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Extension Agronomy

eUpdate

05/01/2020

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. Evaluating the need for foliar fungicides on wheat

The leaf diseases leaf rust, stripe rust, tan spot, Septoria tritici blotch, and powdery mildew are the most common cause of disease-related yield loss. Often, leaf diseases are managed by a combination of genetic resistance and crop rotation; however, foliar fungicides may be needed when these practices fail to keep diseases at low levels.

This year, low levels of stripe rust were detected in several counties in South Central Kansas during the last week of April (Figure 1). So far the disease is restricted to the middle canopy and still at a very low incidence. Many growers may be evaluating the potential need for fungicides over the next 7-14 days.

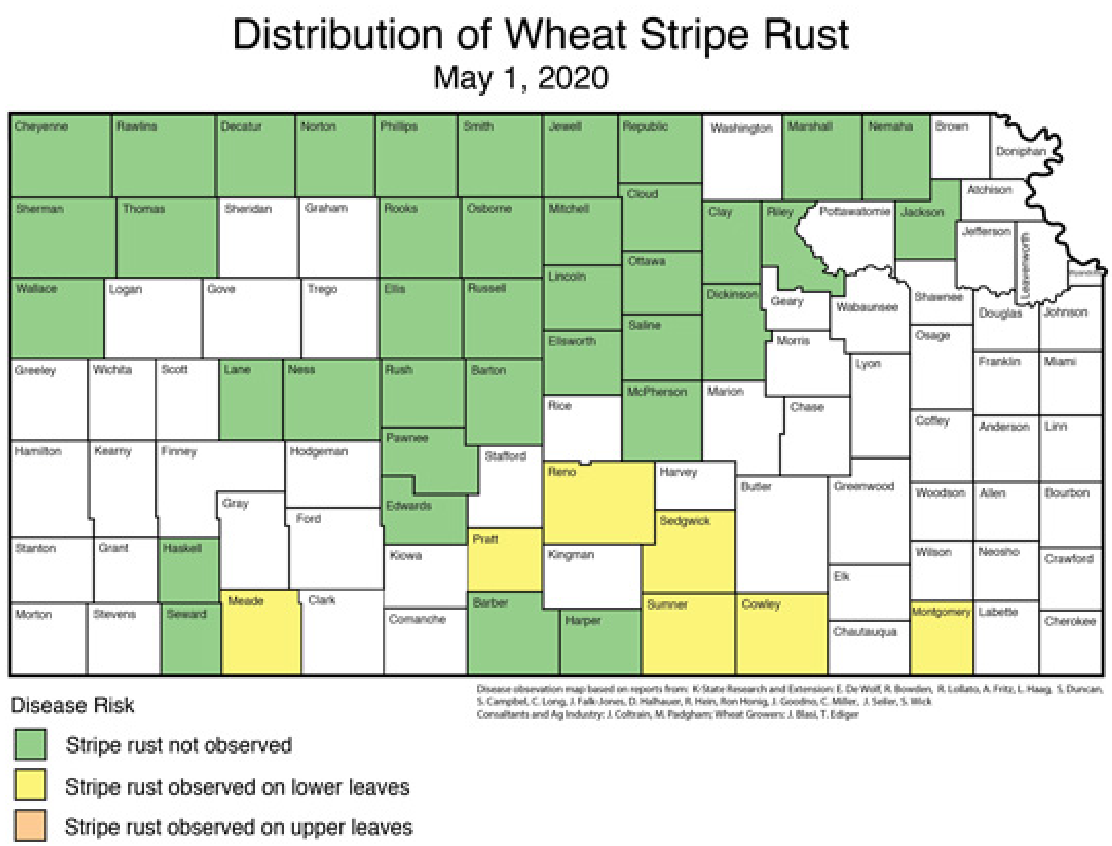

Figure 1. Distribution of stripe rust in Kansas as of May 1, 2020. Map is based on observations of K-State Research and Extension, crop consultants, and wheat producers in the state. Map created by Erick DeWolf, K-State Research and Extension.

This article features some selected key points from a KSRE publication that answers common questions about the role of fungicides in wheat disease management and helps evaluate the need for a fungicide by analyzing information available at the time of application. The entire publication, **MF3057 "Evaluating the Need for Wheat Foliar Fungicides"**, can be viewed at https://bookstore.ksre.ksu.edu/pubs/MF3057.pdf

When should a fungicide be applied relative to crop growth?

Fungicides can best protect these critical growth stages from disease when applied between full emergence of the flag leaf and anthesis (flowering). Diseases that damage plants at these early stages often reduce the grain yield significantly. Fungicide applications made before flag leaf emergence generally result in less disease control on the upper leaves during grain development and smaller yield responses. Always check and follow product label recommendations to ensure full compliance with growth-stage limitations and pre-harvest intervals.

How long will the fungicide provide disease control?

The residual life of the fungicide application is influenced by the product used, rate of application, and disease targeted for control. In general, products belonging to the triazole and strobilurin classes of fungicide will provide 14 to 21 days of disease control. Small differences in residual life among products typically do not result in large differences in grain yield.

In general, the fungicides stay near the site of application or move toward the leaf tip. The fungicides only protect leaves, stems, and heads present at the time of application.

Are there important differences in how well various fungicide products work?

Nearly all fungicide products labeled and widely marketed for use on wheat in Kansas contain active ingredients belonging to triazole (DMI), carboxamides (SDHI) and strobilurin (QoI) classes of fungicides or mixtures of these classes. Both fungicide classes are effective at controlling common leaf diseases in Kansas. Products containing only the triazole class of fungicides are the best option in areas prone to Fusarium head blight (head scab). There are a few options containing triazole + carboxamides that would also be a good option of head blight control. More information about product options and efficacy against diseases can be found in the K-State Research and Extension publication EP130 Foliar Fungicide Efficacy Ratings for Wheat Disease Management.

What is the typical yield response of wheat to foliar fungicides?

Researchers with K-State Research and Extension have been evaluating the potential role of fungicides in leaf disease management for many years. In most situations, these experiments were specifically designed to evaluate the benefits of fungicides when susceptible varieties are grown in environments extremely favorable for disease development. A summary of decades of experiments indicates that a single fungicide application between flag leaf emergence and anthesis often results in a yield increase between 4 and 14 percent, with an average yield increase of 10 percent (Figure 2). These figures can be combined with yield potential of a wheat crop to estimate the potential yield response in bushels per acre.

