Issue 807

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eUpdate

06/26/2020

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. June heat in Kansas: High temperatures can stress livestock and corn

The heat continues in Kansas, particularly with the warm minimum temperatures (Figure 1). For the 25-day window of June 1-24, parts of eastern Kansas had lows above 70 °F more the 20 percent of the time. Only the western third of the state had two or less nights with minimum temperatures above 70 °F.

Nighttime temperatures in excess of 70 °F for more than two consecutive days will increase the risk of stress to livestock. As with people, the stress is cumulative.

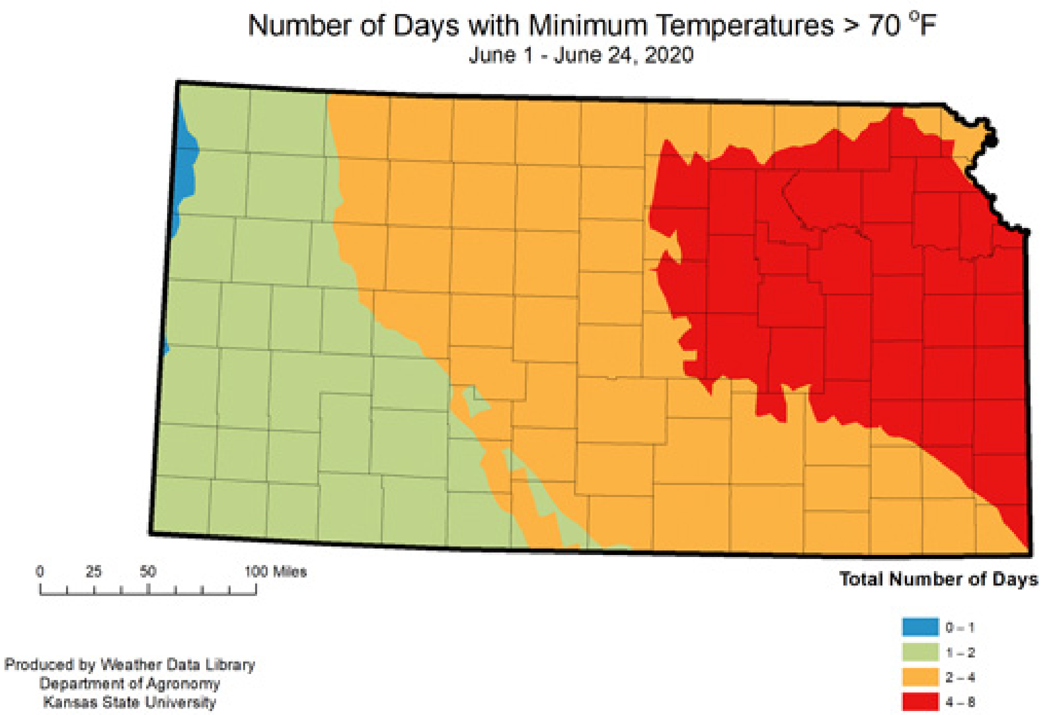

Figure 1. Total days with minimum temperature greater than 70 °F. Source: Weather Data Library

The heat this June can also cause problems for corn in Kansas (Figure 2). The effect of combined heat and drought stresses can reduce plant size, primarily when the plant is entering the stem elongation process. When the crop reaches the V10 (tenth-leaf) stage, nutrient and water demands (0.25 inch/day) are high. At this point, a combination of heat plus drought stresses will affect potential number of kernels and ear size. Overall mean temperatures above 90 °F, and more importantly, lower fluctuations between day and night temperatures, will produce critical impacts on plant and potential ear sizes and the yield components of corn.

Heat stress will have more of an impact on corn at this stage of growth when combined with drought stress. But even in the absence of drought stress, heat stress alone can still hasten vegetative phases and tasseling, potentially increasing the asynchrony between pollen shed and silk extrusion when corn reaches flowering time. The potential for yield reductions from stress at this stage of growth is small, however, compared with severe stress occurring right around pollination.

Figure 2. Leaf rolling in corn from the combined effect of heat and drought. This can also affect final plant size. Photo by Ignacio Ciampitti, K-State Research and Extension.

In the southeast, these conditions have occurred at a bad time. Following a very wet spring, root development has been stunted. The hot/dry conditions then combine for increased stress on these shallow roots with diminishing surface/shallow moisture. The lack of growth then prevents plants from reaching the remaining moisture further below the surface. In several cases, it was so wet that producers had to replant. This younger corn has been subjected to less than ideal moisture and increased heat for the early growth. As a result, development is also stunted, with shorter corn as observed in Cherokee County on June 23, 2020 (Figure 3). In the southwest, early-season plant growth (corn is still V6-V8) in also showing stress, even under irrigation.

Figure 3. Short corn observed in Cherokee County, Kansas on June 23, 2020 (Photo from the Weather Data Library).

Monitor the heat index and growing degree days using the Mesonet

The K-State Mesonet web site has a special page that tracks the current heat index at: http://mesonet.k-state.edu/weather/heat/

There is also a page that tracks growing degree accumulation for multiple crops. With this tool, you can pick the planting/emergence date for the start of the interval. Selecting the graph will illustrate the growing degree accumulation for this season versus normal and plant stage. You can access the page at: http://mesonet.k-state.edu/agriculture/degreedays/

The data updates every five minutes when you refresh the page and is available for all 65 stations across Kansas.

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2. Identifying nutrient deficiency symptoms in soybeans

This time of year, soybeans may begin showing signs of chlorosis or other leaf discoloration in all or parts of the field. There may be many causes of discoloration. Nutrient deficiencies are one possibility.

General considerations

The relative mobility of the nutrient within the plant will determine if the deficiency symptom will first be noticeable on the lower leaves or upper leaves.

Mobile Nutrients: These nutrients can be transferred from older tissues to the youngest tissues within the plant. Deficiency symptoms are first noticeable on the lower, oldest leaves.

- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Magnesium (Mg)

Immobile Nutrients: These nutrients are not easily transferred within the plant. Therefore, symptoms occur first on the upper, youngest leaves.

- Boron (B)
- Calcium (Ca)
- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Molybdenum (Mo)
- Sulfur (S)
- Zinc (Zn)

Possible causes of nutrient deficiencies:

1. Low soil levels of the nutrient
2. Poor inoculation (in the case of N deficiency)
3. Unusually low or high soil pH levels depending on the nutrient in question
4. Roots are unable to access sufficient amounts of the nutrients - due to poor growing conditions, excessively wet or dry soils, cold weather, or soil compaction
5. Root injury due to mechanical, insect, disease, or herbicide injury
6. Genetics of the plant

The following is a brief description of the symptoms of some of the most common nutrient deficiencies in soybeans.

Nutrient deficiency symptoms

Nitrogen. Chlorotic or pale green plants starting with the lower leaf (Figure 1a). Within the plant, any available nitrogen (N) from the soil or from nitrogen fixation within nodules on the roots goes to the new growth first. Soybeans prefer to take up N from the soil solution as much as possible, since this requires less energy than the nitrogen fixation process. However, both sources of N are important for soybeans since they are a big user of N. Nitrogen deficiency can be associated with poor nodulation (Figure 1b).

Figure 1a. Soybean field showing signs of chlorosis. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Figure 1b. Lack of nodulation on far right soybean plants. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Iron. Iron chlorosis, occurs in calcareous soils (contains calcium carbonates) with high soil pH. The classic symptom is chlorosis (yellowing) between the veins of young leaves since iron is not mobile within the plant (Figures 2 and 3). A side effect of iron deficiency can be N deficiency, since iron is necessary for nodule formation and function. If iron is deficient, N fixation rates may be reduced. Iron deficiency occurs on calcareous soils, in addition to high pH, plant stress can favor the development of iron chlorosis, and therefore the severity can vary significantly from year to year in the same field.

