K-STATE Research and Extension

Extension Agronomy

eUpdate

05/22/2020

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. Considerations for pre-emergence herbicides

Pre-emergence, soil-active herbicides applied around the time of planting are an important part of a good weed management program. However, variability in spring weather leads to concerns about both weed control and crop injury. If you are concerned about the performance of your pre-emergence herbicides, be sure to scout fields to determine your post-emergence weed management program.

Most herbicides that are commonly used to control weeds before they emerge in corn and soybean fields fall into one of five herbicides groups:

- Seedling root growth inhibitors (Group 3)
- Seedling shoot growth inhibitors (Group 15)
- Pigment inhibitors (Group 27)
- Photosynthesis inhibitors (Group 5)
- Cell membrane disruptors (Group 14)

Example products for each group are listed in the discussion below and in Table 1. Herbicides vary in the way they are absorbed by plants and how they are affected by precipitation. Many pre-emergence herbicides require sufficient rainfall for activation. In this context, activation means movement of the herbicide into the soil where the herbicide interacts with germinating weeds. Information from each herbicide label regarding uptake and rainfall after application is also listed in Table1.

Group 3 herbicides, such as Prowl (pendimethalin) and Group 15 herbicides like Dual products (*S*-metolachlor), Harness products (acetachlor), Outlook (dimethenamid-P), and Zidua (pyroxasulfone) are absorbed by root and shoot material as plants begin germinating. This is why these products only control weeds before they emerge and also why they must be activated.

Group 27 herbicides are absorbed by seeds, roots, and shoots. Some of these herbicides, such as Balance Flexx (isoxaflutole) only control weeds before emergence. Other, like Callisto (mesotrione) have activity both before and after emergence. If pre-emergence activity is desired, rainfall is required for activation. When post-emergence activity is the goal, adequate soil moisture in necessary, because plant roots will take in herbicide with soil water. This is why Group 27 herbicides are sometimes said to be ‘reactivated’ by rainfall later in the growing season.

Herbicides in Group 5, like atrazine and metribuzin, and **Group 14**, like Spartan (sulfentrazone) and Valor (flumioxazin) are absorbed by plant roots as water is taken in by the plant. Rainfall for activation is less important for Group 5 herbicides, however soil moisture is necessary for activity. In the case of sulfentrazone and flumioxazin, rainfall is needed for activation, however excessive rainfall is associated with soybean injury.

Table 1. Summary of the 5 groups of pre-emergence herbicides for corn and soybean production.

Mode of Action	Grp. No.	Site of absorption (When soil applied)	Herbicide	Rainfall requirement	
				Amount	Timing
Seedling root growth inhibition	3	Emerging shoots and roots	Prowl H_2O	amount not listed	before weed seedling germination
Photosystem II inhibition	5	Roots	Atrazine	none	
			Metribuzin	0.25 inch	time not listed
Cell membrane disruption	14	Roots	Spartan	0.25 to 1.0 inch	7 to 10 days after application
			Valor	at least 0.25 inch	time not listed
Seedling shoot growth inhibition	15	Emerging shoots and roots	Dual II Magnum	0.5 to 1 inch	within 2 days after application
			Harness	0.25 to 0.75 inch.	within 7 days after application and prior to weed emergence
			Outlook	amount not listed	before weed seedling emergence from the soil
			Zidua	at least 0.5 inch	before weed germination and emergence
Pigment inhibition	27	Seed, roots, shoots	Balance Flexx	amount not listed	prior to weed emergence
			Callisto	0.25 inch	within 7-10 days after pre-emergence application

Crop injury can be a concern each of the products listed above. Any conditions that increase crop exposure to the herbicide can result in injury. For example, periods of cool weather, especially cool and wet weather, that slow crop growth and limit the plant's ability to metabolize the herbicide to inactive forms (Figure 1). Planting in marginal conditions that result in poor closure of the seeding slot can is another example of a condition likely to result in crop injury.

Figure 1. This corn seedling emerged during cool, wet conditions and is showing symptoms of mesotrione injury. Photo by Sarah Lancaster, K-State Extension and Research.

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2. 2020 Kansas wheat crop conditions: Wheat Quality Tour summary report

The 2020 Wheat Quality Tour had to take a virtual path during 2020 due to the COVID-19 pandemic. Thus, during May 18 – 21, 2020, a few people drove around Kansas to scout wheat fields and make yield estimates. Many KSRE Agriculture Extension Agents also participated, doing yield estimates and crop scouting in their own region. For his part, Dr. Romulo Lollato drove 1,647 miles in three distinct routes across Kansas, resulting in 65 yield estimates across the state (Fig. 1). At the end of each day, several live reports for the crop conditions across the state occurred. These were recorded and, together with more information, are available at http://kswheat.com/harvest/hrw-virtual-wheat-tour

Figure 1. Routes taken by Dr. Romulo Lollato, K-State Wheat and Forage Specialist, during day 1 (North Central KS), day 2 (West Central and central KS), and day 3 (Southwest and South Central KS) to estimate wheat yield and crop status during the wheat quality tour.

The Kansas wheat crop is very variable and its overall condition depend on the region of the state. The 2020 total production estimate for Kansas, resulting from the tour, was 284 million bushels of wheat, comparing to 306, 243, and 282 million bushels in 2019, 2018, and 2017. The current estimate corresponds to a yield of 45 bu/ac and an area abandonment of about 8%. Weather conditions during the remainder of the growing season will be crucial in determining the final production.

North central, west central, central, and southwest Kansas: Freeze damage and drought stress

Perhaps the two most predominant highlights during the 2019-2020 wheat growing season in Kansas were the extended drought in parts of the state and the freeze events that happened on April 3 and April 13-17. The drought has been affecting southwest and west central Kansas since last fall (Fig. 2, upper panel), resulting in many fields that only emerged in the spring. Since the winter, the drought was also taking its toll on the crop in the North central portion of the state. Meanwhile, the freeze events of April resulted in temperatures ranging from a low of ~8 °F in northwest Kansas (where the crop was tillering), to about 30 °F in south central Kansas where the crop was at the boot stage. Analysis of the risk of freeze damage based on the coldest temperature measured, the stage of crop development, and the number of hours that temperatures were sustained below cold tolerance thresholds associated with the different crop stages across Kansas indicated that the greatest risk of freeze damage was in the central portion of the state (Fig. 2, lower panel).

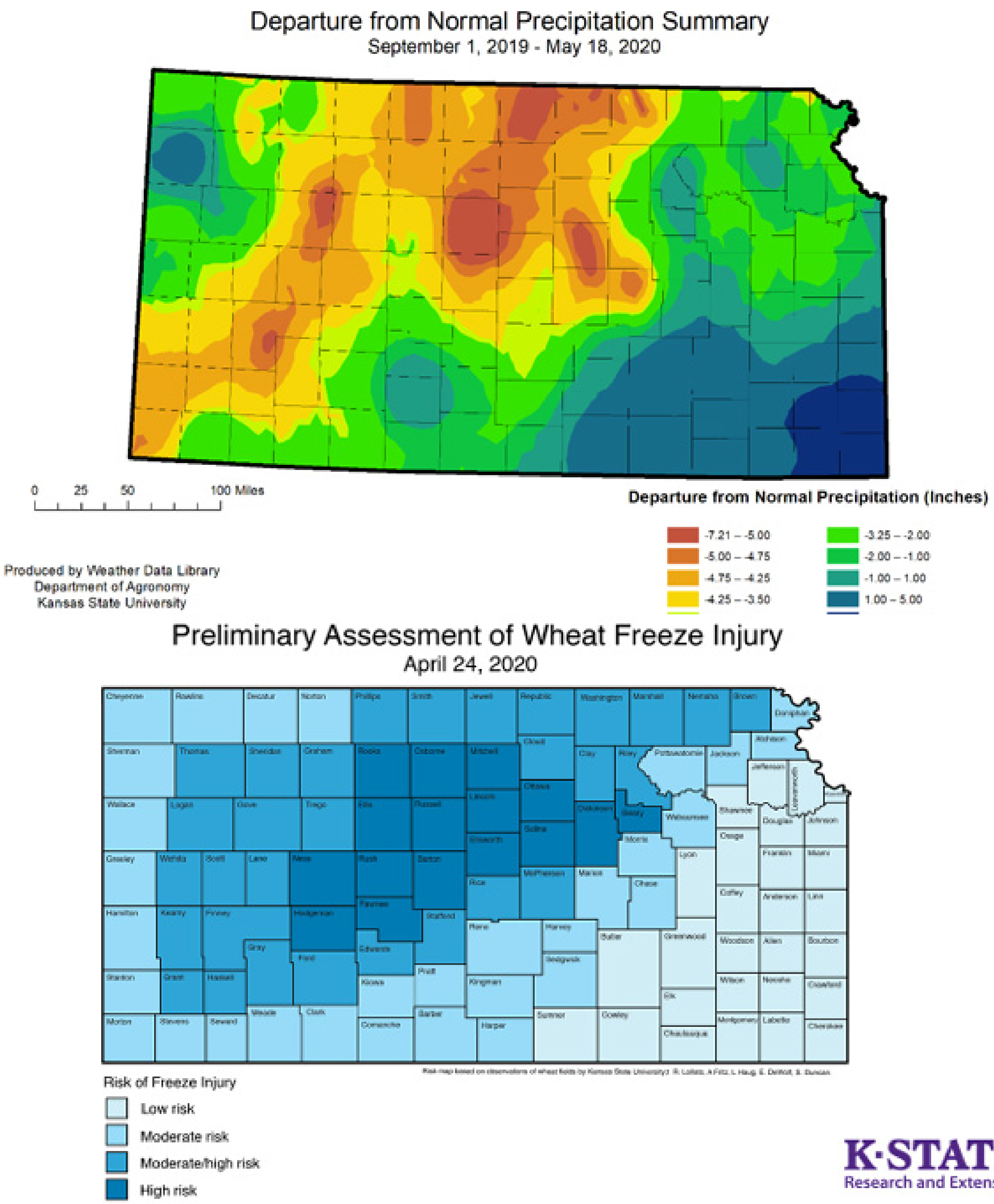

Figure 2. Departure from normal precipitation experienced during the wheat growing season (September 1, 2019 through May 18, 2020; upper panel) and preliminary assessment of wheat freeze injury on April 24, 2020, developed in collaboration with Erick DeWolf and the Weather Data Library, from the estimated wheat growth stage as of April 28, 2020.