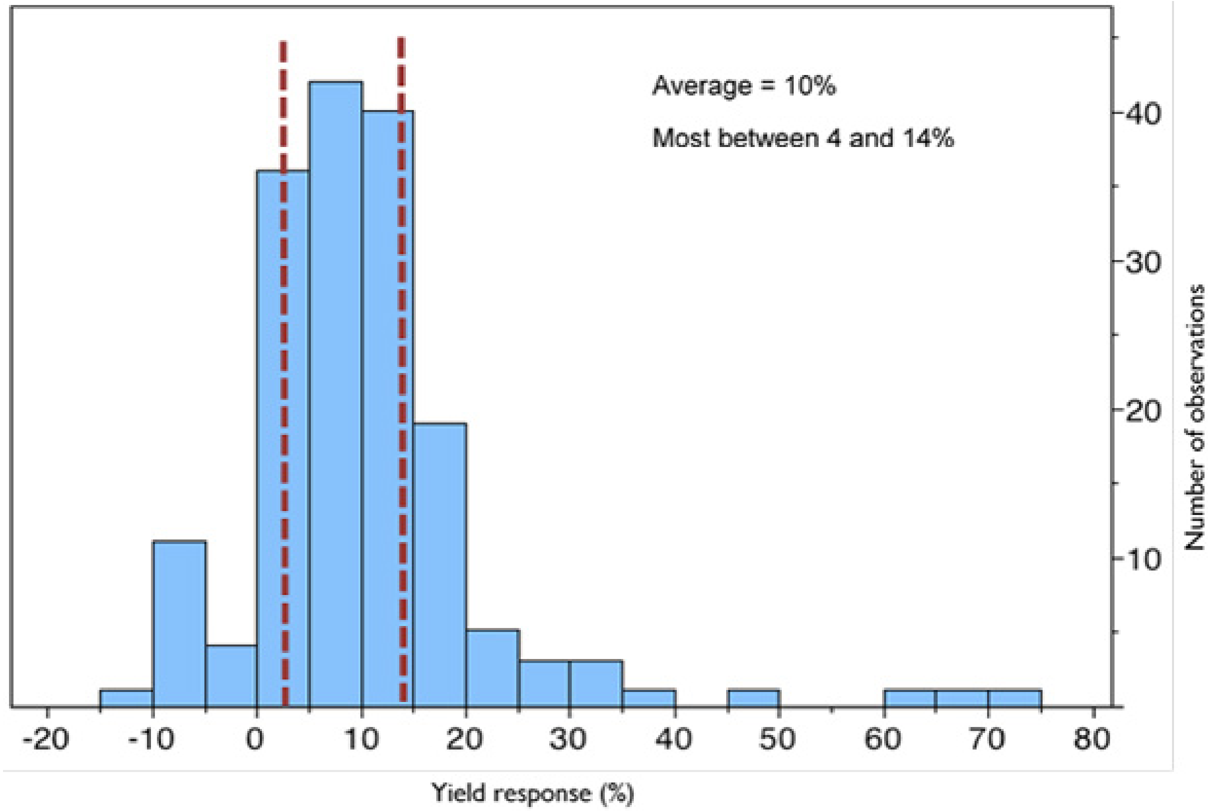

Figure 2. Typical yield response of wheat to foliar fungicides. This plot shows the frequency of different yield responses in 20+ years of research trials in Kansas. Graph from Erick DeWolf, K-State Research and Extension.

What information maximizes the potential benefits of the fungicide application?

Because the yield response to fungicides is variable, it is often helpful to consider different approaches that can maximize the potential benefits of the fungicide application. While it may not be possible to predict the yield response to a fungicide application perfectly, it is possible to use the information at the time of application to improve the chances of obtaining an above-average yield response.

Set priorities based on a variety's balance of genetic resistance and susceptibility to disease.

Information about the disease resistance of a wheat variety is often available well before fungicide decisions need to be made. In fact, for most varieties this information is available before purchase of the seed. Information about the disease reaction of wheat varieties to leaf diseases in Kansas can be found in the Wheat Variety Disease and Insect Ratings, MF991, available from K-State Research and Extension. A variety's reaction to disease often changes over time and it is important to use the most recent information when evaluating a variety's disease resistance. These variety ratings are updated annually to ensure the most current information is available.

Refine the decision based on the risk of severe disease.

In Kansas, the two primary indicators of disease risk are regional outbreaks of the rust diseases and the presence of disease within a field before the heading stages of growth. Using this information, the risk of disease can be classified as low, moderate, or high (Table 2). Research indicates that fungicides are most likely to result in an above-average yield response in production scenarios that combine varieties that are susceptible to multiple leaf diseases with high levels of disease risk (Figure 3). The likelihood of an above-average yield response is reduced at the moderate and low levels of disease risk.

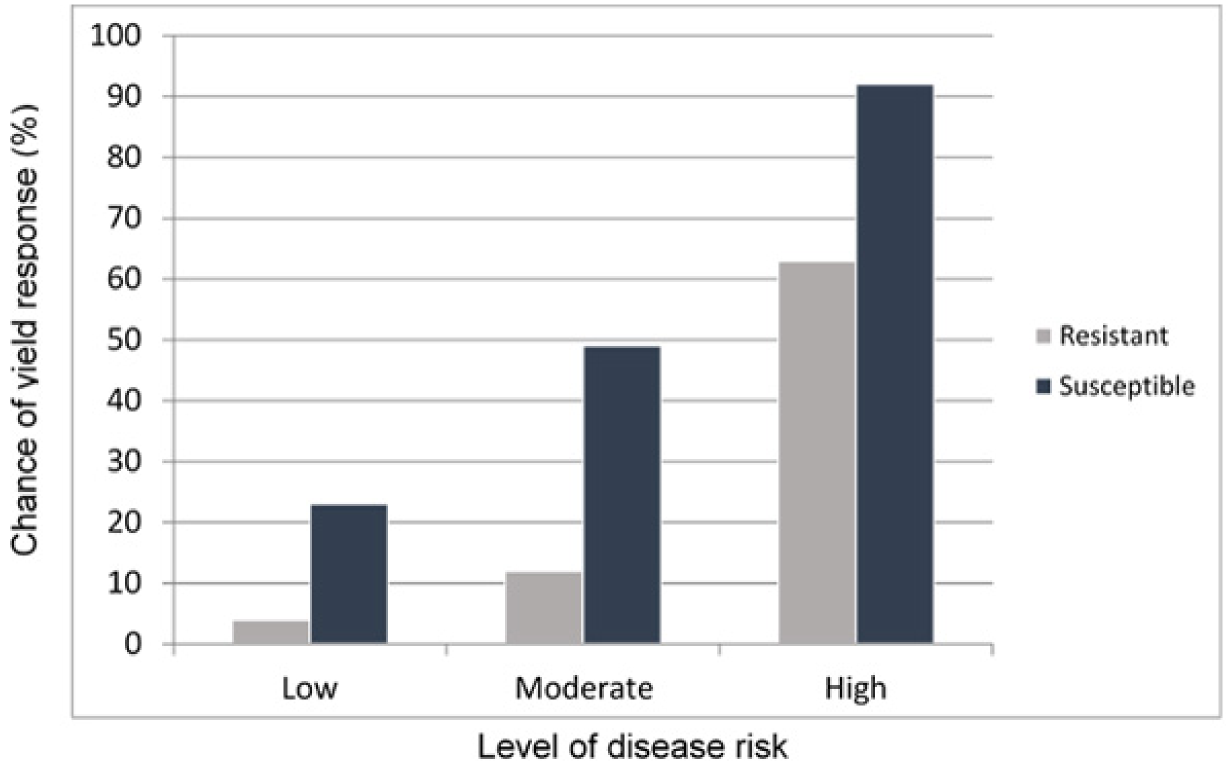

Figure 3. Chance of an above-average yield response to a foliar fungicide based on a variety's reaction to multiple leaf diseases and low, moderate, and high levels of disease risk.

Integrate yield potential and weather into the decision.

Yield potential of a wheat crop and weather information available at the time of application also can influence the final decision to apply a fungicide. Fields with a good yield potential, at least 40 bushels per acre, at the time of application and fields intended for seed production should be a high priority.

These priorities are further reinforced when weather forecasts indicate conditions are likely to remain favorable for wheat growth and disease development. It is wise to more carefully analyze the use of fungicides (and avoid additional input costs) when drought, freeze injury, viral diseases, or other production problems make a crop's yield potential uncertain. Freezing temperatures during the week of April 12 have many growers questioning yield potential this year. Where possible, it is wise to take some time to see how the crop recovers before adding more input costs to a crop with a narrow profit margin.