More information concerning iron chlorosis in soybeans is available in a previous eUpdate article from Issue 745, "Management strategies to minimize iron chlorosis in soybeans".

Figure 2. Iron chlorosis in soybeans; the upper leaves become chlorotic. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Figure 3. Close-up of iron chlorosis in soybeans. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Magnesium. Lower leaves will be pale green, with yellow mottling between the veins. At later stages, leaves may appear to be speckled bronze. This deficiency may occur on very sandy soils.

Manganese. Stunted plants with interveinal chlorosis (Figure 4). Can be a problem in soils with high pH (>7.0), or on soils that are sandy or with a high organic matter content (>6.0% OM). Manganese activates enzymes which are important in photosynthesis, as well as nitrogen metabolism and synthesis. Symptoms are hard to distinguish from iron chlorosis.

Figure 4. Manganese deficiency symptoms are similar to symptoms of iron chlorosis in soybeans. Photo by Jim Camberato, Purdue University.

Phosphorus. Phosphorus deficiency may cause stunted growth, dark green coloration of the leaves, necrotic spots on the leaves, a purple color to the leaves, and leaf cupping. These symptoms occur first on older leaves. Phosphorus deficiency can also delay blooming and maturity. This deficiency may be noticeable when soils are cool and wet, due to decrease in phosphorus uptake.

Potassium. Soybean typically requires large amounts of potassium. Like phosphorus deficiency, potassium deficiency occurs first on older leaves. Symptoms are chlorosis at the leaf margins and between the veins (Figure 5). In severe cases, all but the very youngest leaves may show symptoms.

Figure 5. Potassium deficiency: chlorosis of the lower leaves. Photo by Dave Mengel, K-State Research and Extension.

Sulfur. Stunted plants, pale green color, similar to nitrogen deficiency except chlorosis may be more apparent on upper leaves. Plant-available sulfur is released from organic matter. Deficiency is most likely during cool wet conditions or on sandy soils with low organic matter content.

For more information, see K-State Research and Extension publication MF-3028, *Diagnosing Nutrient Deficiencies in the Field* at: http://www.ksre.ksu.edu/bookstore/pubs/MF3028.pdf

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3. New study evaluated different herbicide programs for Palmer amaranth control in post-harvest wheat stubble

Recent rainfall events across various parts of Kansas have slowed down the wheat harvest, but wet soil and high temperatures have provided a conducive environment for Palmer amaranth seedbanks to germinate in standing wheat. In fact, several wheat fields with poor canopy closure have been observed with severe infestation of Palmer amaranth populations (Figure 1A). *Producers should prioritize the harvest of those wheat fields first and get wheat stubble sprayed as early as possible*. Otherwise, this newly emerged and rapidly growing Palmer amaranth flush will be a serious challenge for producers in post-harvest wheat stubble. Due to a fast growth habit, these Palmer amaranth seedlings can grow up to a half-inch in height per day under current Kansas weather conditions and can easily escape the recommended plant height (3- to 4-inch) for herbicide applications in wheat stubble. As glyphosate-resistant Palmer amaranth is also quite common in Kansas wheat fields, controlling those large-sized glyphosate-resistant Palmer amaranth populations in wheat stubble can be a daunting task.

Figure 1. (A) Emerged Palmer amaranth seedlings under poor wheat canopy, and (B) Palmer amaranth growth in post-harvest wheat stubble at the time of herbicide applications in 2019. Photos by Vipan Kumar, K-State Research and Extension.

A field study conducted in 2019 at the K-State Ag Research Center near Hays, KS evaluated various herbicide programs, including Roundup PowerMax, Clarity, 2,4-D, Aatrex, Gramoxone, Sencor, Valor SX, Spartan, Sharpen, Authority Supreme, Kochiavore, Panther MTZ, and Huskie applied alone or in tank-mixtures (24 total programs) for Palmer amaranth control in post-harvest wheat stubble (Table 1). The experimental site had a natural seedbank of Palmer amaranth population (sensitive to glyphosate). Palmer amaranth plants were treated when reached to the height of 2 to 2.5 feet and were showing signs of inflorescence initiation (Figure 1B).

Table 1. List of herbicide programs tested for controlling Palmer amaranth in post-harvest wheat stubble at the Kansas State University Agricultural Research Center near Hays in 2019.

Treatment Number	Herbicide Programs [a,b]	Rate (oz/a)	Herbicide groups
1	Non-treated	-	-
2	Roundup PowerMax	32	9
3	Clarity	16	4
4	2,4-D amine	32	4
5	Roundup PowerMax + Clarity	32+16	9 & 4
6	Roundup PowerMax + 2,4-D amine	32+32	9 & 4
7	Clarity + Aatrex	16+16	4 & 5
8	Clarity + 2,4-D amine	16+32	4
9	Gramoxone	48	22
10	Gramoxone + Aatrex	48+16	22 & 5
11	Gramoxone + Sencor	48+5	22 & 5
12	Gramoxone+ Valor	48+2	22 & 14
13	Gramoxone + 2,4-D amine	48+32	22 & 4
14	Gramoxone + Spartan	48+4	22 & 14
15	Gramoxone + Authority Supreme	48+10	22 & 14, 15
16	Gramoxone + Panther MTZ	48+15	22 &14, 15
17	Sharpen	2	14
18	Sharpen + Aatrex	2+16	14 & 5
19	Sharpen + Sencor	2+5	14 & 5
20	Sharpen + 2,4-D amine	2+32	14 & 4
21	Kochiavore	16	4
22	Huskie + Aatrex	15+16	6, 27 & 5
23	Liberty	36	10
24	Liberty + 2,4-D amine + Roundup PowerMax	36+32+32	10, 4, 9
25	Liberty + Clarity + Roundup PowerMax	36+16+32	10, 4, 9

[a] Herbicide treatments were applied on 2- to 2.5-ft tall Palmer amaranth plants showing inflorescence initiation in post-harvest wheat stubble.

[b] All treatments were applied with appropriate adjuvants as dictated by each herbicide label.

Results indicated that all tested herbicide treatments provided excellent late-season control of Palmer amaranth (>88% control) at 8 weeks after treatments (WAT), except Kochiavore and a tank-mixture of Huskie + Aatrex **(**Figure 2**)**. A majority of the tested programs significantly reduced Palmer amaranth seed production (>93% reduction) compared to the non-treated weedy check (data not shown). The least Palmer amaranth control was observed with Kochiavore and a tank mixture of Huskie + Aatrex in comparison to the non-treated weedy check (Figure 2). Tank-mixtures containing soil-residual herbicides such as Aatrex, Sencor, Valor, Spartan, Authority Supreme, and Panther MTZ also prevented any late-season flush of Palmer amaranth.