The true damage of the freeze to the wheat crop depended on the freeze's interaction with drought stress. In regions where the freeze was followed by precipitation, the crop recovered well. These include the region between Republic county down to Saline county, southwest to Barton county and north until about Russel county and eastern Ellis county. The predominant symptoms in these cases include a number of tillers that were terminated and perished in the lower canopy (20-40% of the tillers at the time of the freeze event). Otherwise, the upper canopy does not show symptoms of freeze damage because there were enough new tillers developed to make up for a large portion of the yield potential (Fig. 3). However, low-lying fields in this region, in which low temperatures were lower and likely sustained by a longer period of time, had severe freeze damage. In these cases, the stand was thinned out allowing for weeds to thrive (Fig. 4). Even though the crop was trying to recover due to available moisture, the yield potential of the newly formed heads is very limited (Fig. 4). In these cases, the new tillers are much shorter than the older tillers, which can result in harvest losses. Additionally, these later tillers will also mature later and likely hold moisture high during harvest time.

Figure 3. Wheat field in Republic county showing loss of the lower leaves due to the freeze damage, but good recovery of new tillers and foliage. Photos by Romulo Lollato, Extension wheat specialist with Kansas State University.

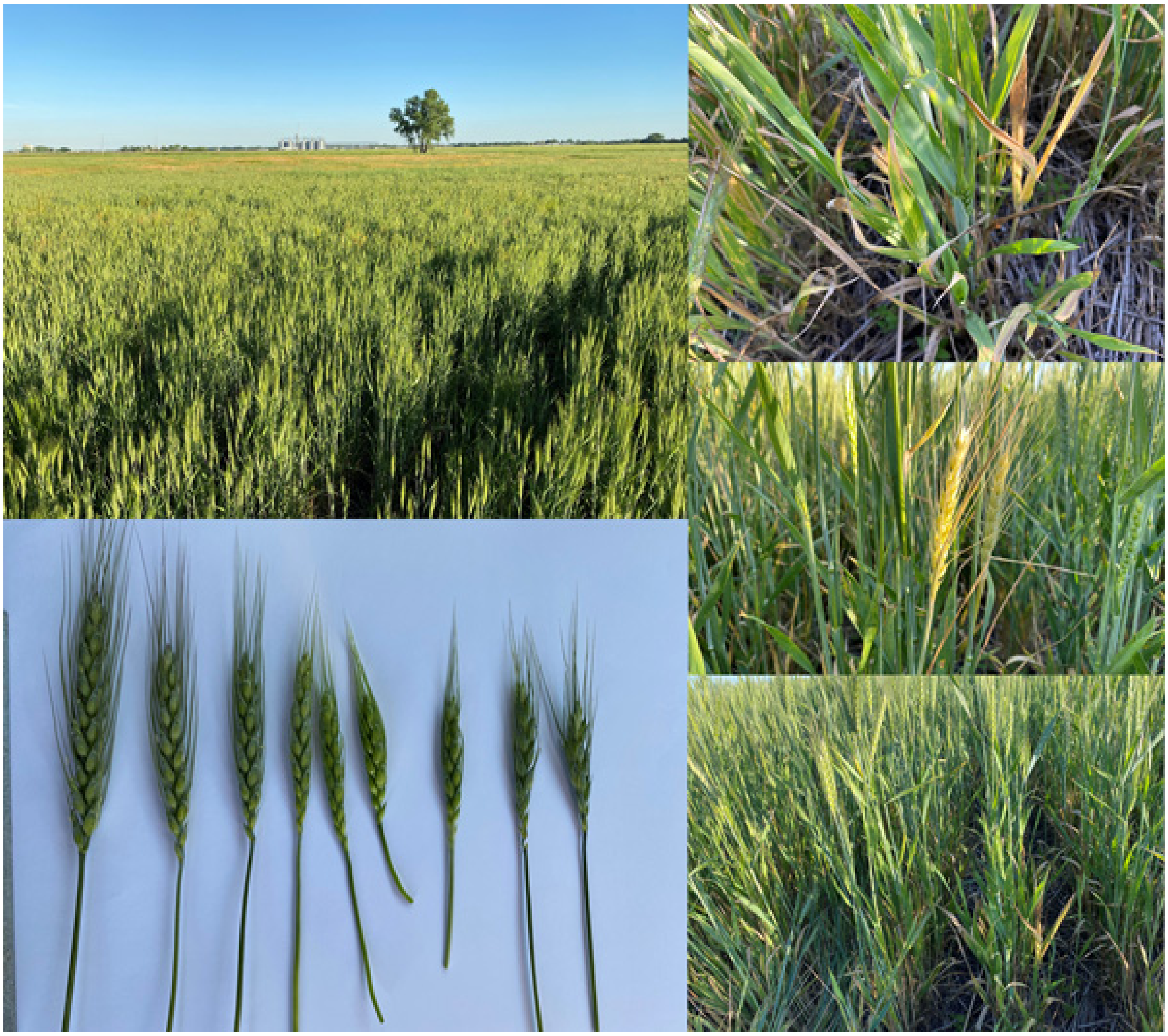

Figure 4. Wheat field in a low-lying area of Barton county. Although there was enough moisture for the crop to recover, the cold temperatures in low lying areas led tiller loss and thinning out of the stand, allowing weeds to thrive. The newly emerged heads are considerably smaller and lower in the canopy than the original heads, which can result in harvest delays and losses. Photos by Romulo Lollato, Extension wheat specialist with Kansas State University.

In regions where the cold snap was not followed by precipitation, the crop is struggling to recover from the freeze damage. This region was mostly that of Smith and Osbourne counties and west. The loss of several tillers and lack of moisture for recovery is resulting in many extremely thin and drought stressed stands, with several plants producing one or two heads (Fig. 5). The effects of the freeze damage were worst in late-planted fields (usually following a soybean crop in central Kansas or corn crop in northwest Kansas) as compared to fields sown at the optimum time (after a wheat or corn crop in central Kansas, or after a wheat crop or fallow period in northwest Kansas).

Figure 5. Wheat field in western Phillips county struggling to recover from the freeze damage due to drought stress. Photo by Romulo Lollato, Extension wheat specialist with Kansas State University.

The cropping system was also playing a role in west-central Kansas. In this region, many fields still had a good yield potential, and were neighboring fields that were extremely affected by the freeze/drought (Fig. 6). Drought stress intensified as we headed southwest. Counties west of Hodgeman, including northern Ford County, Gray, Haskell, and Seward counties, were severely impacted by the long-term drought stress. The majority of the dryland wheat fields in that region were already going through the early stages of grain development, and many times were 8-9 inches tall (Fig. 7).

Figure 6. Neighboring wheat fields in Wichita Co, west central KS, showing good and poor yield potential, likely led by different sowing dates and cropping systems. Photo by Romulo Lollato, Extension wheat specialist with Kansas State University.

Figure 7. Fields in southwest Kansas were severely impacted by long-term drought stress, resulting in reduced height, abortion of tillers, and early senescence. Photo by Romulo Lollato, Extension wheat specialist with Kansas State University.

Central and south central Kansas: Stripe rust

As we headed to central and south central Kansas, the crop conditions and yield potential noticeably increased. This was mostly driven by good moisture conditions (Fig. 1) and temperatures that did not get cold enough to cause damage during the freeze even. In this region, however, which encompasses the counties of Meade in the southwest border, Sumner in the southeast, and as far north as McPherson; the incidence of stripe rust was extremely high. Many fields had already lost a considerable amount of green leaf area (Fig. 8), which can highly compromise wheat yields. Unfortunately, most of the wheat crop in this region is already past the last date in which fungicides can be applied based on product label, so in these cases, there is not much growers can do. For the regions in which the crop is behind in development and that there is still time to apply fungicides, we advise producers to scout their fields for the disease be prepared to spray especially susceptible varieties. The decision to spray a foliar fungicide should take into account the yield potential of the crop, the crop price, disease incidence, weather conditions, variety susceptibility to the disease, and the costs of product and application.

Figure 8. Wheat field in Pratt Co, Kansas, with excellent yield potential but severe stripe rust in the lower, mid, and upper canopy. This level of disease incidence and severity can highly compromise wheat yields. Photo by Romulo Lollato, Extension wheat specialist with Kansas State University.

