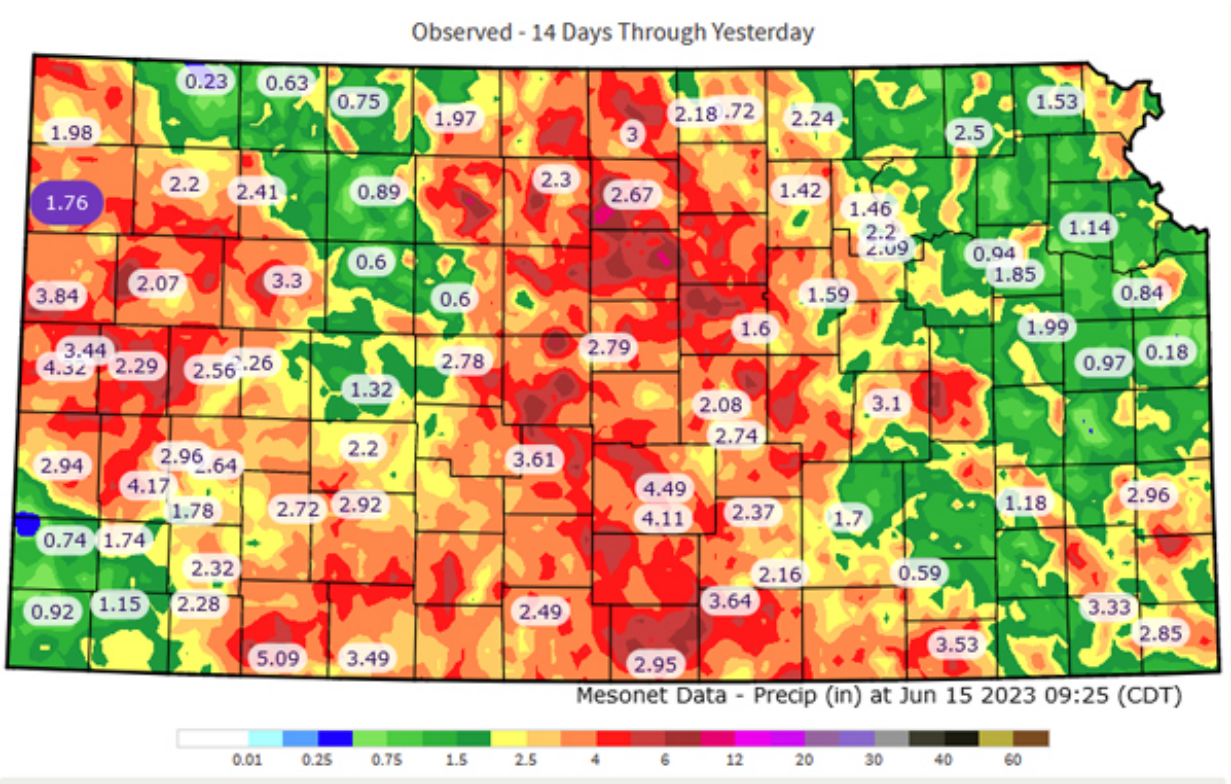

Figure 1. Total precipitation for June 1-14, 2023. Source: Kansas Mesonet (mesonet.k-state.edu).

Updated Summer Outlook

With the dry spring, most areas still need plentiful moisture to keep up with vegetation and crop demands. Flash drought can develop rapidly and the recent greening can quickly turn for the worst. Especially when we are considering many farm ponds and longer-term moisture sources are still in very poor conditions. New outlooks were issued today from the Climate Prediction Center contributing some consideration toward the expected summer pattern.