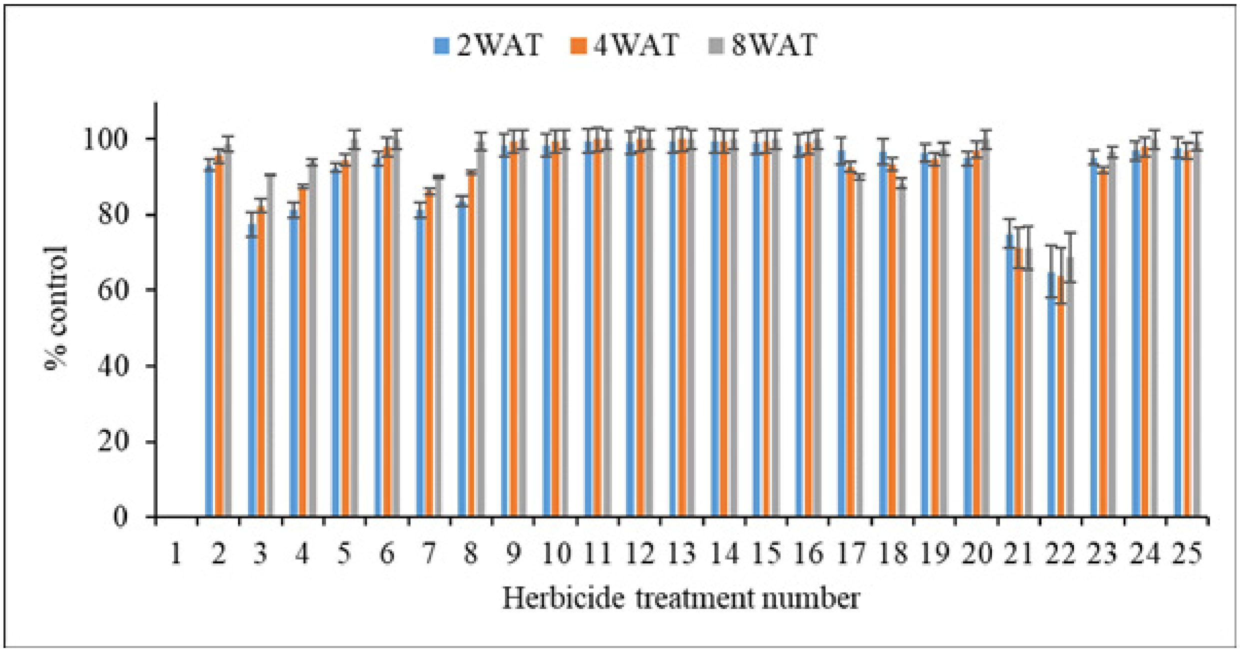

Figure 2. Effect of late-season herbicide programs on Palmer amaranth control at 2, 4, and 8 weeks after treatment (WAT) in post-harvest wheat stubble (see table 1 for herbicide treatment number).

Important note: Growers are advised to read each herbicide label for rotational crop restrictions (for next summer crop) before using any of these mentioned products.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

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4. Considerations for weed control following wheat harvest

Post-harvest weed control in wheat stubble is very important to conserve soil moisture and prevent weeds from going to seed and adding to the weed seedbank. Weeds are likely to be growing quickly, especially where there are thin stands. Controlling these weeds while there is moisture and active growth, before they set seed, is a good idea.

The standard treatment for many years to control weeds and volunteer wheat in wheat stubble was glyphosate plus 2,4-D LVE. If kochia was present, we may have added some dicamba, but it generally wasn't added in the eastern areas of Kansas because of drift concerns to soybeans. Glyphosate plus 2,4-D and/or dicamba remain a primary option for weed control in stubble, but with the development of glyphosate-resistant weeds, these options certainly don't work as well or quickly as they used to.

Glyphosate used to be fairly foolproof, even on big weeds, but that is no longer the case. Dicamba and 2,4-D probably weren't contributing as much to the weed control in those tank mixes as we may have thought, so now we are struggling to achieve acceptable control. Timing and weed size is much more critical with almost all other herbicides than it was with glyphosate. Consequently, it is very important to try and apply those treatments before the weeds exceed 4 to 6 inches tall, but that often doesn't happen. In addition, treatment before weeds exceed 4 inches tall may require a number of applications to manage multiple flushes of weeds, which adds significantly to the cost of control.

Higher rates of the 2,4-D and dicamba may improve control, but in most cases we probably don't want to exceed 1 qt/acre of 2,4-D or a pint/acre of dicamba. Sharpen is another herbicide tank-mix partner that may help with control of the pigweeds and provide some residual control. Sharpen works best with the addition of methylated seed oil and can provide some pretty good burndown on smaller weeds, but if the weeds are very big, it tends to burn the tops and plants eventually resume growth. Applying 2 or 3 oz/acre of Sharpen instead of 1 oz/acre will improve control of larger weeds and provide longer residual control. Sharpen requires complete coverage so using 15 to 20 gallons/acre spray solution is important.

One herbicide alternative to glyphosate that can work well to control emerged pigweed and kochia is paraquat. Paraquat is a contact herbicide, so spray coverage is critical. Spray volumes of 20 gallons/acre or higher are preferred, especially on larger weeds or denser stands. Paraquat also needs to be applied with a non-ionic surfactant or oil concentrate to enhance surface coverage of the plant foliage. A tank mix with atrazine will enhance control and provide some residual weed control if planning to plant corn or sorghum next spring. Likewise, metribuzin can be tank-mixed with paraquat if rotating to soybean to enhance control and provide some residual. If planting wheat this fall, a tank mix with Sharpen is an option to provide some residual control. Recent work at K-State suggests that making the paraquat application as soon as possible following wheat harvest allows for better coverage and more effective control especially of the pigweeds.

Another herbicide that can be added to the burndown treatments for residual broadleaf weed control in wheat stubble is flumioxazin (Valor and others). Flumioxazin has been used as a pre-plant/pre-emergence treatment in soybeans for years, but it hasn't been used much in wheat stubble because of the cost. However, with the recent reduction in flumioxazin prices, it may be worth considering as part of our stubble management treatments for residual weed control, especially the pigweeds. Wheat can be planted 30 days after 2 oz/ac, or 60 days after 3 oz/ac Valor application, if at least one inch of rain occurs between application and planting. Corn, sorghum, cotton, sunflowers, or soybeans can be planted the following spring following flumioxazin treatment. Residual weed control with flumioxazin will depend on rainfall for activation, just as with pre-plant treatment in soybeans.

Note: Recent data evaluating the efficacy of some of these herbicide programs on Palmer amaranth control in wheat stubble in western Kansas are presented in a companion article in this eUpdate (see "Herbicide considerations for Palmer amaranth control in post-harvest wheat stubble").

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5. Update on drought conditions in Kansas - June 23, 2020

Highlights

- Significant moisture in central Kansas
- Warm start and a warm ending gave a mix of departures from normal temperatures
- Extreme drought expanded slightly in southwest Kansas; severe and moderate drought moved north and abnormally dry conditions expanded in the east
- Forecast for the upcoming week is for above-normal temperatures and normal precipitation

For the week ending on June 23, 2020, precipitation occurred statewide with the heaviest over central Kansas (Figure 1). The highest average precipitation was in the South Central Division, which averaged 2.59 inches, 235% of normal (Figure 2). The East Central Division received the least precipitation, averaging 0.45 inches and only 35% of their weekly normal.