The above factors are a few of the major challenges that the 2020 Kansas wheat crop was facing during the tour. While all should contribute to restricted wheat yields to a certain extent, the largest uncertainty when estimating wheat production at the state level is the weather during grain filling. Because the crop is two to five weeks from harvest, cool and moist conditions during grain fill are essential to ensure a decent crop. If warm and dry conditions arise, the wheat yield potential can be severely limited.

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3. Possible causes for white heads in wheat

White heads have been appearing in many wheat fields around Kansas. Sometimes the white heads are just single tillers scattered throughout part or all of a field, and sometimes they occur in small-to-large patches. Heads might be completely white starting from the stem, or may just have a few spikelets showing the discoloration.

There are many causes of white heads. Here are some of the most common causes and their diagnosis.

Freeze injury to stem or crown. Depending on the stage of growth at the time of a late spring freeze, parts or all of the heads may die and turn white (Figure 1).

In years when the freeze occurs about the boot stage or a little earlier, there can be injury to the lower stem, which then cuts off water and nutrients to the developing head and that stem simply does not develop. In years when the wheat is in the early heading stage at the time of the freeze, the freeze can damage the heads directly.

Often, wheat on north-facing slopes, on ridge tops, or in low-lying areas will be most affected by freeze injury. But freeze injury can also be so severe that it occurs throughout the fields, in no particular pattern. Crown rot is another potential problem that can be traced back to freeze injury.

When the crown is damaged by cold temperatures or a freeze, part or all of the tillers can die. If the tiller from a damaged crown forms a head, this head will almost always be white. The crown will have internal browning, and stands will usually be thinner than normal.

Figure 1. Freeze-damaged wheat heads. Photos taken by Romulo Lollato, Extension wheat specialist with Kansas State University.

Hail. Hail can cause white head to appear when it breaks the connection between the stem and the head (Figure 2). Occasionally, hail can also damage just a portion of a head and cause that damaged portion to turn white. The hail impact to the heads may also remove spikelets and expose the rachis

(Figure 3).

Figure 2. Wheat field in Sumner county showing a high incidence of white heads due to hail damage. Photo taken May 22, 2019 by Romulo Lollato, K-State Research and Extension.

Figure 3. The heads in this photo have had a few spikelets removed due to hail impact and have their rachis exposed. Photo by Romulo Lollato, K-State Research and Extension.

Dryland root rot (also known as dryland foot rot). This disease, caused by the *Fusarium* fungus, causes white heads and often turns the base of the plants pinkish (Fig. 4). As with take-all, dryland root rot causes all the tillers on an infected plant to have white heads. This disease is usually most common under drought stress conditions, and is often mistaken for either drought stress or take-all.

Figure 4. White wheat head caused by Fusarium root rot. Detail on the right shows pink discoloration inside the stem typical of the Fusarium pathogen. Photo by Romulo Lollato, K-State Research and Extension.

Head scab. When there are periods of rainy weather while the wheat is flowering, as seen across most of Kansas this growing season, some heads may become infected with Fusarium head blight and turn white. The heads of some red-chaffed varieties turn a darker red when infected with scab, but the heads of most varieties turn white. Symptoms can be restricted to one or few spikelets in the head, but often times the upper half or the entire head might be affected (Figure 5). Head scab is most common where wheat is grown after corn, or after a wheat crop that had head scab the previous year. Head scab can be identified by looking for pink spores of the Fusarium fungi, as well as by a darker discoloration to the rachis of the wheat head. During the current growing season, head scab has been observed in south-central and southeast Kansas, but it is probably still early to see symptoms in central and north-central Kansas as it takes approximately three weeks from flowering for the first symptoms to appear.

Figure 5. Wheat heads affected by head scab or Fusarium head blight. Symptoms range from one or few spikelets that turned white, to the upper half or entirety of the head. Photo by Romulo Lollato, K-State Research and Extension.

Take-all. This disease often causes patches of white heads scattered throughout the field. It occurs most frequently in continuous wheat, and where there is a moderate to high level of surface residue. Take-all is also favored by high pH soils, so a recently limed field might also show symptoms. To diagnose take-all, pull up a plant and scrape back the leaf sheaths at the base of a tiller. If the base of the tiller is shiny and either black or dark brown, it is take-all. All tillers on a plant infected with take-all will have white heads. Plants will pull up easily.

Sharp eyespot. This disease is common in Kansas, but rarely causes significant yield loss. Sharp eyespot causes lesions with light tan centers and dark brown margins on the lower stems. The ends of the lesions are typically pointed. If the stems are girdled by the fungus, the tiller may be stunted with a white head. Each tiller on a plant may be affected differently.

Wheat stem maggot. Wheat stem maggot damage is common every year in Kansas, but rarely results in significant yield loss. It usually causes a single white head on a tiller, scattered more or less randomly through part or all of a field. One typical symptom of white heads caused by wheat stem maggot is that the flag leaf and lower stem are often green, and only the last internode (peduncle) and head are white. If you can grab the head and pull the stem up easily just above the uppermost node, the tiller has probably been infested with wheat stem maggot. Scout for symptoms of chewing close to the base of the plants, which could indicate that the head has died as function of wheat stem maggot (Figure 6).

Figure 6. White wheat head due to wheat stem maggot, characterized by a white head and peduncle but with a healthy and green lower stem. Detail on the right shows chewing of the base of the peduncle by the maggot. Photo by Romulo Lollato, K-State Research and Extension.

Premature dying (drowning). As wheat begins to mature, plants in some areas of the field may have an off-white color similar to take-all (Figure 7). This premature dying could be due to drowning, hot dry winds, or some other stress. The pattern of discolored heads will often follow soil types or topography, and may occur in large patches. The grain will be shriveled and have low test weight.

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Figure 7. Large patches of drowned wheat in central Kansas (upper photo) and south central Kansas (lower photo). Photos taken May 16 and 17, 2017, by Romulo Lollato, K-State Research and Extension.

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4. Wheat disease update and fungicide considerations

Stripe rust continues to be the top disease story for Kansas wheat in 2020, as the growth stage of the crop across the state ranges from heading (Feekes 10.1) to ripening (Feekes 11). In several counties in southwest Kansas (including Pratt, Kiowa, Clark, Meade, Hodgeman, and Pawnee), stripe rust has been reported for the first time, or has moved from the lower to the upper canopy (Figure 1).

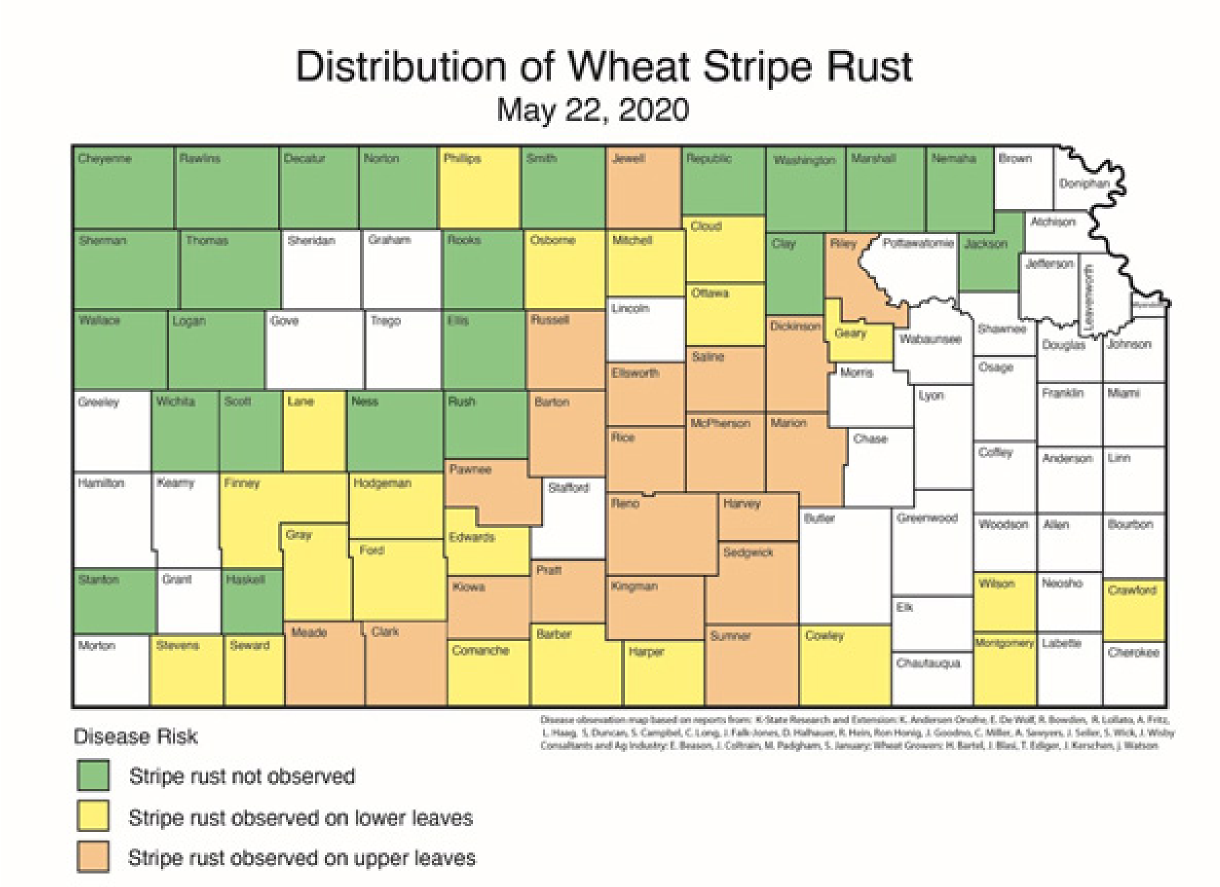

Figure 1. Distribution of stripe rust in Kansas as of May 22, 2020. Map is based on observations of K-State Research and Extension, crop consultants, and wheat producers in the state. Map created by Kelsey Andersen Onofre and Erick DeWolf, K-State Research and Extension.