The active southern jet stream that has resulted in widespread moisture for southwest Kansas and the southern US is expected to shift northward in July. As a result, there is more uncertainty about the local patterns that will drive moisture. This is reflected with equal chances of at/above/below-normal moisture for Kansas during the month. Temperatures are also expected to warm as the southern heat moves northward into Kansas. The CPC is calling for slight favor to above-normal temperatures in July statewide (Figure 2). As we move into late summer, the El Niño enhanced southern jet stream is expected to slide back south. Therefore, August/September is expected to weigh the three-month average statewide in favor of above-normal moisture for much of the state (Figure 3). Temperatures are still expected to be favored towards above normal for most of Kansas, another typical trend from a prominent El Niño.

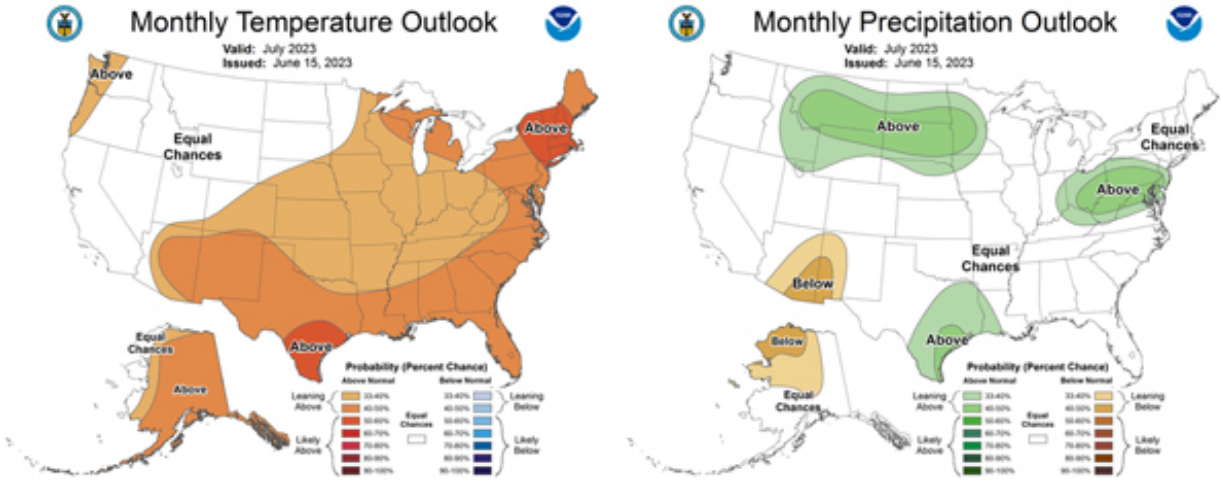

Figure 2. Climate Prediction Center forecasts for temperature (left) and moisture (right) for July. Source: www.cpc.ncep.noaa.gov