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2. Diagnosing early-season growth problems in corn

Getting a good stand of corn, with vigorous early-season growth, is the first step in getting desirable yields. When adverse conditions, such as a hard rain or unusually cool weather, occur after planting and emergence, producers should get out in their fields and take a close look at how their corn is doing.

If the plants emerged in good fashion, but the seedlings then have problems maintaining adequate growth and development or leaf color, there may be several possible reasons. A few of the most likely causes include:

- **Freeze damage**. In most cases, much of the corn that is emerged at the time of a freeze will recover with minimal damage. However, some of the new growth may have a hard time emerging from the dead tissue. New growth may become trapped and start to split from the side of the leaf sheath. Generally, warmer temperatures will increase growth rates and new leaves will eventually split the dead tissue, emerge, and continue to grow normally.
- **Unusually cool temperatures, compacted soil, or waterlogging**. Wet soils and unusually cool temperatures can inhibit root growth, slowing plant development. This can cause yellowed, wilting plants due to poor root growth, drowning, or a seedling blight infection. Seedling blight is often characterized by stem tissue near ground level that is discolored or water-soaked in appearance. Also, planting in wet soil can compact the seed furrow, inhibiting root growth. A shallow compaction layer can slow early root growth, resulting in stunted, nutrient deficient plants.

Figure 1. Sidewall and seed zone compaction in heavy clay soil. Photo by Stu Duncan, K-State

Research and Extension.

Figure 2. Yellow corn due to low soil temperature, slow early growth. Photo by Ignacio A. Ciampitti, K-State Research and Extension.

Figure 3. Poor seedling emergence produces uneven stands. Photo by Ignacio A. Ciampitti, K-State Research and Extension.

- **Early-season lodging ("floppy corn syndrome").** This is usually associated with hot, dry weather during V1 to V6, which prevents adequate development and penetration of nodal roots. Plants can survive for a time on just the seminal root system, but they will have little mechanical support. Reasons for poor nodal root development and an elevated crown include sidewall compaction, erosion after emergence but before nodal root development, and sinking of the seedbed due to pounding rains. Often a good soaking rain is enough to allow nodal roots to establish and plants to recover. Inter-row cultivation can be used to push soil against plants with exposed crowns.

Figure 4. "Floppy corn" syndrome. Corn seedling lodging caused by dry weather and warm soil stunting crown root development. Photo by Doug Shoup, K-State Research and Extension.

- **White grubs or wireworms***. These soil insects may be eating the roots, which will cause the plants to wilt.
- **Black cutworms**. These insects, which can be found in the soil or on the surface, cause "windowpaning" of the leaves on young plants. Cutworms may also cut off seedling plants at the soil surface.
- **Flea beetles***. These tiny leaf-chewing insects can cause "scratches" on leaves. Eventually, the leaves may shrivel, turn gray, and die. Plants are more susceptible to flea beetle injury when temperatures are cold and seedling growth is slow. Seedling plants are often able to recover from flea beetle injury because the growing point remains below ground level until the fifth leaf emerges.

*The insecticide seed treatments that are applied commercially to all seed prior to bagging should mitigate damage by wireworms/white grubs and flea beetles for 3-4 weeks after planting.

- **Nematodes**. Poor growth that occurs as circular to oval patches in the field could be an indicator of nematode problems. Approximately 35 days after emergence is an ideal time to sample for nematodes, particularly the root lesion nematode that inhabits about 80 percent of Kansas corn fields. Take 20 cores at a depth of 12 inches from directly in or alongside the row from the outer edges of affected areas. Additionally, 2 to 3 root balls of affected plants should be submitted at the same time. Bag the root samples separately from the soil cores. Samples can be submitted through local Extension offices or sent directly to the Plant Disease Diagnostic Lab in Throckmorton Hall.

- **Fertilizer injury:**

- Free ammonia from an anhydrous ammonia application. This can injure roots and kill germinating seed if the ammonia was applied too shallowly (especially in coarser soils), too close to the time of planting, or if dry soil conditions slowed the conversion of ammonia to ammonium. One way to minimize damage is to apply the ammonia at a 10- to 15-degree angle from the direction of planting. If injury occurs then it is more randomly distributed, reducing the multi-plant skips, and allowing the unaffected plants to compensate.
- Ammonia injury can also occur when side-dressing anhydrous ammonia under dry soil conditions. Root injury can occur if the plants get too big or the knives run too close to the row. Ammonia injury resulting from poor soil sealing can cause leaves to appear water-soaked or have dead margins. Roots may appear sheared off, or burned off. Plants will normally recover from this injury, but yields can be reduced.
- Putting a urea-based N fertilizer in contact with the seed. Urea will hydrolyze into ammonia and injure the seedling.

Figure 5. Seedlings damaged after starter fertilizer containing urea-N was placed in direct seed contact. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

- **Nitrogen (N) deficiency**. This does not usually occur until a later stage of growth in conventional tillage systems. But in no-till corn, especially in high residue situations, N deficiency is common where producers haven't applied nitrogen as a starter, or broadcast a significant amount of N prior to or at planting. In early planting into very cold soils where no N was applied close to the seed as a starter, seedlings may be N deficient in conventional-till also. Nitrogen deficient corn seedlings will be spindly, with pale yellow-green foliage. As the plants grow, the lower leaves will "fire," with yellowing starting from the tip of the leaf and progressing back toward the stalk.
- **Phosphorus deficiency**. This can result in stunted growth and purple leaves early in the growing season. Phosphorus deficiency is often enhanced by cool, wet growing conditions.

- **Iron deficiency**. This can cause upper leaves to be pale green between the veins. Iron deficiency is more common on high pH and calcareous soils.

- **Sulfur deficiency**. This can result in stunted plants having pale green leaves, with no distinct pattern on the leaves.

More detailed information on identifying nutrient deficiencies in the field will be coming in a future eUpdate in a couple weeks.

- **Herbicide injury**. This is not as common now as in the past, but can still occur. Corn is very susceptible to injury from carryover sulfonylurea herbicides which may have been applied to a previous crop, such as wheat. Carryover depends on soil pH, soil texture, application rates, rainfall, and other factors listed on the herbicide labels. Symptoms include stunting, chlorosis, and an overall sickly appearance. Corn will not grow out of this type of injury.

Figure 6. ALS herbicide carryover injury to corn. Photo by Stu Duncan, K-State Research and Extension.

For more information, see "Diagnosing Corn Production Problems in Kansas," K-State publication S-54, at: http://www.ksre.ksu.edu/bookstore/pubs/S54.pdf.

For those interested in accessing this publication on their tablets as an eBook, the eBook link can be found here: http://www.agronomy.k-state.edu/extension/crop-production/corn/

Also, see the "Corn Production Handbook," K-State publication C-560, at: http://www.ksre.ksu.edu/bookstore/pubs/C560.pdf

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3. How do soil temperatures for 2020 compare to historical averages for Kansas?

The terms 'weather' and 'climate' are often used incorrectly. Weather and climate are not independent. The averages of daily weather are used to monitor climate. Changes in climate lead to changes in weather patterns, including extreme weather events. Climate "normals" are three-decade averages of climatological variables, such as temperature and precipitation. Climate normals provide a historical perspective and help us understand the unusualness for current weather.