In addition to stripe rust, leaf rust has also been reported in Saline and Rice counties and may become a problem in surrounding areas. Leaf rust can be differentiated from stripe rust by visibly darker spores that are scattered, not striped, across leaves (Figure 2). Leaf rust typically does not infect heads or stems. Leaf and stripe rust can both result in yield loss, particularly if the flag leaf is showing symptoms on many plants within a field.

Figure 2. Typical symptoms of leaf rust and stripe rust. Photos by E. De Wolf and K. Andersen Onofre, K-State Research and Extension.

Along with foliar diseases, Fusarium head blight continues to be a concern for southern and central Kansas. Fusarium head blight development is favored by rainy weather in the week prior to flowering and during the flowering period, which we have seen in several parts of Kansas. A convenient risk tool is available (http://www.wheatscab.psu.edu/) which provides current risk for head blight across the United States. Eastern and central Kansas have been at high risk for several days, according to this tool. Fungicide applications for Fusarium head blight control should be made at the start of flowering for optimal control, but research has found that applying a few days before or after early flowering can still provide adequate control when there is high disease pressure. Fungicide is most effective when applied to varieties that are known to be susceptible. Currently Caramba 0.75 SL, Proline 480 SC, Prosaro 421 SC, and Miravis Ace SE are labeled for control of Fusarium head blight and have performed well in independent tests conducted by Kansas State University and collaborating institutions. More information about these and other products can be found here: https://bookstore.ksre.ksu.edu/pubs/EP130.pdf

Although some producers have already made their fungicide decisions, many may still be considering an application. It is important to review not only how well a fungicide works against a disease of concern, but also label restrictions. Many fungicides have harvest restrictions and cannot be applied past a certain growth stage (for example, Feekes 10.5.4) or a certain number of days prior to harvest (pre-harvest interval). Please review all label recommendations before application to ensure compliance.

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5. Corn planting and emergence progress report for Kansas and selected Corn Belt states

Corn has already been planted on over half of the acreage in the main producing states, ranging from 57% in Ohio to 96% in Iowa, including 74% in Kansas according to the latest USDA report (Figure 1, left). Area of corn emerged follows a similar trend, ranging from 11% in Ohio to 62% in Iowa, including 45% in Kansas (Figure 1, right). One exception for corn emergence is Wisconsin, where emerged area is only 15% compared to its 81% planted area. The latter situation reflects the impact of environmental factors slowing down the emergence progress.

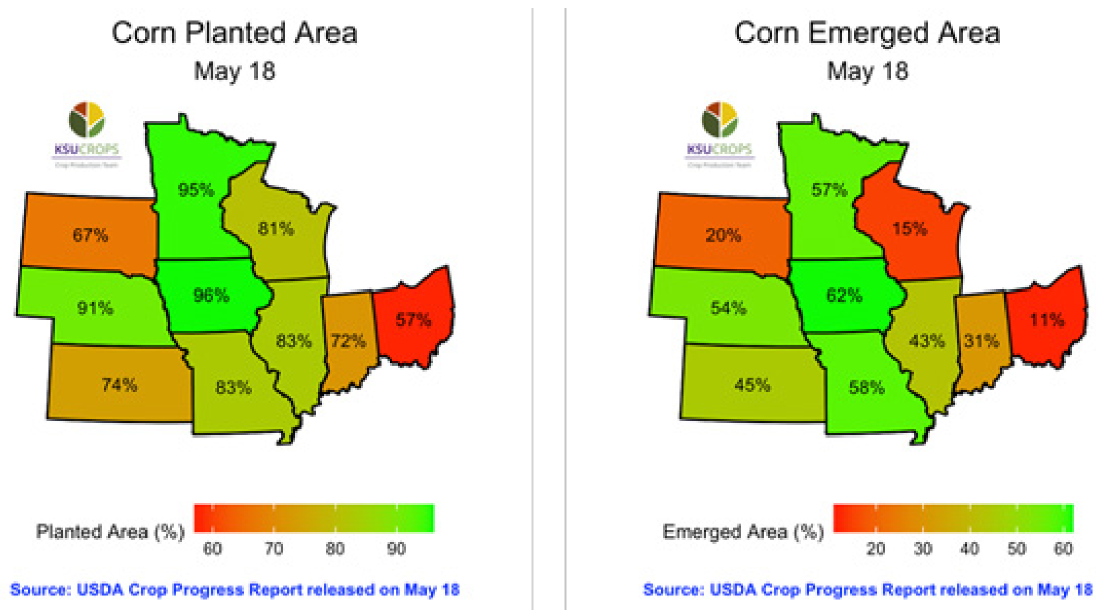

Figure 1. Percent corn planted area (left) and corn emerged area (right) for selected U.S. Midwest states reported on the USDA Crop Progress Report released on May 18, 2020. Graphic created by Leonardo Bastos, K-State Research and Extension.

The progress of corn planted area of the current season has either followed or exceeded the five-year average for Illinois, Indiana, Iowa, Kansas, Minnesota, and Nebraska (Figure 2). The 2020 season is largely ahead of the progress of last year, when planting was delayed due to cold and wet spring conditions in all the Corn Belt region. In Kansas, the current season progress is closely following the five-year average. Iowa, Minnesota, and Nebraska are already reaching the end of their corn planting operations, with Kansas, Illinois, and Indiana likely catching up in the week to follow, depending on weather conditions.

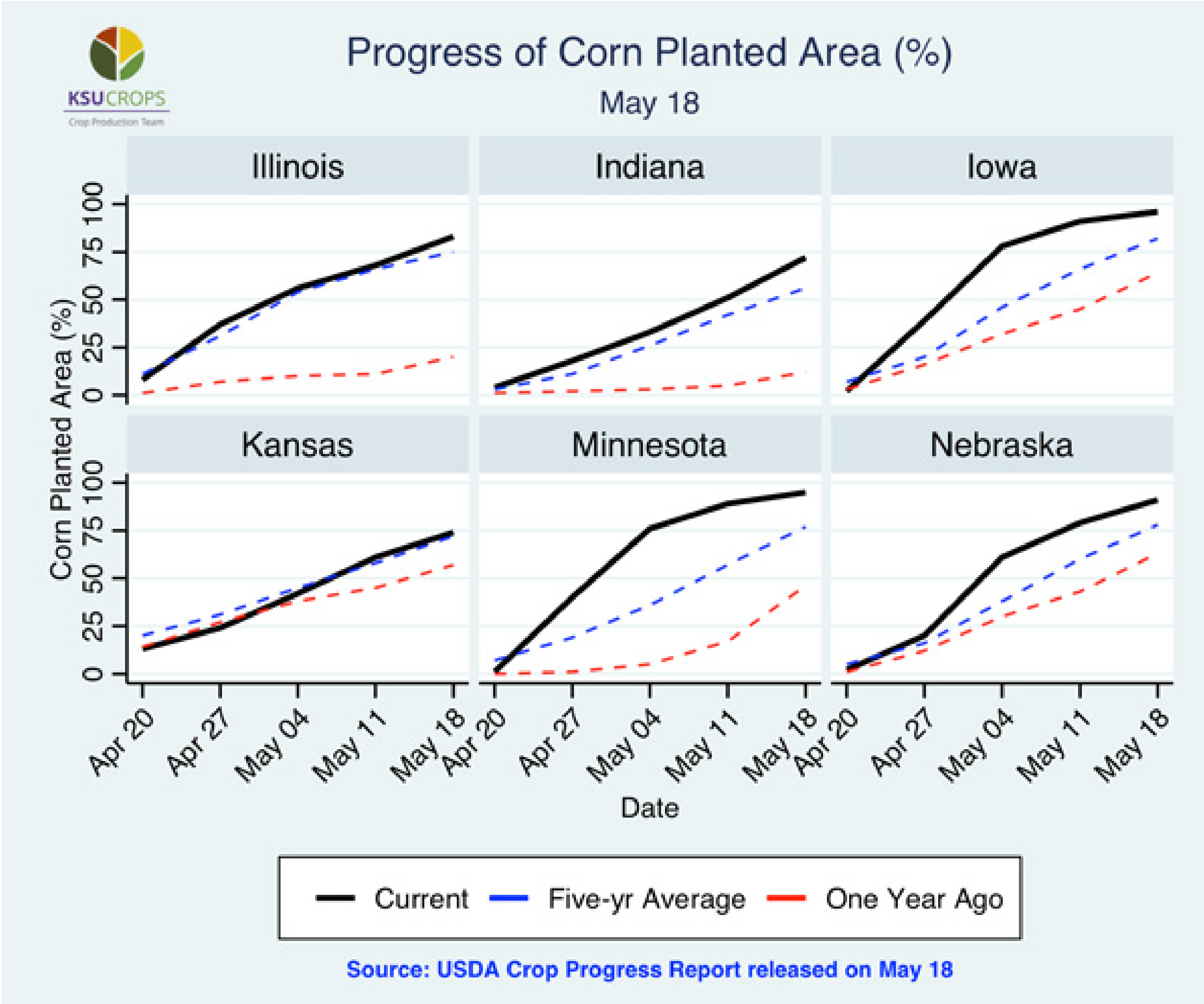

Figure 2. Progress of corn planted area (%) for selected U.S. Midwest states reported on the USDA Crop Progress Report released on May 18, 2020, including current date, five-year average, and one year ago (2019). Graphic created by Leonardo Bastos, K-State Research and Extension.