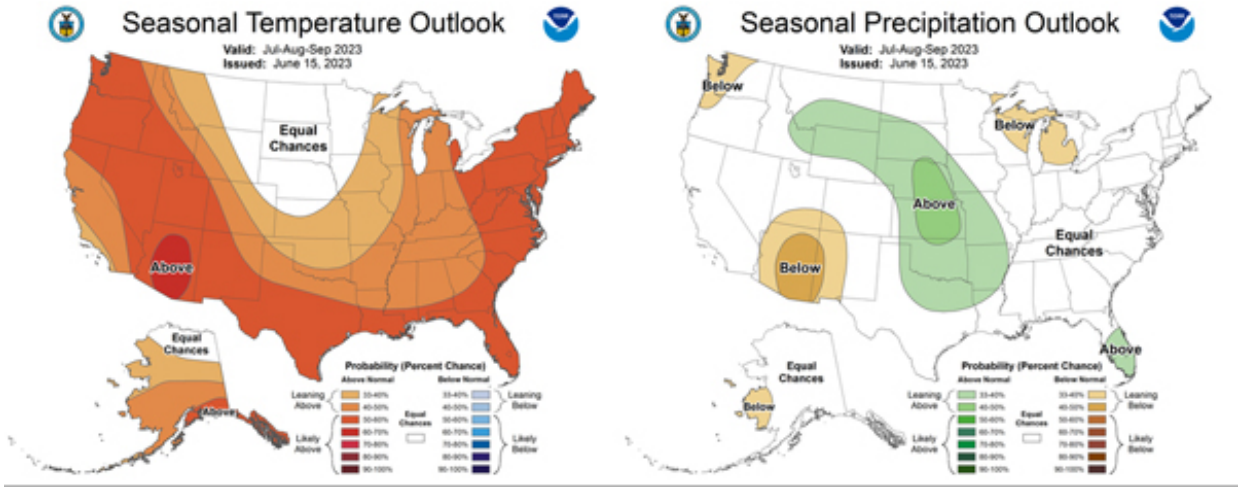

Figure 3. Climate Prediction Center forecasts for average temperature (left) and moisture (right) for the July through September period. Source: www.cpc.ncep.noaa.gov

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6. Kansas Ag-Climate Update for May 2023

The Kansas Ag-Climate Update is a joint effort between our climate and extension specialists. Every month the update includes a brief summary of that month, agronomic impacts, relevant maps and graphs, 1-month temperature, and precipitation outlooks, monthly extremes, and notable highlights.

May 2023: Strong El Niño is coming and it could be significant

The average temperature for May was 65.8°F, or 1.9°F above normal. This ranked as the 29th warmest May out of 129 years of records, dating back to 1895. All divisions were above normal, with anomalies ranging from +1.1°F (south central) to +2.9°F (north central).

The average precipitation for May was 3.58", which was 0.63" below normal. This ranked as the 65th driest May on record. The three western climate divisions all finished the month above normal. Northwest Kansas was the wettest division (5.08"), where it was the 18th wettest May on record.

When combined with April's precipitation, the growing season to date ranks in the top 20 driest in four divisions: north-central, central, south-central, and southeast. Departures from normal in these areas range from 2.2 to 3.1 inches. Northwest and southwest Kansas are the only two divisions above normal since April 1st.

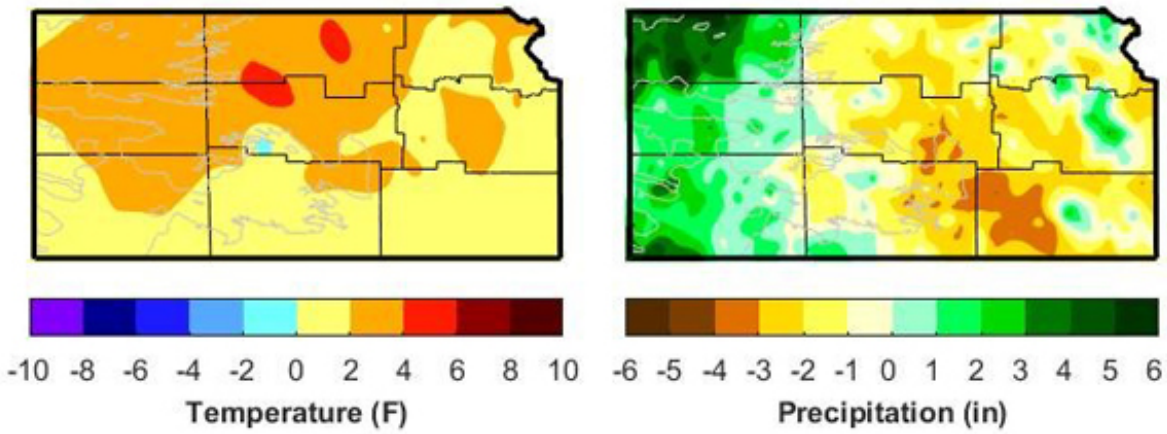

Figure 1. Departures from normal temperature (°F) and precipitation (inches) for May 2023.

View the entire May 2023 Ag-Climate Update, including the accompanying maps and graphics (not shown in this eUpdate article), at http://climate.k-state.edu/ag/updates/

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