This article discusses soil temperature climatology (30-year average) and how 2020 compares to the climate normal for Kansas. To learn more about weather and climatology, please see the publication MF3197-"What is the difference between weather and climate?" at:
https://bookstore.ksre.ksu.edu/pubs/MF3197.pdf

2020 Air Temperatures

Last year, late winter and early spring were highlighted with very cold and wet conditions across the region. This led to significant cattle stress impacts, as well as much colder soil temperature records in the east. However, thus far in 2020, a much better balance has occurred. While Kansas has observed colder-than-normal temperatures, they were short lived and were usually countered by warmer-than-normal temperatures the following week (Figure 1). This balance has led to a gradual warm-up in soil temperatures that very closely follows the climatological normal.

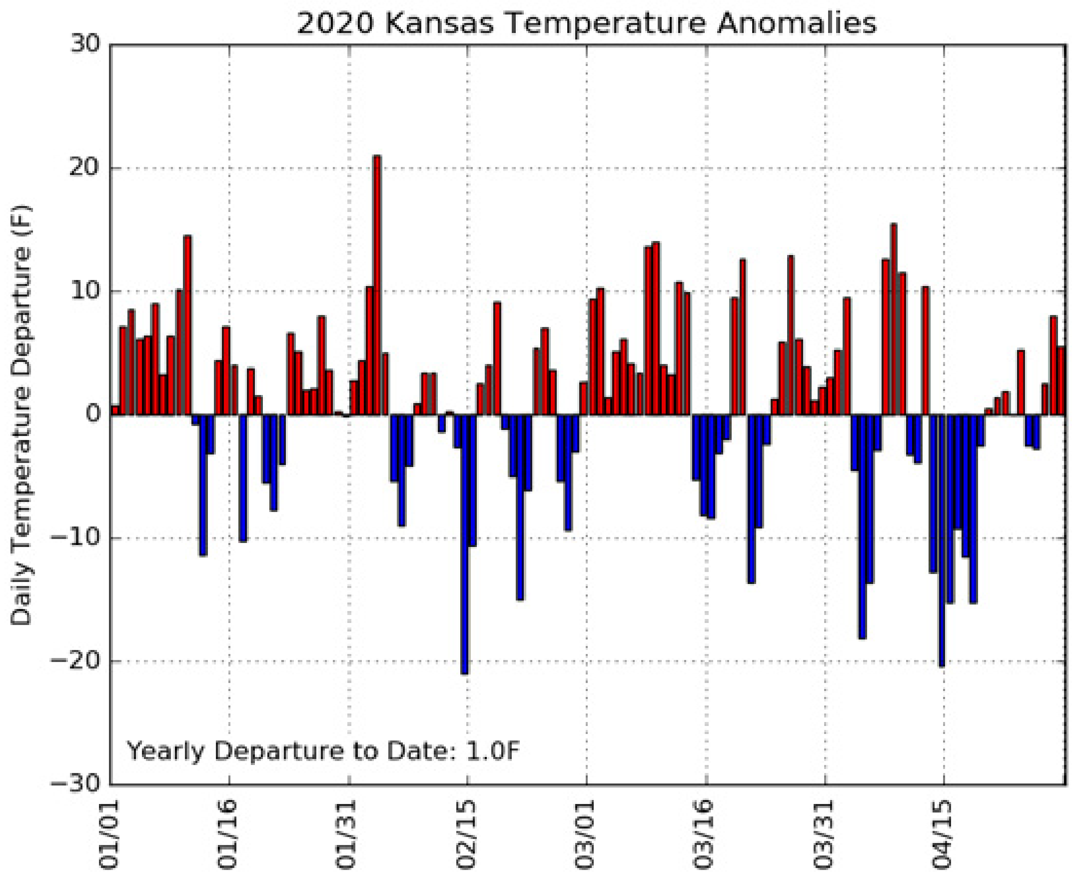

Figure 1. State-wide temperature (°F) anomalies by day as measured on the Kansas Mesonet. The 30-year average is represented as the zero line on the y-axis. The red bars (positive values) indicate temperatures were higher than the average. The blue bars (negative values) indicate temperatures were lower than the average. The yearly departure to date for 2020 is 1°F, meaning soil temperatures are approximately 1 degree warmer than the climate normal.

Soil Temperature Climatology

In Kansas, we are fortunate to have 11 Mesonet stations with data going back to the mid-1980s. This includes 2- and 4-inch soil temperatures and the stations are somewhat spread across the state with all 11 still collecting data today. However, there are a few caveats with this dataset: 1) ground cover density and type may have changed over time (dirt vs. grass, etc.) and, 2) only preliminary quality control has been done over the dataset. Regardless, with 30+ years of data, we can still successfully use the trends as a base line. Especially since this much soil data doesn't exist anywhere else in the state. For this quick summary, we focused only on 2-inch soil depth data.

Soil Temperature Summaries by Region

EAST

This region was, by far, the wettest this spring. As a result, moist soils have a higher heat capacity and can absorb and hold heat longer than if it were dry. Two-inch soil temperatures ran at, or above, normal for most of the spring (Figure 2). Soil temperatures didn't impact planting at all - the concern was the wet soils. Folks were unable to get in the field for planting due to excessive soil moisture.

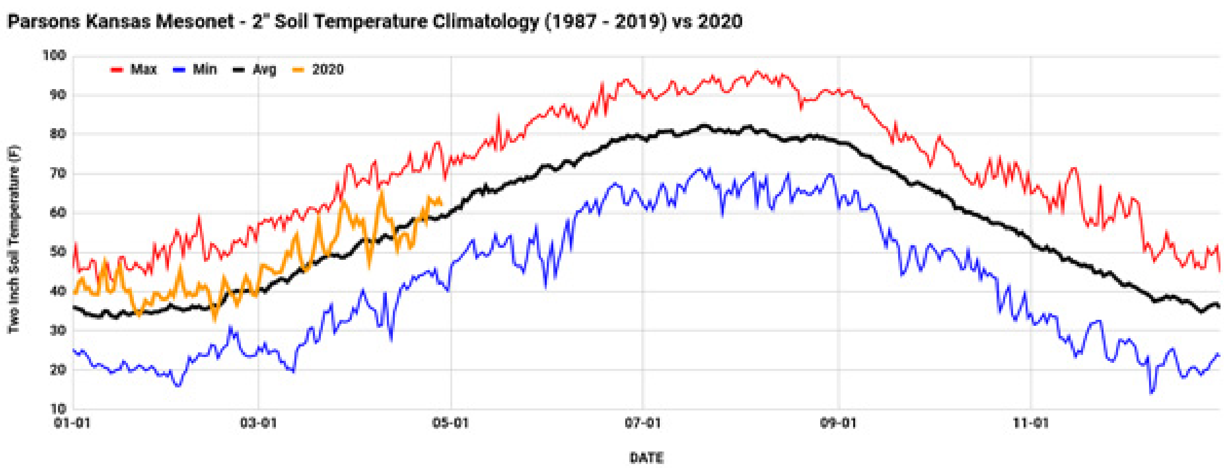

Figure 2. Two-inch soil temperatures this spring at Parsons compared to the Maximum (red), Minimum (blue) and Average (black) over the last 32 years. Source: Kansas Mesonet (mesonet.ksu.edu/agriculture/soiltemp).