One of the main reasons for the 2020 planting season to be on track with the five-year average and ahead of last year is the weather. That is reflected by the number of days suitable for fieldwork in a week, which has generally been 4 or greater since planting started in Illinois, Indiana, Iowa, Kansas, Minnesota, and Nebraska (Figure 3). In Kansas, farmers have had between 4 and 6 days per week when fieldwork was possible since mid-April. The current number of days suitable for fieldwork is considerably greater compared to one year ago, when most farmers had very small windows of planting each week.

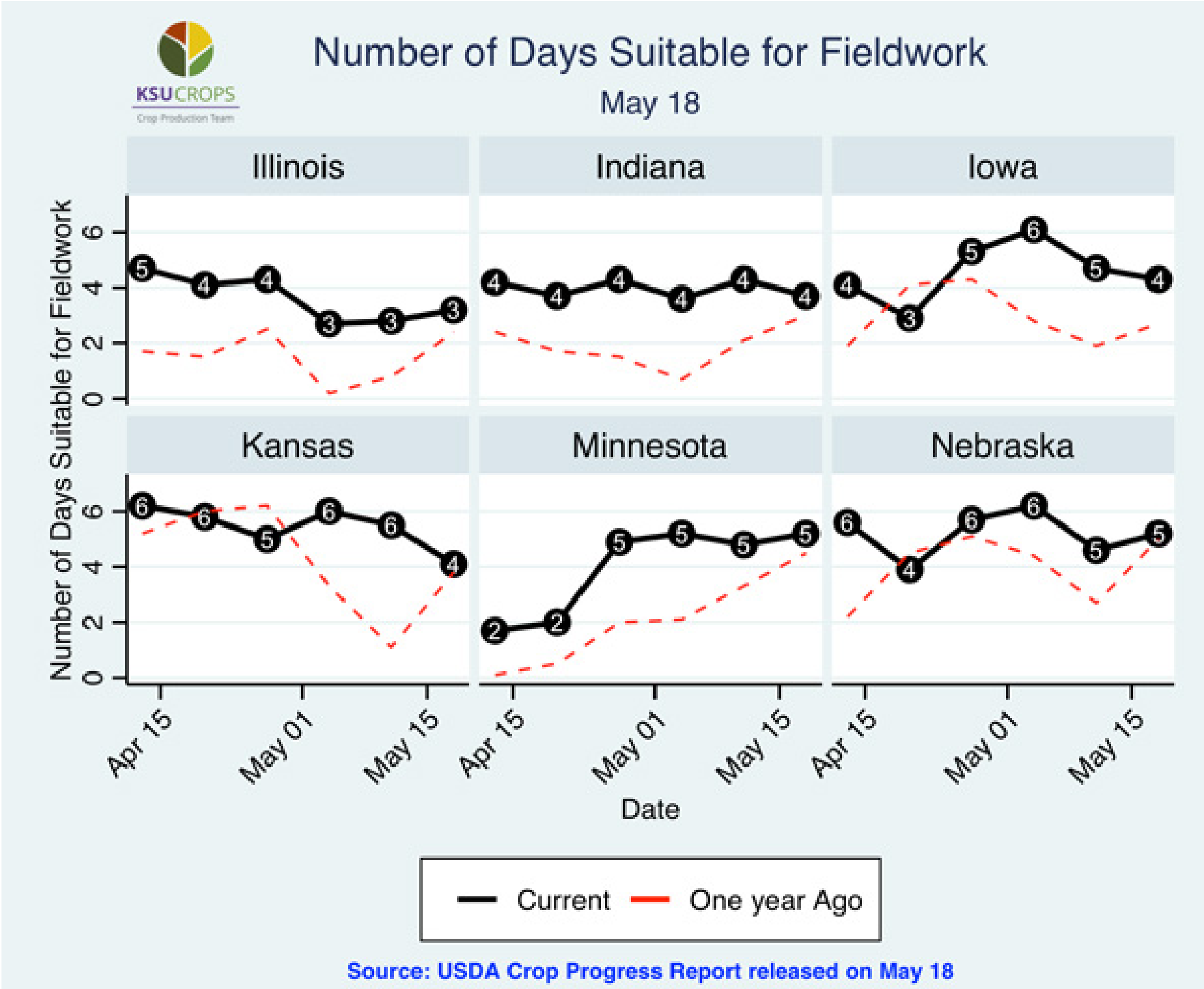

Figure 3. Number of days suitable for fieldwork for selected US Midwest states reported on the USDA Crop Progress Report released on May 18, 2020, including current date, and same-week one year ago (2019). Graphic created by Leonardo Bastos, K-State Research and Extension.

Another aspect of good planting weather is the topsoil moisture condition during the planting season (Figure 4). Since mid-April, most of the cropland area has been under adequate topsoil moisture condition in Illinois, Indiana, Iowa, Kansas, Minnesota, and Nebraska (Figure 4). In the latest report, adequate topsoil moisture ranged from 49% of the cropland area in Illinois to 79% of the area in Minnesota, including 51% in Kansas. Cropland area with surplus topsoil moisture conditions has been limited in Kansas, Nebraska, and Iowa since mid-April, while an increase in surplus moisture condition area was reported for Illinois (50% of cropland area) and Indiana (39% of cropland area) this past week.

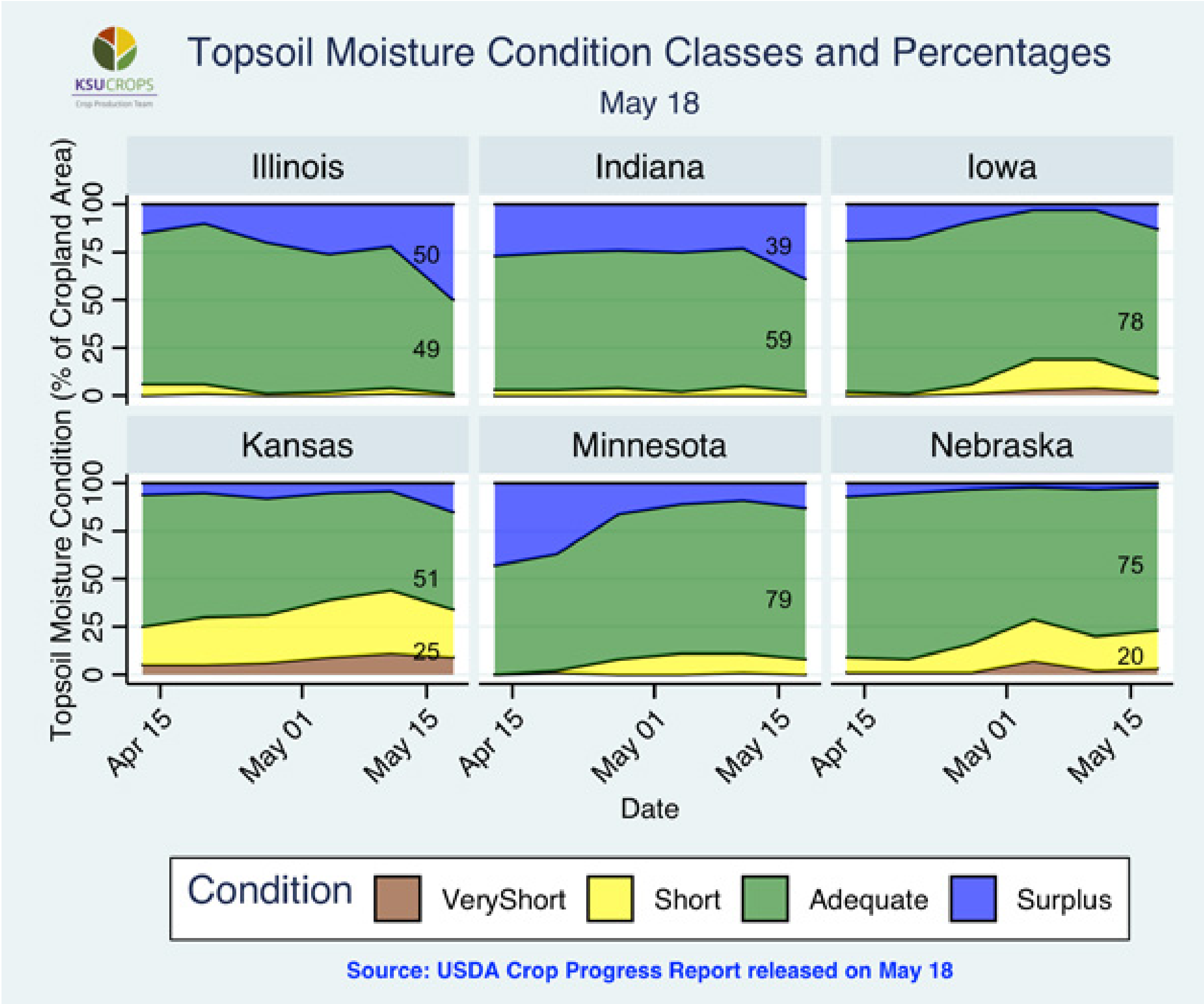

Figure 4. Topsoil moisture condition class and extent (% cropland area) for selected U.S. Midwest states reported in the USDA Crop Progress Report released on May 18, 2020. Graphic created by Leonardo Bastos, K-State Research and Extension.