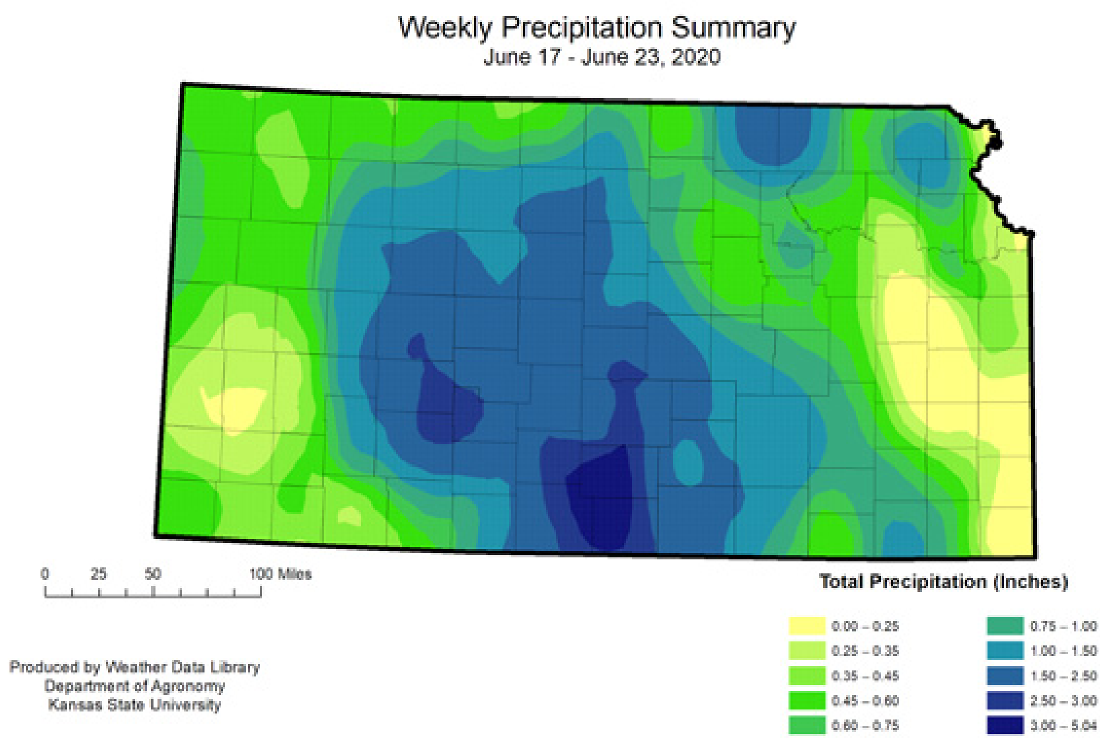

Figure 1. Total precipitation (inches) recorded for the week of June 17 – June 23, 2020. Map by the Kansas Weather Data Library.

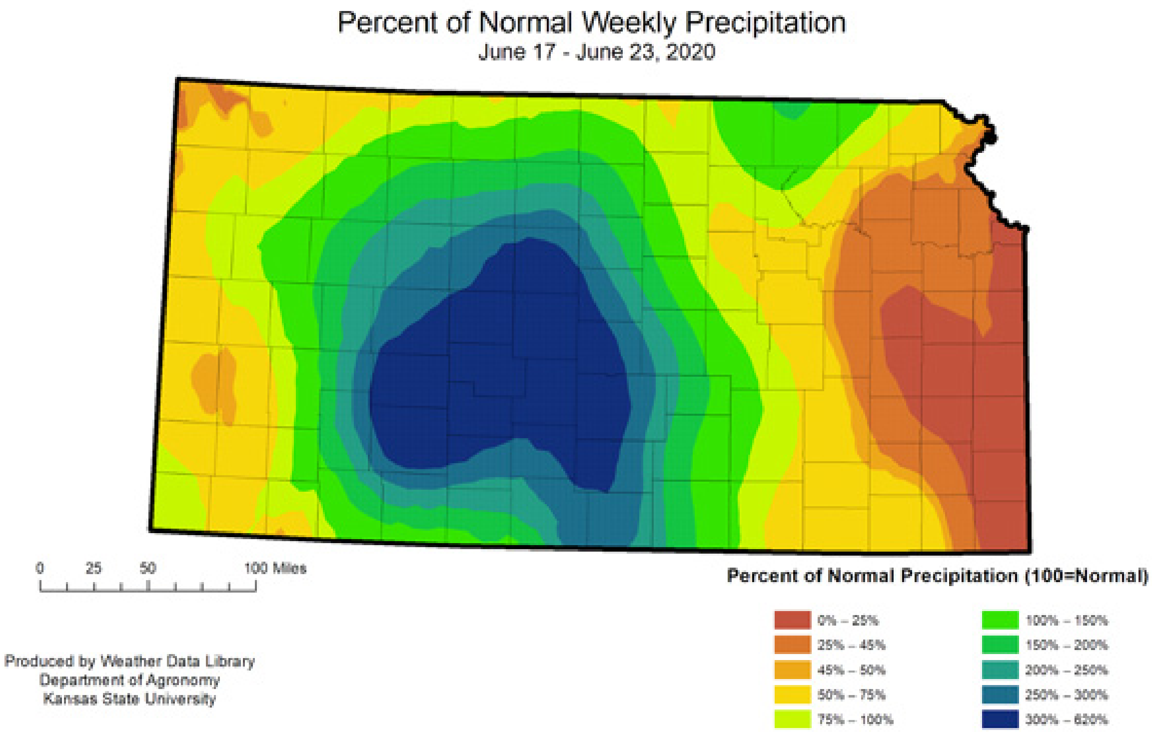

Figure 2. Percent of normal precipitation for the week of June 17 – June 23, 2020. Values less than 100 indicate below-normal amounts. Map by the Kansas Weather Data Library.

Temperatures also showed considerable variability with the warmest reading of 100 ^{o}F at various locations in western KS, on the 18th. The coldest reading was 48 ^{o}F (Brewster 1N, Sherman County, on the 17th). The state averaged 1.0 ^{o}F warmer than normal for the seven-day period (Figure 3). The warmest division was the Southeast, which averaged 2.0 ^{o}F warmer than normal. The Northwest Division was the coolest, with an average departure of 0.4 degrees cooler than normal. (Figure 3).

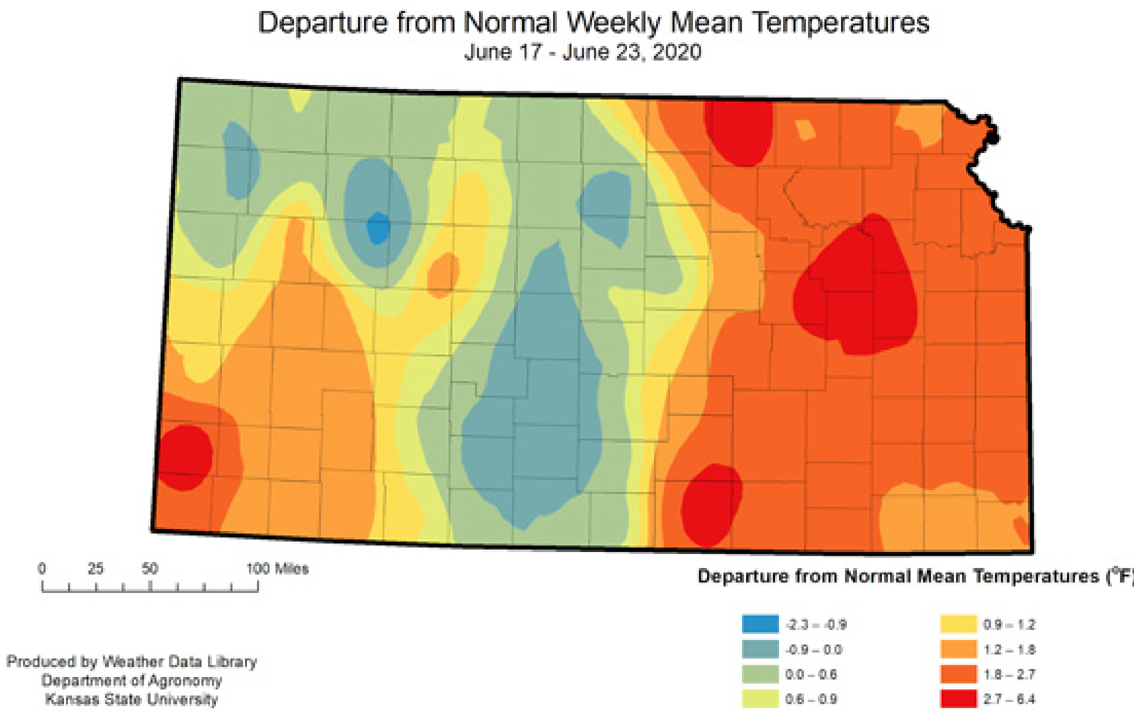

Figure 3. Departure from normal weekly mean temperatures. Map by the Weather Data Library.