CENTRAL

Probably the most diverse region, central Kansas saw varying conditions over small distances. Soils here were considerably drier than further east. As a result, they tended to vary more with weather conditions. During periods of abnormal temperatures, soils followed the anomalies but to larger extremes than what occurred in the east. These fluctuations impacted planting the most as the juggling between acceptable soil moisture and precipitation often didn't cooperate with warm enough conditions.

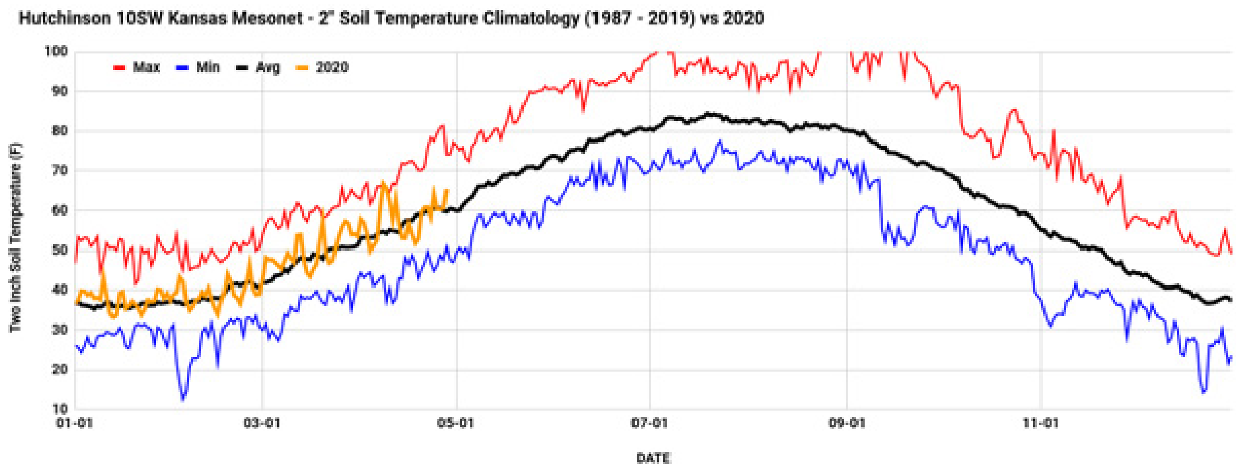

Figure 3. 2020 two-inch soil temperatures at Hutchinson compared to climatology. Source: Kansas Mesonet data.

WEST

Western Kansas unfortunately remained quite dry all winter. Some precipitation events kept the area from falling into worse drought, but at the same time, missed another area that desperately needed moisture. In the south, Garden City (Figure 4) ran well above normal for most of the year to date. With dry soils, little precipitation, and warmer temperatures it makes sense. However, the lack of moisture isn't ideal for planting despite the above-normal temperatures. These dry soils are also susceptible to drastic swings to below average conditions as observed several times, particularly in April.

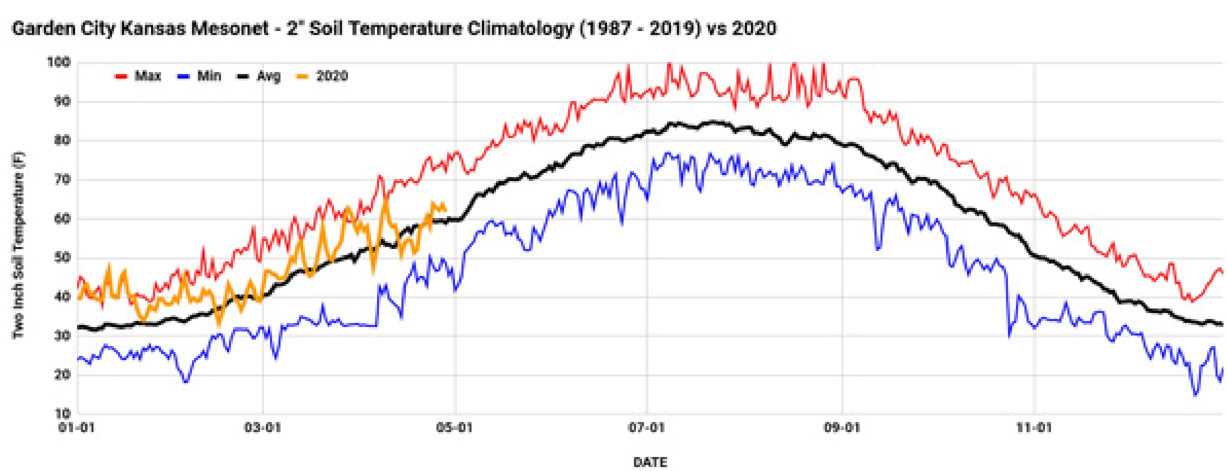

Figure 4. 2020 two-inch soil temperature at Garden City compared to climatology. Source: Kansas Mesonet data.

Further north at Colby, it was a bit of a different story. This area saw some abnormally dry drought conditions be eased late winter by several precipitation events. As a result, cooler temperatures prevailed and soil temperatures were slow to warm during these times. In the last month, soils have once again dried out with warmer temperatures, increased evaporation, and plant growth. Therefore, they fluctuate more with the diurnal temperature trends, losing all the afternoon heat gained, and are averaging below the 32-year normal (Figure 5).

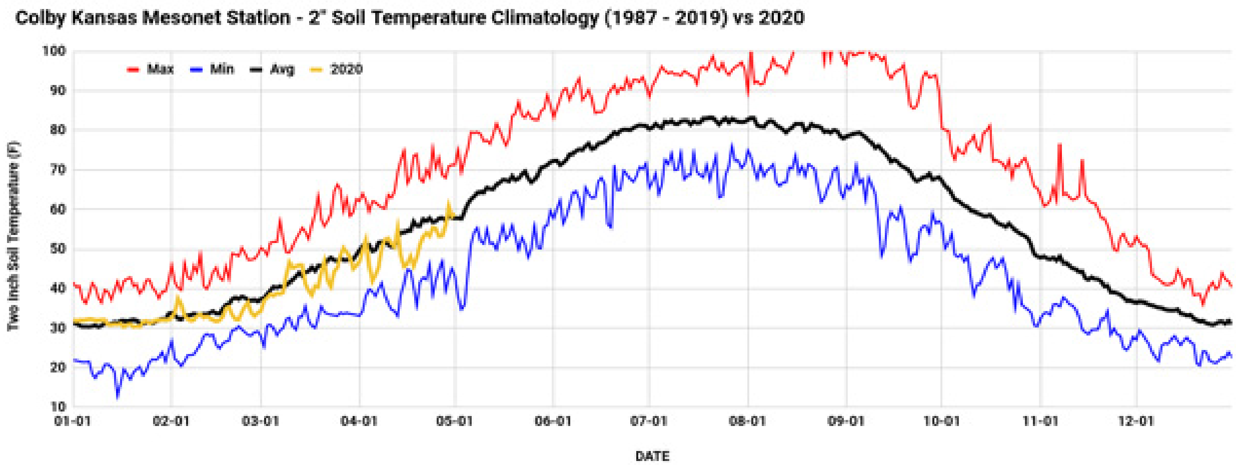

Figure 5. 2020 two-inch soil temperatures at Colby compared to climatology. Kansas Mesonet data.