Weather conditions in the following weeks will determine how fast farmers will be able to move the needle and get closer to the end of planting operations. According to the 6-10 day weather outlook from the National Weather Service Climate Prediction Center (http://www.cpc.ncep.noaa.gov/), most of the Corn Belt states will have more than a 45% chance of above-normal precipitation and temperatures. In Kansas, the chance of above-normal precipitation ranges from 32% to 44%, and the chance of above-normal temperature ranges from 32% in Southwest Kansas to 52% in Northeast Kansas. For more information on current temperature and soil moisture in Kansas, check our Mesonet: https://mesonet.k-state.edu.

In summary, the 2020 corn planting season has moved passed half the acreage and is on track with the five-year average and ahead of the 2019 planting season due to current better weather conditions in many Corn Belt states. Depending on weather, it is expected for many states to start reaching the end of planting season in the following weeks. Also, with greater chances of above-normal temperatures in the coming weeks, crop emergence will be able to pick up and set us off to a promising growing season.

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6. Summer weather outlook for Kansas

May has featured cooler-than-normal temperatures across all but the Southwest Division, where near-normal temperatures have prevailed. The Climate Prediction Center's summer outlook favors a continuation of those warmer-than-normal conditions in the southwest, but is neutral for the rest of the state (Figure 1). That means it is equally like to have warmer- or colder-than-normal temperatures for the three-month period of June through August. Remember that this is the average for the three months, a cooler-than-normal June could be countered by a warmer-than-normal July or August.

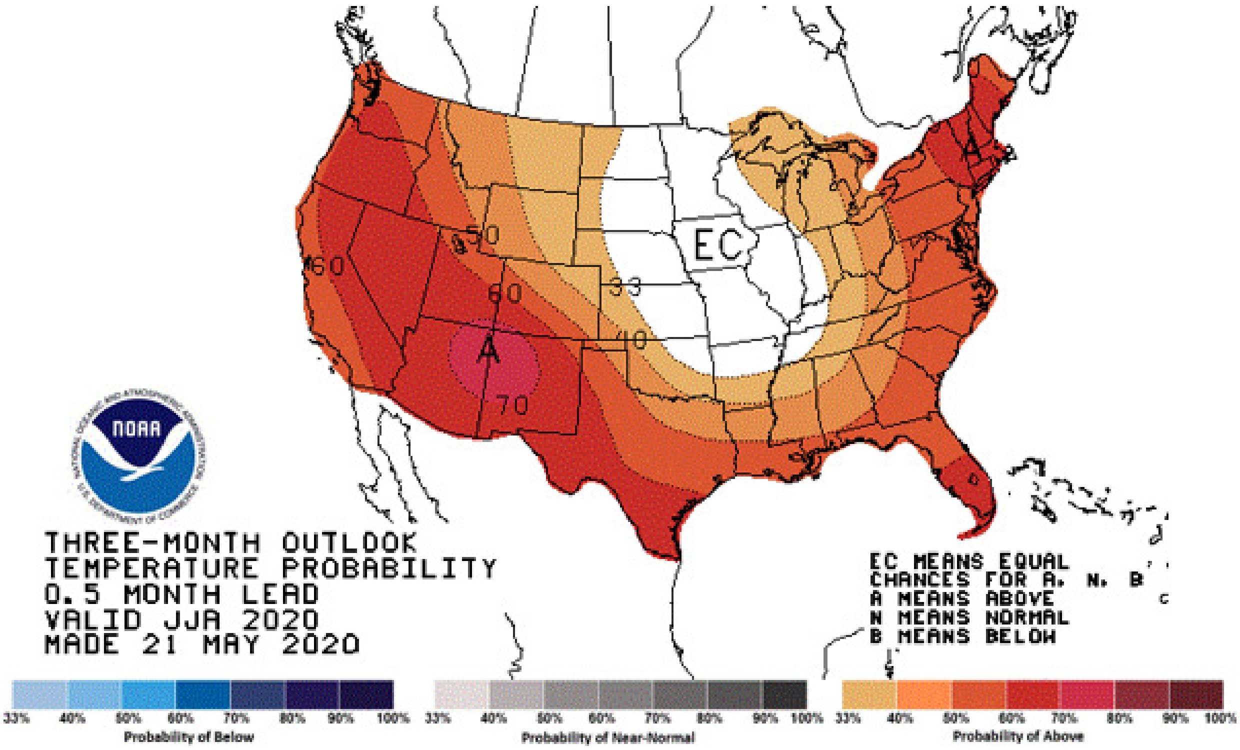

Figure 1. Summer temperature outlook (NOAA)

Antecedent conditions

Temperatures were cooler than normal in April (Figure 2), creating issues with planting and emergence of summer crops. Several freeze events, including ones in early May, further stressed the winter wheat crop.

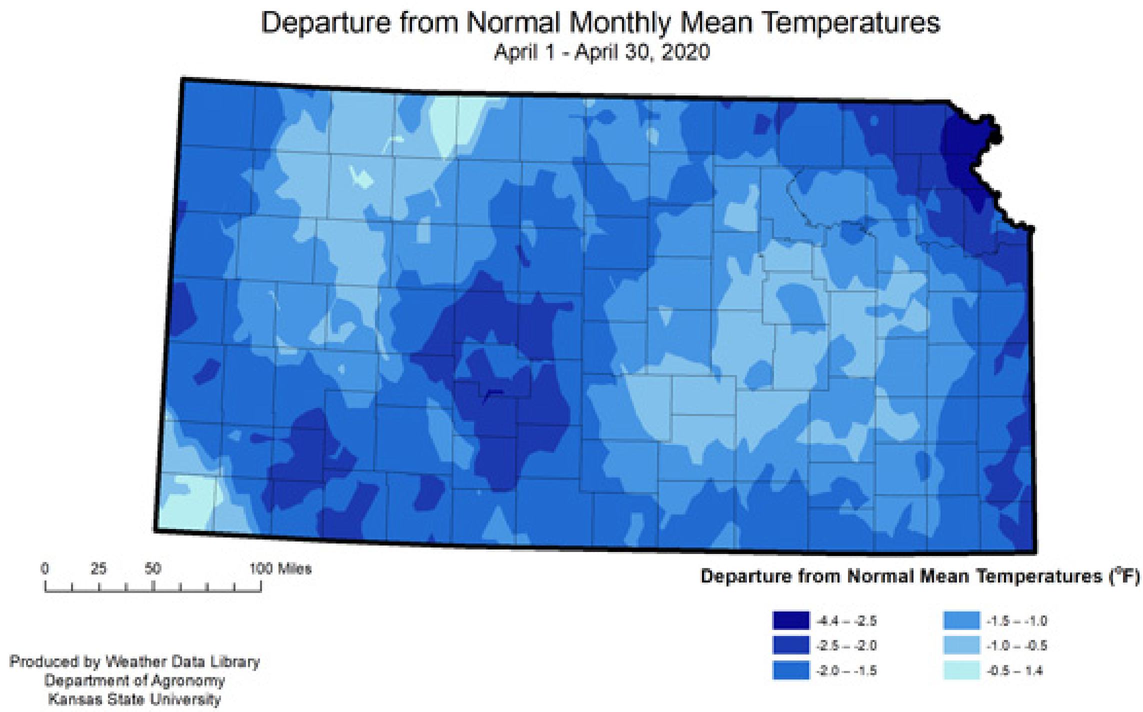

Figure 2. Departure from normal April average temperatures. Source: Weather Data Library

Aside from temperature, a major concern is precipitation. Summer precipitation constitutes the majority of the annual precipitation, particularly in the west. Currently, there is a sharp divide of above-normal amounts in the southeastern areas of the state and below-normal amounts in the western third. The southwestern corner of the state has received particularly little amounts. Elkhart, Morton County, has recorded just 2.14 inches for the year-to-date, less than half of the normal 5.25 inches that would be expected. In contrast, Columbus, Cherokee County has recorded 25.20 inches compared to the normal of 16.07 inches.

Precipitation outlooks

The precipitation outlook for summer favors above normal precipitation for much of central and eastern US (Figure 3). This includes much of Kansas except the areas of the state that need it the most.