Current drought status for Kansas

The abundant precipitation in the central parts of the state resulted in improvement in areas that saw more than 2 inches during the week. Areas with less rainfall remained the same or deteriorated. Severe and extreme drought (D3) expanded and abnormal dry conditions expanded in the eastern parts of the state (Figure 4). Overall, the areas that showed improvement covered more ground than the areas with deterioration (Figure 5). The percent of the state in extreme drought (D3) remained the same, while percent in all other categories declined slightly. Summer crops and perennials are showing active growth and increased evapotranspiration demands, especially in the west (Figure 6). Drought stress is showing in many fields and is likely to continue if the sufficient moisture fails to materialize in timely intervals.

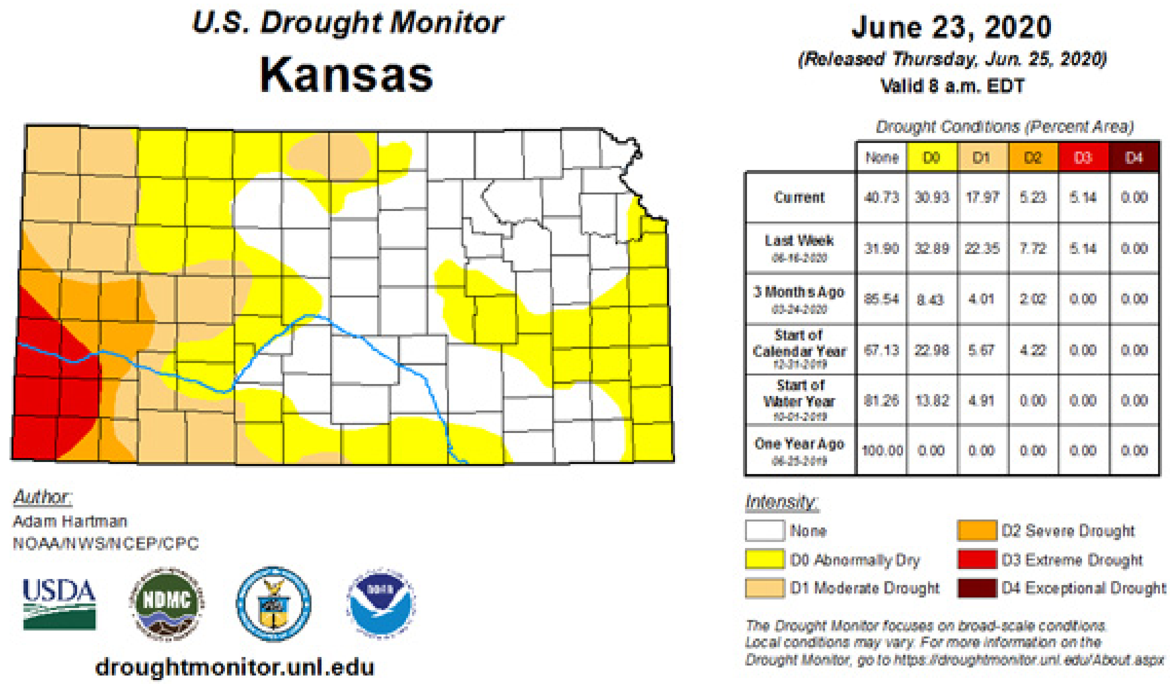

Figure 4. Current weekly drought status (U.S. Drought Monitor)

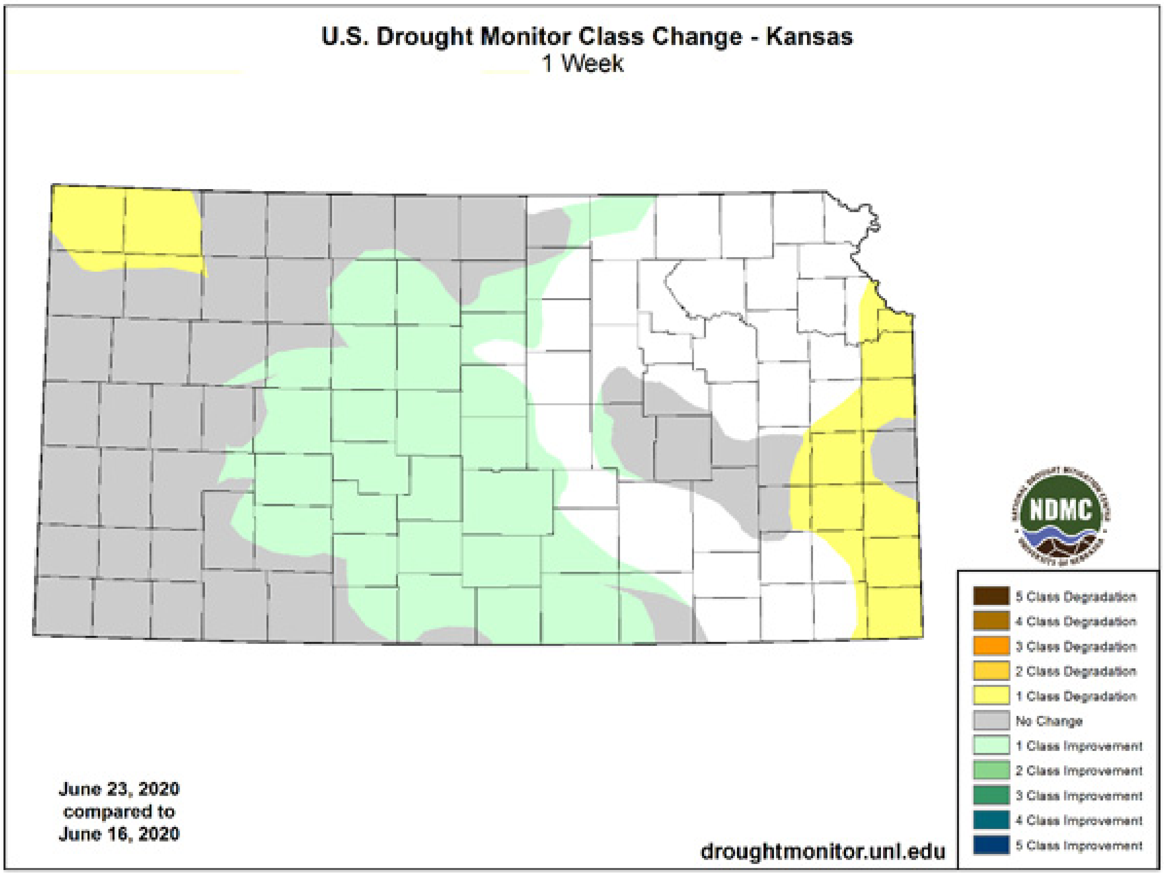

Figure 5. Change in weekly drought status (U.S. Drought Monitor)