Keep in mind, these are daily averages. Of concern when planting is the risk of minimum temperatures dropping below a particular threshold, usually under 50F. For much of the state, this won't be a concern as overnight low temperatures will only occasionally drop into the 40s. However, a duration of a few hours isn't long enough to reduce soil temperatures into concerning levels. The only area that may still have potential is northwest, where daily minimum soil temperatures just eclipsed the 50F mark this week. With warmer-than-normal temperatures in the forecast for the near future, the risk of dropping below 50F is becoming less every day.

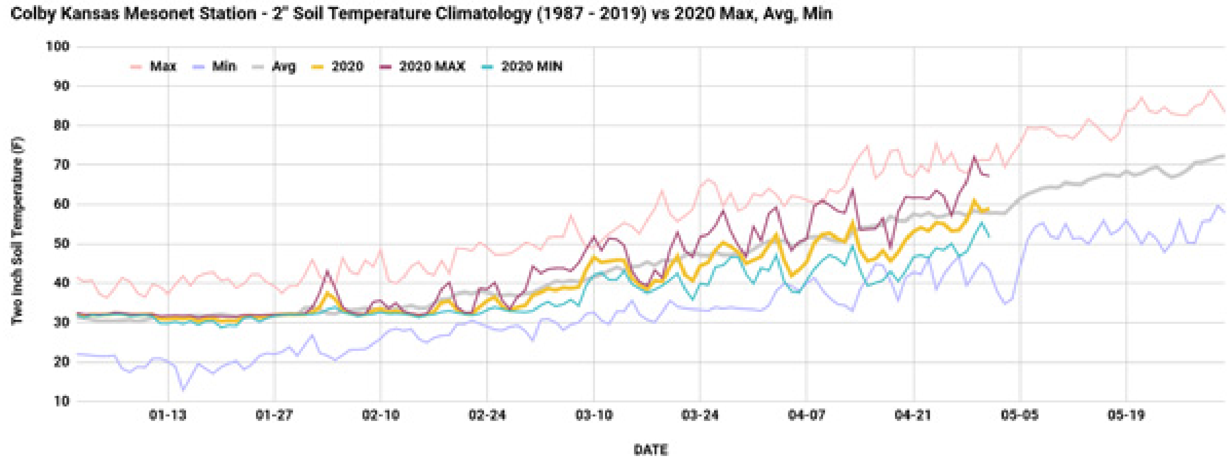

Figure 6. Colby 2020 maximum (purple), average (yellow), and minimum (blue) soil temperatures compared to climatology. Source: Kansas Mesonet Data.

Mid-April Cold Period

The most prominent cold period was early- to mid-April where temperatures were below normal for over a week. As a result, soil temperatures fell into the 40s for much of the state. Unfortunately, this was a critical period for planters as corn was beginning to go into the ground. Fortunately, temperatures rebounded quickly with increased sun angle and incoming solar radiation this late in the spring. The duration of below-normal soil temperatures was limited (Figure 7, yellow line in black box) compared to the long duration, and at times record cold conditions observed in 2019 (Figure 7, purple line in dashed black box) and over a month later in the spring. Therefore, any issues were likely isolated and minimal to corn in the ground.

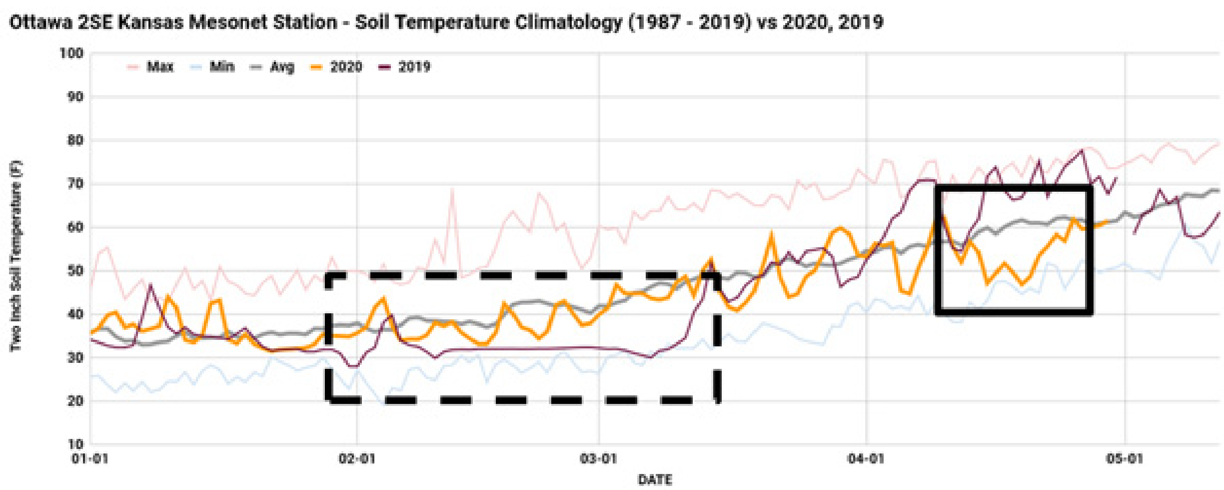

Figure 7. Soil temperature climatology at Ottawa compared to 2020 (yellow), 2019 (purple), and average (gray). Also highlighted are periods of below-average conditions in 2019 (black dashed box) and 2020 (black box).

Helpful Resources

Soil temperature data: mesonet.ksu.edu/agriculture/soiltemp

The climate data isn't available online yet but hopefully in the near future. Stay tuned!

Summary

- Two-inch soil temperatures have been near the 30-year normal this spring.
- Slightly slower soil temperature warm-up has occurred for the northwest compared to the rest of the state.
- 2020 has consisted of a balance in warm/cold temperature anomalies unlike the very cold start to 2019.
- A brief period of below-normal soil temperature conditions occurred mid-April but rebounded quickly.

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4. The 2020 tornado season is off to a slow start

April 2020 has come to an end without any tornadoes within Kansas, and a very low severe storms probability forecasted through early next week. That brings the question, "When did Kansas last see a late start to the tornado season?". Turns out, you do not have to look back too far. In 2018, the first tornado of the season was recorded on May 1. That year was a relatively slow year for tornado activity, with just 48 reported over the year. A late start does not necessarily mean a calm season. Last year, the first tornado was recorded on April 17, and the annual total was 101. The earliest date for the first tornado was January 28, 2006, when three tornadoes were reported. The latest date for the first Kansas tornado occurred on May 26, 1967.

Though there have already been six tornado warnings issued in the state, none have had reported touchdowns. Annually, the severe weather season plateaus on June 10 with the highest probability for tornadoes, hail, and wind (Figure 1). This is based off a 30-year climatology ending on 2011. The peak for tornado probability occurs two weeks earlier on May 27 (Figure 2).