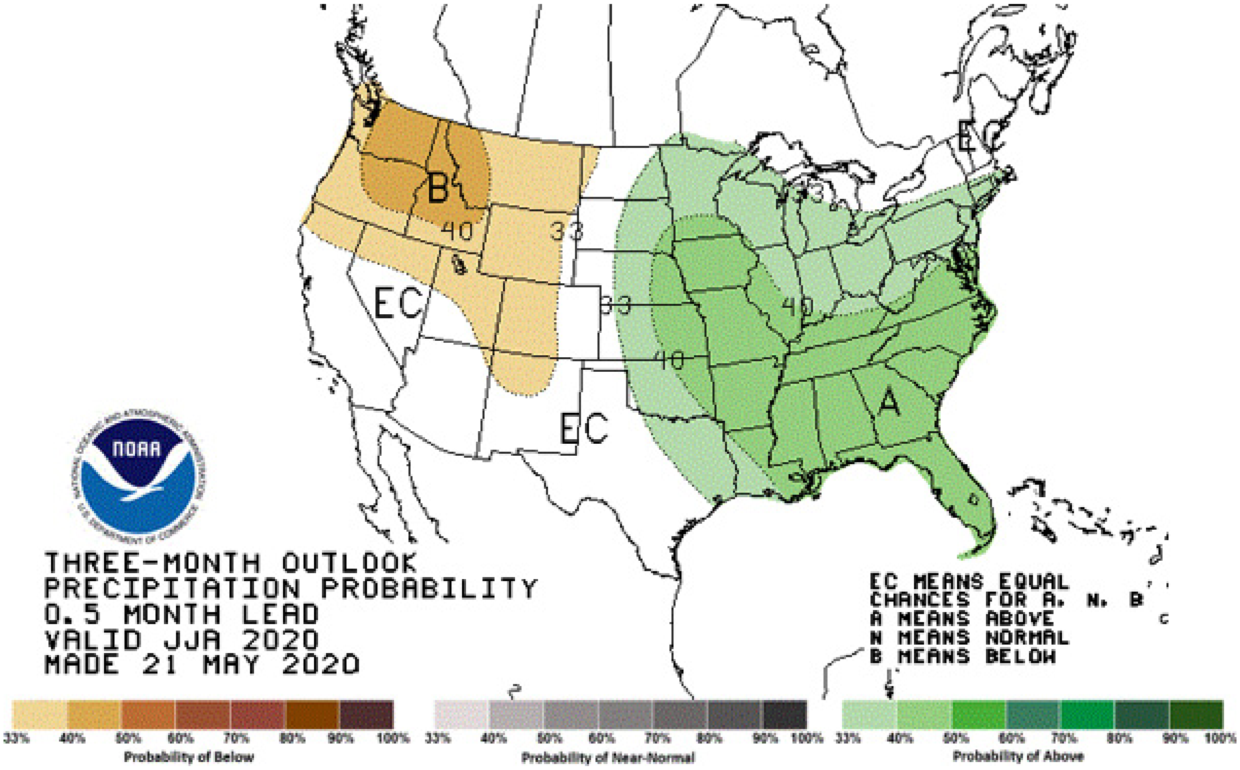

Figure 3. Summer precipitation outlook (NOAA)

Forecast models provide a wide variance in possible precipitation outcomes for the season and resulting drought impacts. While there are many models, one method is to blend the models together in what is called an "Ensemble Mean." This provides a quick glimpse in overall trend in all forecast models for the period. The result of the June through August model output is overall moderate confidence in above (green) normal precipitation (Figure 4). This would favor above-average precipitation, however, that can fall all at once or spread out over many days and doesn't provide further guidance on flood or drought impacts.

The US Drought Monitor favors improvement of drought conditions in some parts of the state. However, persistence is expected along the Colorado border, with intensification in the northwest (Figure 5).

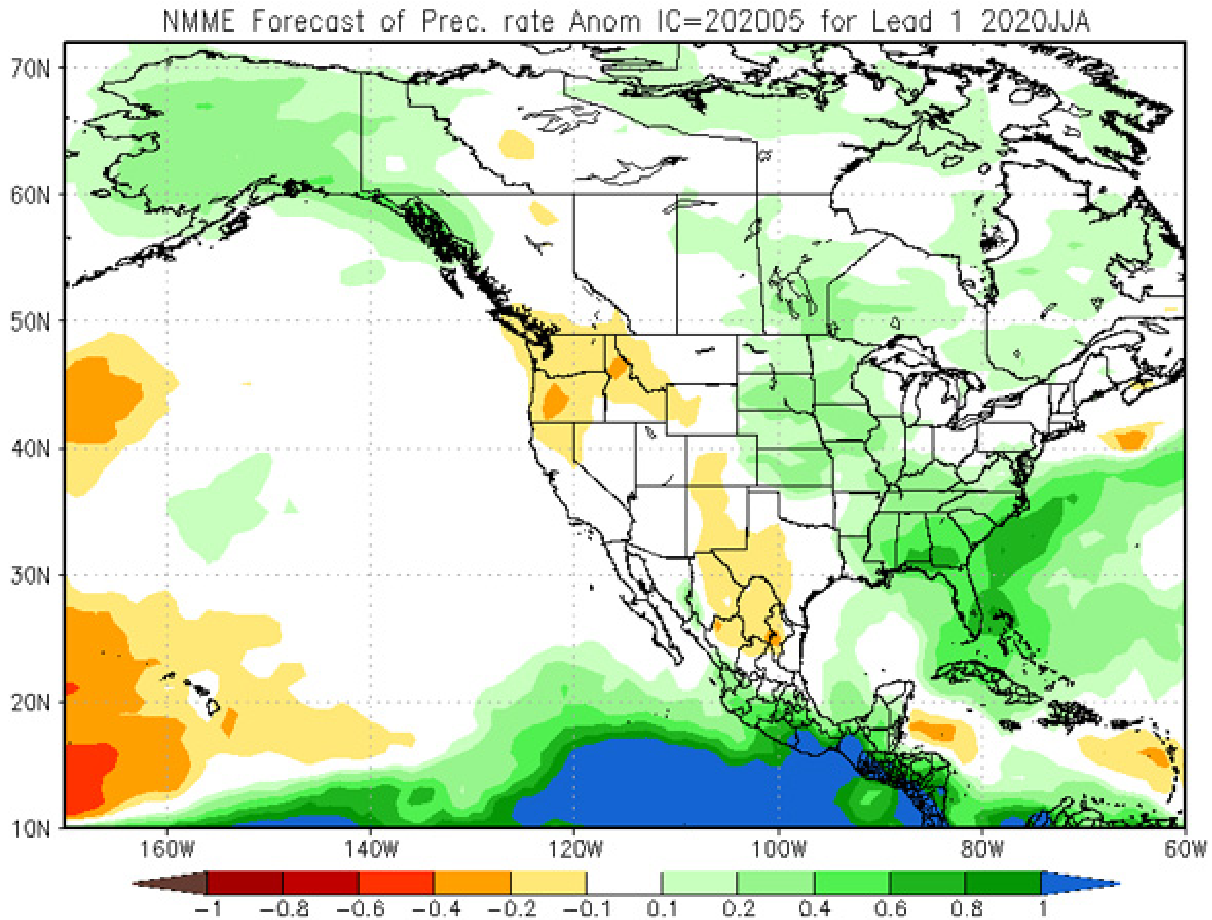

Figure 4. National Model Mean Ensemble forecast into August 2020. Source: Climate Prediction Center