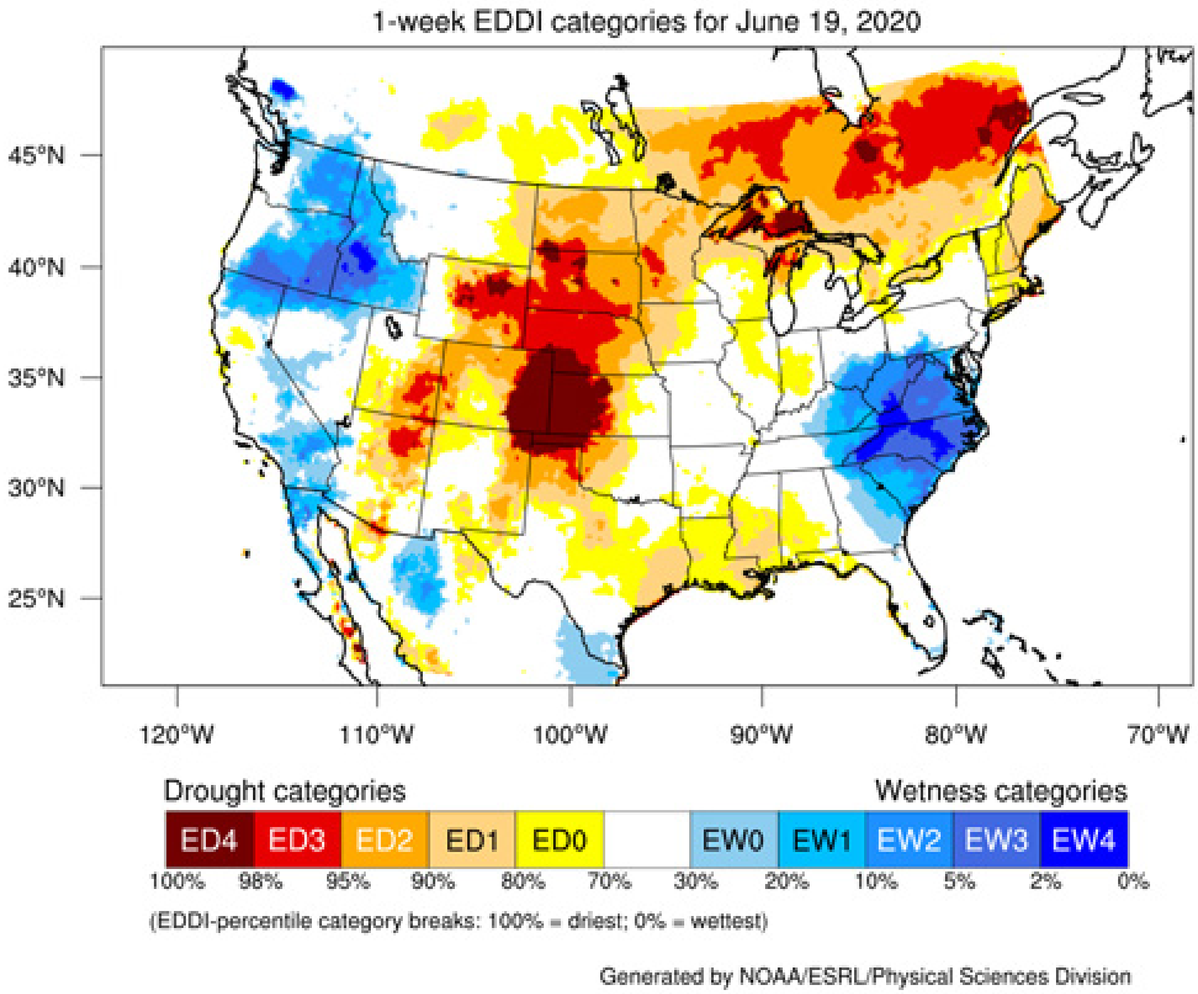

Figure 6. Evaporative Demand Drought Index (EDDI) for the week ending on June 19th (NOAA)

In the upcoming week, there is an increased chance of above-normal precipitation across the eastern third of the state (weekly average precipitation for late June is 0.7-1.5 inch). As we move into July, average precipitation across the state begins to decrease. As a result, even normal precipitation will be slow to result in improvement, especially as warmer-than-normal temperatures are expected. The quantitative precipitation forecast favors at least some precipitation across the state, with less than a quarter of an inch along the KS/OK border in Southwest KS and as much as 1.75 inches in the extreme northeast (Figure 7). The July outlook favors warmer than normal temperatures for the state, with a slight chance of above normal precipitation confined to eastern Kansas (Figures 8 and 9).

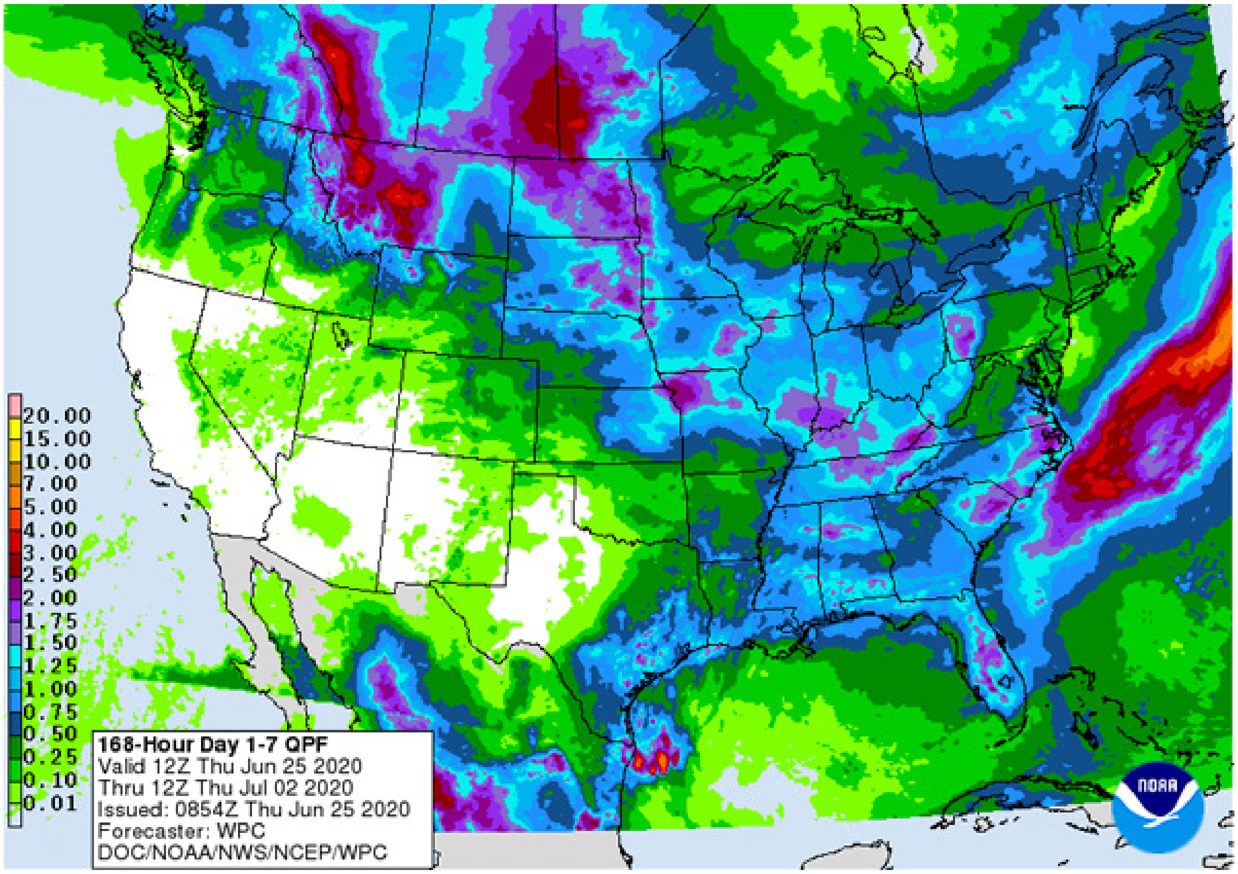

Figure 7. Quantitative Precipitation Forecast for week ending 7/2/2020 (Weather Prediction Center)