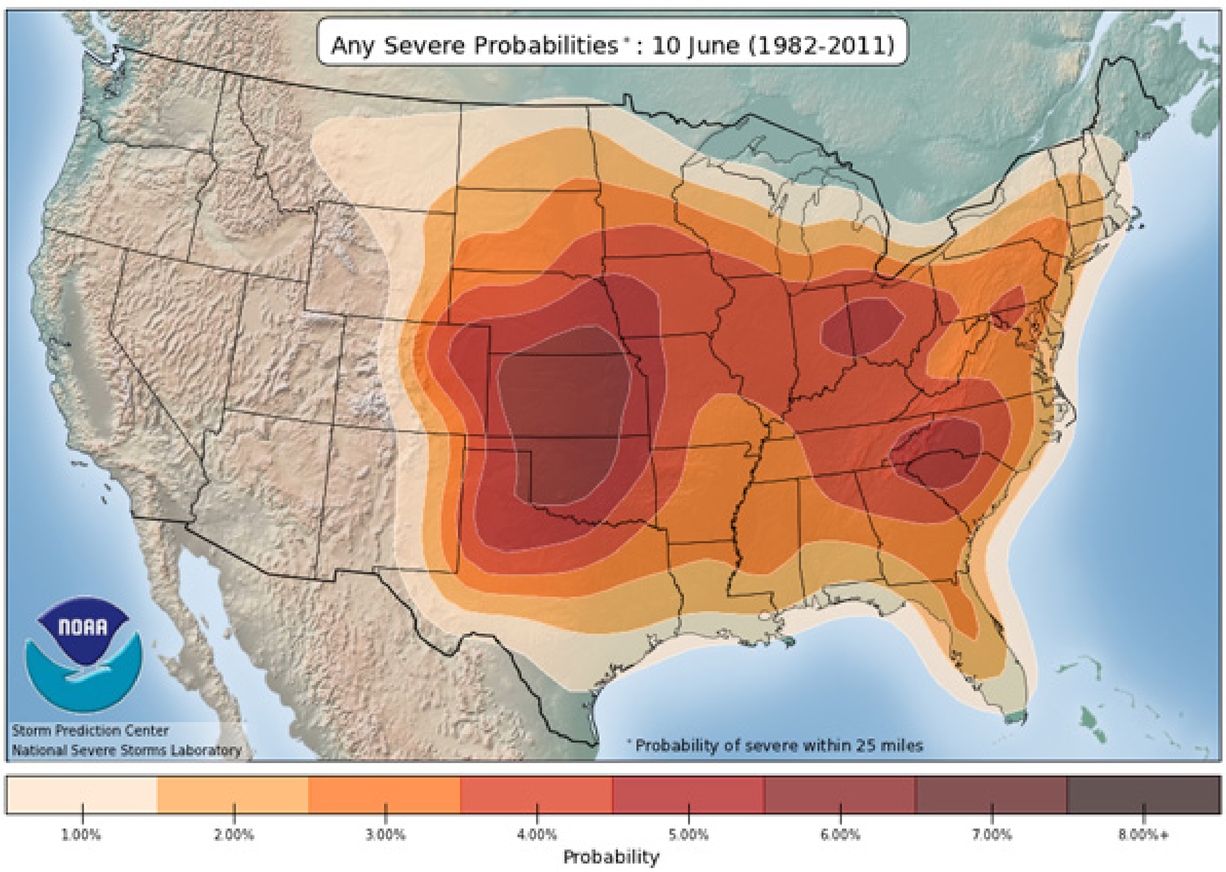

Figure 1. Severe weather probability climatology (Source: NOAA, Storm Prediction Center).

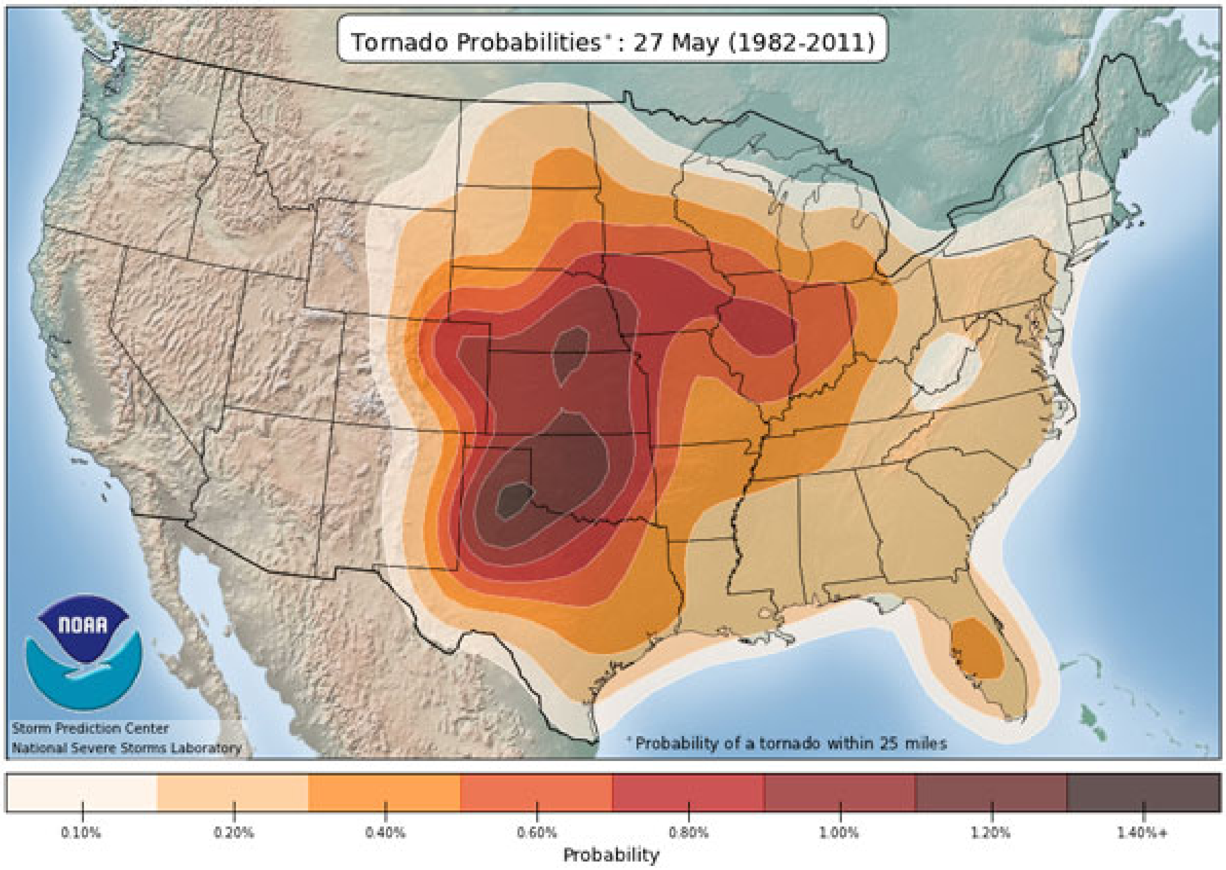

Figure 2. Tornado probability peak for Kansas (Source: NOAA, Storm Prediction Center).

Thus far in 2020, the amount of tornadoes elsewhere across the United States is actually running above average (Figure 3). This activity is mostly focused in the south and southeast – especially on Easter. However, the medium term forecast shows little probability of significant outbreaks and the quick pace of rising annual tornado numbers is likely to slow down.