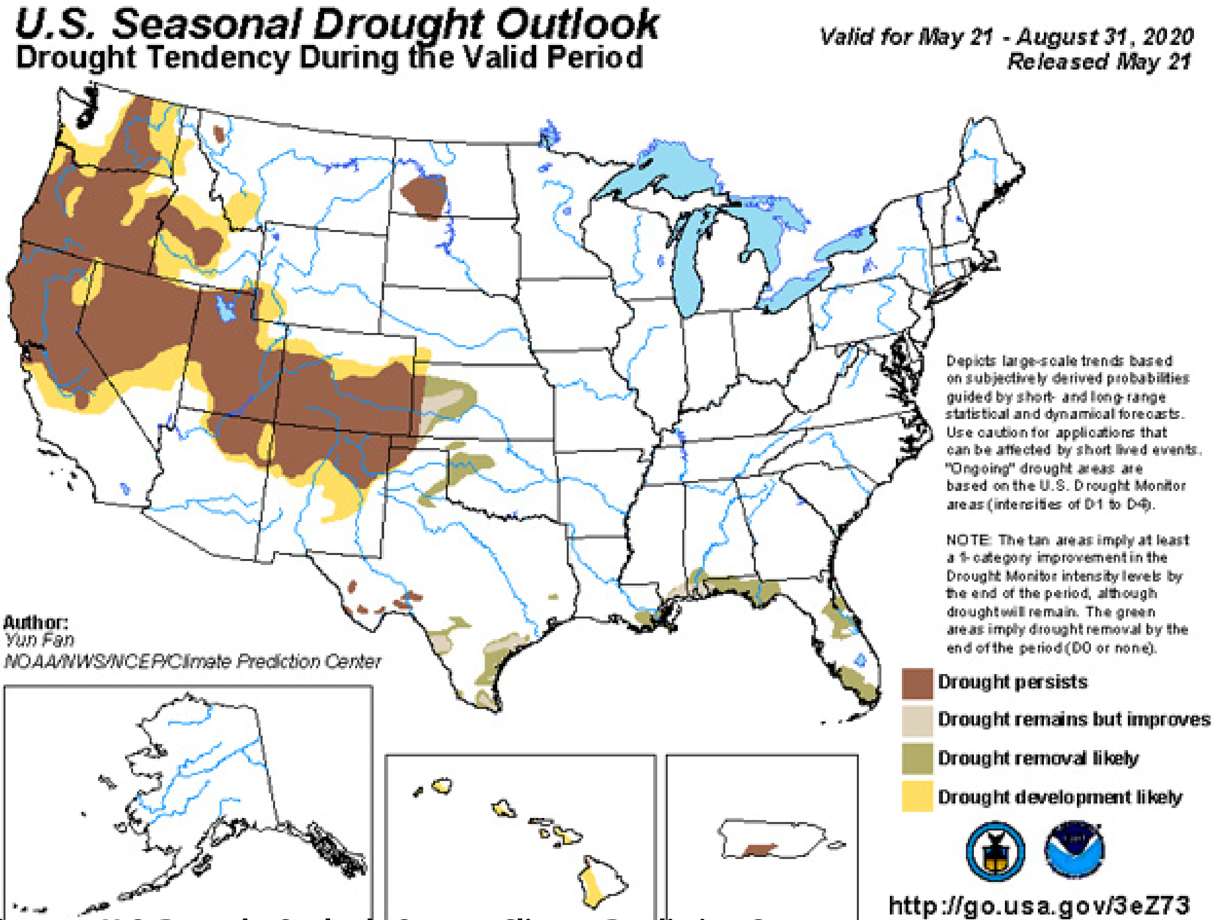

Figure 5. U.S. Drought Outlook. Source: Climate Prediction Center

Some Science Behind the Outlook

Historically, the ENSO (El Niño Southern Oscillation) in the equatorial Pacific has little impact to summer conditions in Kansas. This year, trends are towards either La Niña (colder than normal sea surface temperatures) or neutral conditions (Figure 6). Combined with warmer temperatures in the Atlantic Ocean, tropical activity is often more active than normal to our east/southeast in the oceans. Tropical systems form under high pressure which would infer ridging to our east.

Another concern is the Pacific Ocean off the west coast of the United States. Temperatures are much warmer than normal already and expected to continue (Figure 6). This often develops negative EPO (East Pacific Oscillation) which incurs another ridge of high pressure across the western United States, driving the Jetstream northward.

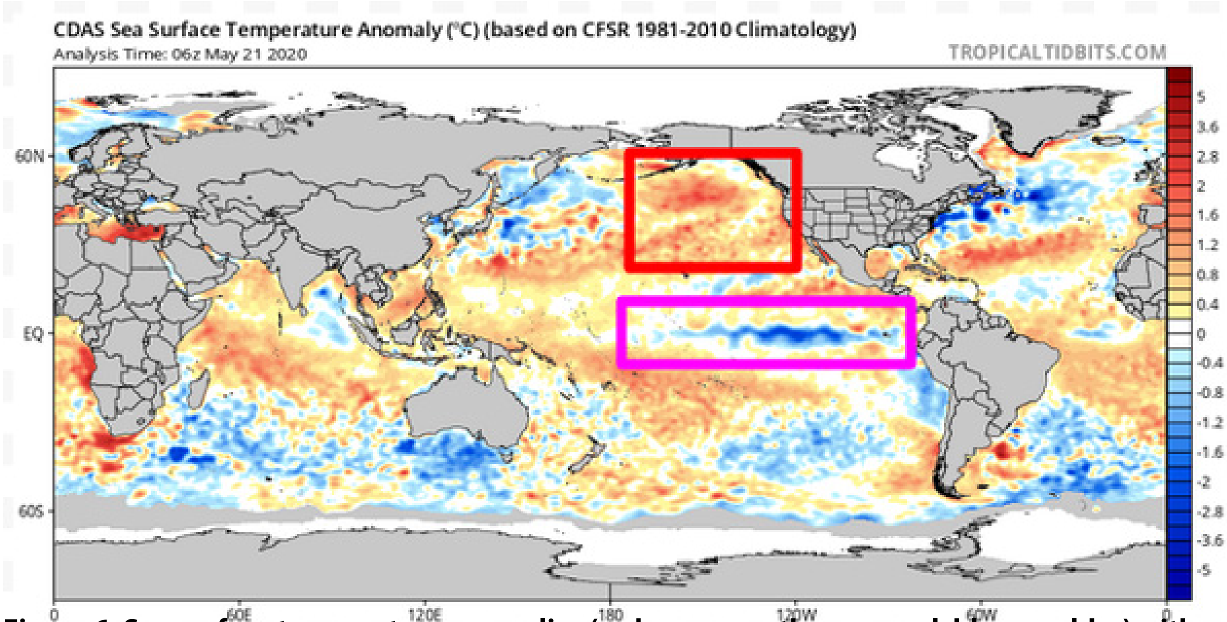

Figure 6. Sea surface temperature anomalies (red = warmer than normal, blue = colder) with Eastern Pacific Oscillation (red box) and the El Nino Southern Oscillation (purple box) highlighted. Image from Tropicaltidbits.com.

With high pressure often to the west and east, two things can happen. First, we could spend much time in the transition area on either side of the high pressures. This would typically mean impacts from ridge-riding troughs (weak low pressure systems) providing increased amounts of moisture and normal to slightly below-normal temperatures. Another possible, but probably unlikely scenario would be a large scale ridge/high pressure across the entire US. This would likely mean above-normal temperatures and drier conditions. This scenario would have monsoonal influences and rely on its location for any moisture. Should it persistently set up over one location, it would have a resulting impact on temperatures (and increased precipitation).

The resulting expected weather pattern this summer will likely be influenced by the dominant areas of high pressure to the east/west and any associated blocking patterns that develop. Predictability will be limited on the timing and duration of these events. Often, summers get remembered for a short term period that has a high impact (significant rain event or week long heat wave). This summer (as usual) will feature them, but the impacts will be determined by the persistent pattern averaged over the next three months.

Summary

- Temperature outlook is neutral for all but the western third of the state.
- Above normal precipitation is favored in the east.
- Drought is likely to persist in the west and may intensify.

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7. Make plans to attend the K-State Virtual Wheat Field Day, May 27-28

Kansas State University will host its first-ever live Virtual Wheat Field Day on the evenings of Wed., May 27 and Thurs., May 28.

In a twist on the typical wheat field day that Kansas farmers often attend, K-State Research and Extension will host a two-part wheat field day live on YouTube to update growers and others on the most recent crop advances and challenges while keeping producers safe from COVID-19.

The May 27-28 Virtual Wheat Field Day 2020 is really two "field evenings," with each one to begin at 7 p.m. and end at 9 p.m. Agriculture Today radio host Eric Atkinson will moderate the program. The format will allow for questions from the audience.

Growers are encouraged to attend one or both evenings on YouTube Live at separate links:

May 27 session - https://youtu.be/UnD12lADM3E

May 28 session - https://youtu.be/VrF3F2yqJpc

The program, with each speaker presenting from their own homes, includes:

May 27

- Welcome and introduction – Eric Atkinson, host of Agriculture Today radio show
- State of the 2020 Kansas wheat crop and variety selection in different parts of Kansas – Romulo Lollato, K-State Extension Agronomist
- Diseases in the 2020 Kansas wheat crop; selecting varieties with disease resistance in mind – Erick DeWolf, K-State plant pathologist
- Variety performance and selection in western Kansas - Lucas Haag, K-State Northwest Area agronomist
- Introduction: New K-State extension wheat pathologist – Kelsey Andersen
- Discussion panel with questions from the audience – Eric Atkinson

May 28

- Welcome and introduction – Eric Atkinson
- Current and upcoming K-State varieties for central Kansas – Allan Fritz, K-State wheat breeder;
- Current and upcoming K-State varieties for western Kansas – Guorong Zhang, K-State wheat breeder
- Variety performance and selection in central Kansas – Stu Duncan, K-State northeast area extension agronomist
- Overview of Kansas Wheat Commission-sponsored research - Aaron Harries, KWC
- Discussion panel with questions from the audience – Eric Atkinson

More information is available by contacting Romulo Lollato at lollato@ksu.edu or 785-477-4644.

K-STATE Research and Extension

KANSAS WHEAT

VIRTUAL WHEAT FIELD DAY

Wednesday, May 27, 2020

YOUTUBE LIVE: https://youtu.be/UnD12lADM3E

7:00 p.m. Welcome | Eric Atkinson

7:10 p.m. Wheat Variety Selection | Romulo Lollato

7:40 p.m. 2020 Wheat Disease Update | Erick DeWolf

8:10 p.m. Variety selection: Western KS | Lucas Haag

8:40 p.m. K-State Extension Pathologist | Kelsey Andersen

8:50 p.m. Discussion Panel | Eric Atkinson

Thursday, May 28, 2020

YOUTUBE LIVE: https://youtu.be/VrF3F2yqJpc

7:00 p.m. Welcome | Eric Atkinson

7:10 p.m. Wheat Breeding: Central KS | Allan Fritz

7:40 p.m. Wheat Breeding: Western KS | Guorong Zhang

8:10 p.m. Variety Selection: Central KS | Stu Duncan

8:40 p.m. KWC-Sponsored Research | Aaron Harries

8:50 p.m. Discussion Panel | Eric Atkinson

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