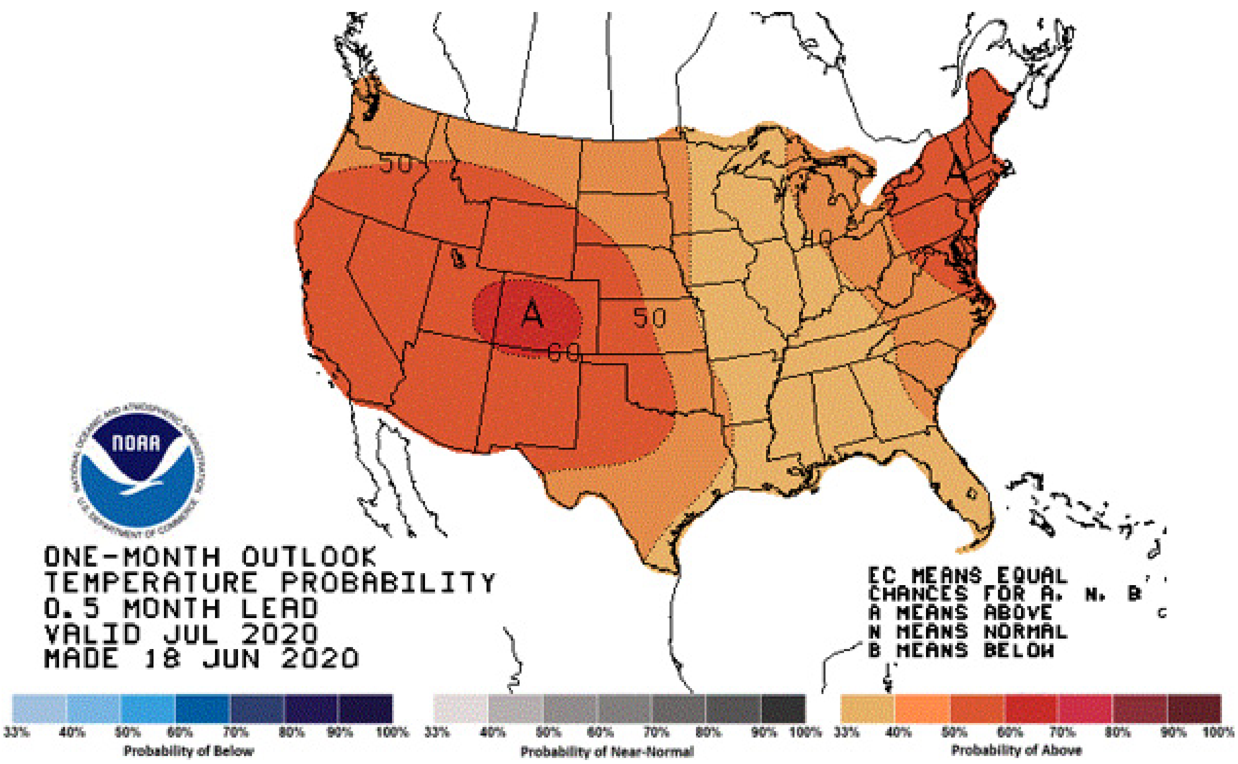

Figure 8. Temperature outlook for July 2020 (Climate Prediction Center)

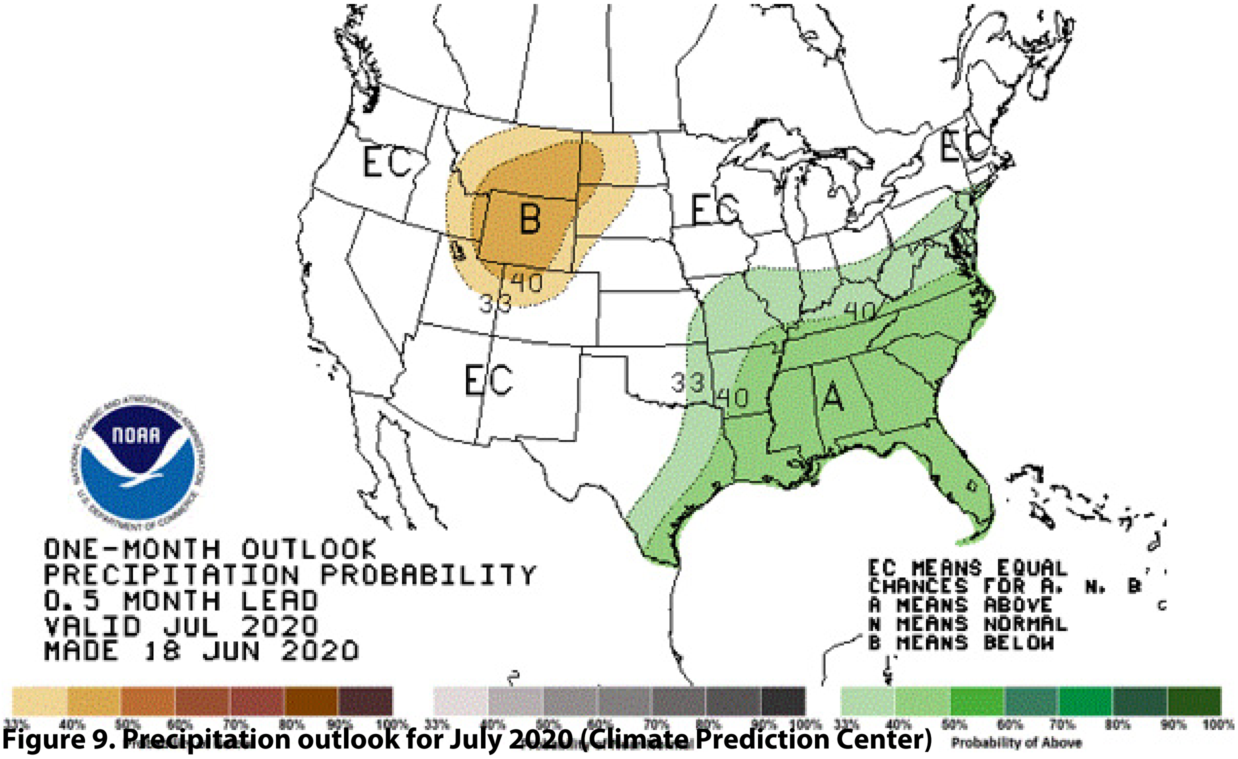

Figure 9. Precipitation outlook for July 2020 (Climate Prediction Center)

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6. 2020 Kansas Corn Yield Contest

Now that corn is in the ground and growing, harvest in Kansas will be here before you know it. Corn producers in the state are encouraged to keep in mind the Kansas Corn Yield Contest before they fire up the combines this year.

Kansas Corn, in conjunction with K-State Research and Extension, will conduct a 2020 Kansas Corn Yield Contest. All Kansas corn producers are eligible to enter the free contest, but they must be active members of the Kansas Corn Growers Association.

The contest is a fun way for producers to showcase their high yielding and high quality corn with other growers in the state, and provide motivation to producers to increase yields. The contest also serves as a vehicle to improve farming operations and increase awareness of best management practices (BMPs) to improve and sustain corn yields.