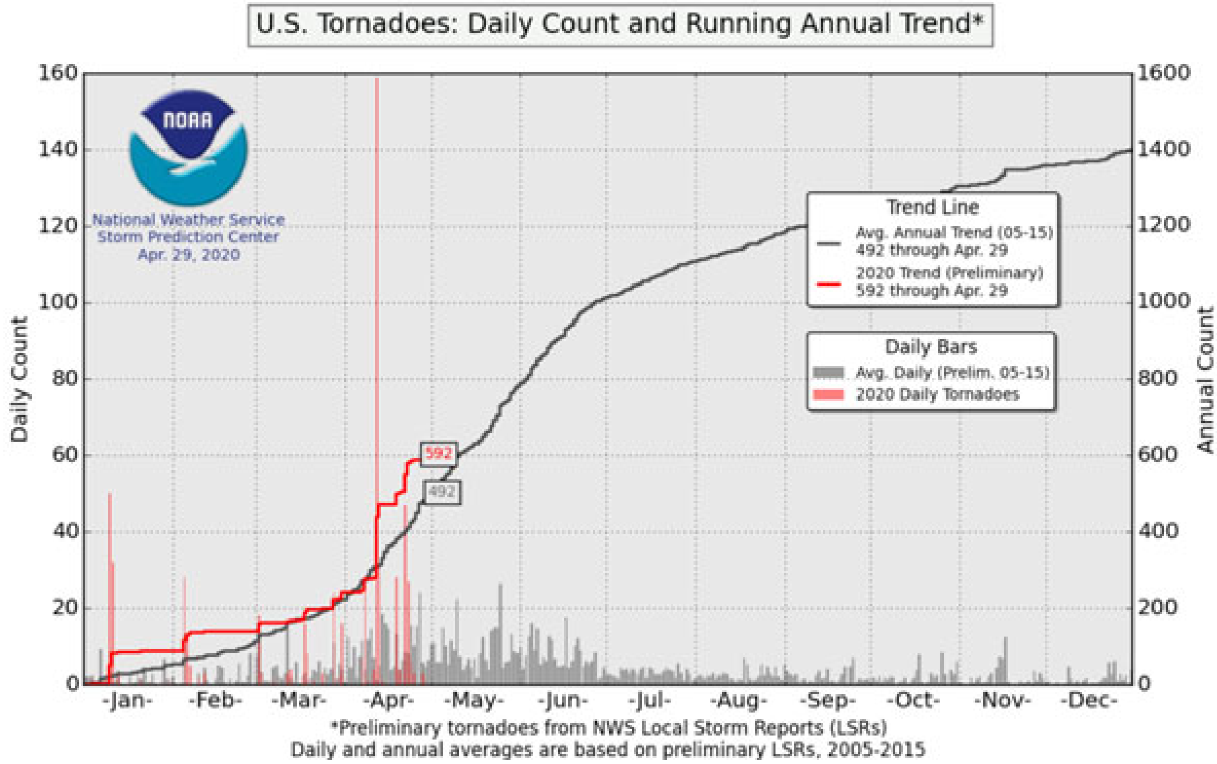

Figure 3. United States annual average (black line) and 2020 running count (red line) of tornadoes (Source: NOAA, Storm Prediction Center).

Despite the lack of tornadoes, April 2020 wasn't without severe weather. There were several reports of hail swathes (Figure 4), where hail piled up to a depth of several inches, and covered several miles. Also, on April 11, hail up to baseball size (2.75") was reported in Marion County. Preliminary totals from the Storm Prediction Center are 29 large hail events and 10 damaging wind events.

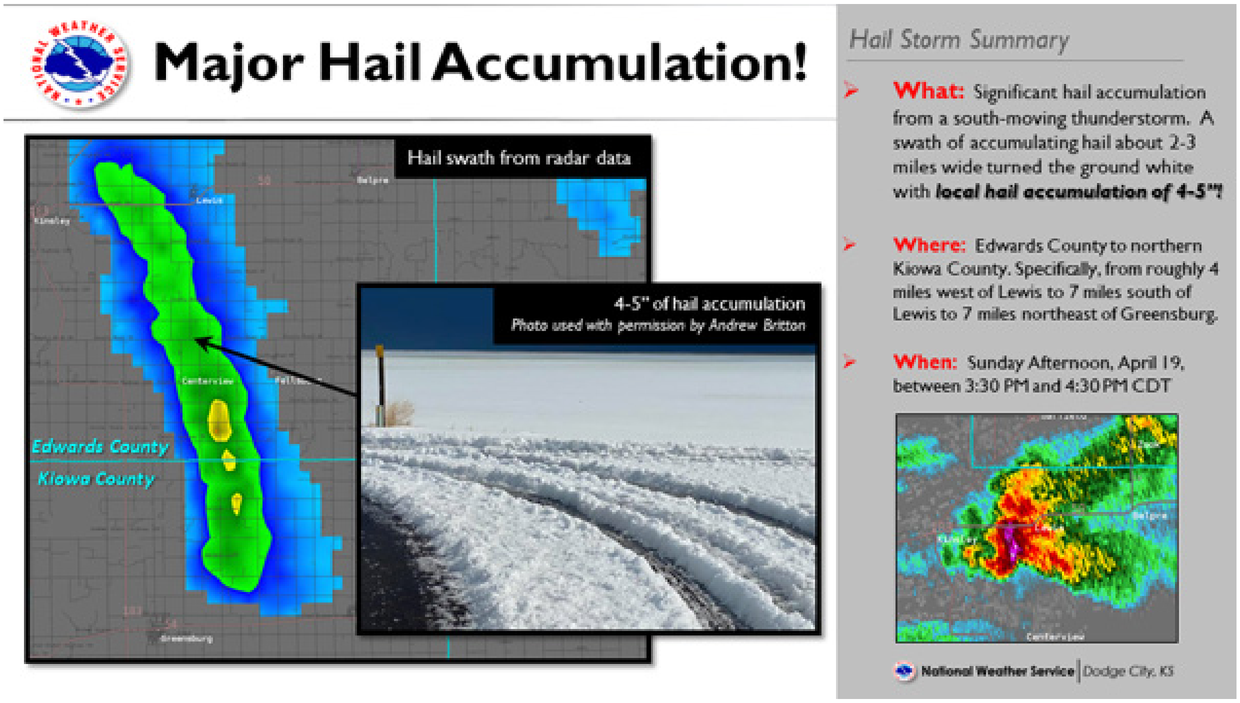

Figure 4. Hail swath in Edwards County via National Weather Service Dodge City.

Always be prepared for severe weather

Although the forecast is for relatively quiet severe weather through the beginning of May, don't become complacent. The severe weather season is just beginning across Kansas. Be weather aware, have multiple ways to obtain warnings, and always have a plan!

Here are some good websites for additional severe weather data in Kansas:

National Weather Service (NWS) Topeka: https://www.weather.gov/top/

NWS Wichita: https://www.weather.gov/ict/

NWS Kansas City: https://www.weather.gov/eax/

NWS Dodge City: https://www.weather.gov/ddc/

NWS Goodland: https://www.weather.gov/gld/

NWS Hastings: https://www.weather.gov/gid/

NWS Springfield: https://www.weather.gov/sgf/

NOAA Storm Prediction Center: www.spc.noaa.gov

Summary

- In 2018 the first Kansas tornado of the year was recorded on May 1.
- The latest first tornado recorded in the state occurred in 1967 on May 26.
- Tornado numbers are above average across the nation thus far in 2020.
- Despite a lack of tornadoes thus far, severe weather has and still will occur – don't become complacent!

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5. We need your input - How do you use the Chemical Weed Control Guide?

The Chemical Weed Control Guide is one of the most used K-State Extension publications, but we are always looking for ways to make the information more user-friendly. Extension Agronomy wants to hear from you! We are asking you to complete a short survey related to the Chemical Weed Control Guide. It can be completed in just a few minutes using a computer or mobile device.

To start the on-line survey, you can scan the QR code or visit the web address listed below. If you have questions or want to request a paper copy of the survey, please contact Extension Weed Science Specialist, Dr. Sarah Lancaster at slancaster@ksu.edu.

https://kstate.qualtrics.com/jfe/form/SV_4Z1gPg8wfpnkJrT