In addition to grower recognition, cash awards will be awarded at the district and state levels. The districts align with crop reporting districts, plus a NNE district was created to include Doniphan and parts of Brown and Atchison (Figure 1). In addition, one statewide dryland winner and one statewide irrigated winner will be announced. Entries for 2019 contest are presented in Figure 2. District winners will receive $300 and a plaque. Second place entries will receive a $200 prize and third place will receive a $100 prize. The highest yielding dryland and irrigated entries statewide will receive an additional $500 prize. All farmers entering the contest and completing the harvest form will receive a shirt from Kansas Corn, if they have not earned one already through the Corn Challenge. Contest winners will be recognized at the Kansas Corn Symposium in January 2021.

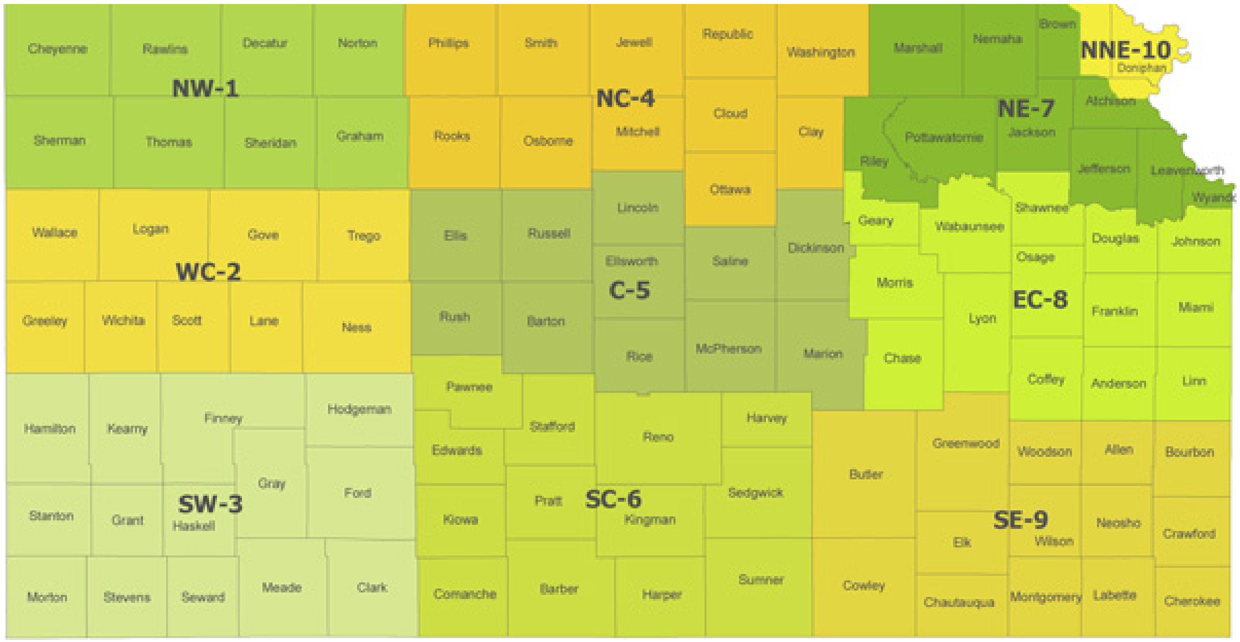

Figure 1. Dryland and irrigated contest districts. Note: NNE includes only those fields north and/or east of KS Hwy 73 in Brown, Doniphan, and Atchison counties.

The contest is free of charge to members of the Kansas Corn Growers Association. Registration must be completed online by **August 31, 2020.** If harvest occurs before the August 31 deadline, the registration must be received two weeks prior to harvest**.** Exceptions can be made for late harvest, but must be requested ahead of time. All harvest entry forms must be **received online by December 1, 2020**. Entries submitted to the National Corn Yield Contest qualify to enter the state contest, but entries must be made to both contests.

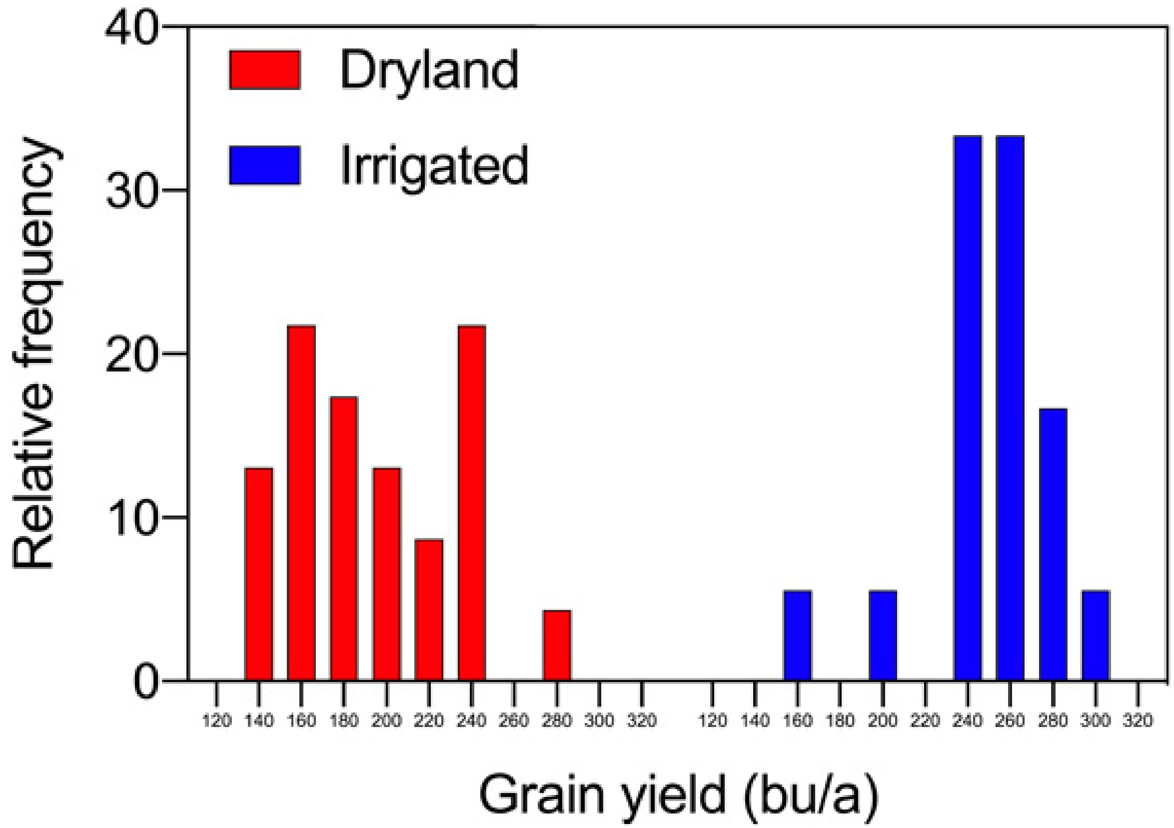

Figure 2. Kansas contest winner entries to the Kansas Corn Contest from 2019. Relative frequency referred to number of entries in the contest along the y-axis and yield values along the x-axis are in bushels per acre (red bars for dryland and blue bars for irrigated). Graph produced by Ignacio Ciampitti, K-State Research and Extension.

Results from the 2018 Kansas Corn Yield Contest can be reviewed at:

https://bookstore.ksre.ksu.edu/pubs/MF3463.pdf ("Kansas Corn Yield Contest, High Yield Management")

For complete contest rules, forms, and to register, visit kscorn.com/yield.

For more information, call Kansas Corn at 785-410-5009 or email yield@ksgrains.com

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