Issue 841

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eUpdate

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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. Marestail in soybeans: Strategies for the best control

Controlling marestail in soybeans continues to be a big challenge for Kansas no-till producers. Application timing and weed size are critical factors for successful control of this weed that germinates in the fall or early spring. Research has shown that up to 80% of marestail can die over the winter as a result of cold temperatures and/or lack of adequate moisture. In addition, a well-established cover crop in the fall can further reduce marestail establishment and survival and often is quite effective for marestail control. However, marestail that does survive is often robust and can be difficult to control with herbicides, especially later in the spring. Herbicide options are also limited by widespread resistance to glyphosate and/or ALS-inhibiting (group 2) herbicides in marestail.

Figure 1. Glyphosate-resistant marestail in soybeans. Photo by Dallas Peterson, K-State Research and Extension.

Early spring options

Recent observations suggest marestail in Kansas will bolt (Figure 2, right) in April throughout most of the state, so timing control before the end of March is recommended. In the early spring, using a Group 4 (growth regulator) herbicide such as 2,4-D and/or dicamba is an inexpensive and effective option to control rosette marestail (Figure 2, left). Dicamba has provided better marestail control than 2,4-D and will also provide some residual control, especially at higher use rates. Haluxifen (Elevore) is a newer group 4 herbicide that can provide similar marestail control to dicamba. In addition to targeting smaller weeds, application of group 4 herbicides also generally allows adequate time ahead of planting soybeans to meet required pre-plant intervals.

Using herbicides with longer residual helps control weeds that germinate between treatment and soybean planting. Products that include chlorimuron (Classic, Canopy), cloransulam (FirstRate), flumioxazin (Valor, others), saflufenacil (Sharpen, Optill, Verdict), or metribuzin, can help provide residual control against several broadleaf species, including marestail. However, it is very important to consult and follow the herbicide label guidelines for the required pre-plant intervals prior to planting soybeans as well as the proper rate for your soil.

Figure 2. Marestail in the rosette growth stage (left photo) versus bolted (right photo). Photos by Dallas Peterson, K-State Research and Extension.

Pre-plant options

As soybean planting nears, existing marestail plants can become difficult to control because plants will have bolted and be considerably larger. Herbicides to apply as a burndown prior to planting include tank mixes of glyphosate with 2,4-D, and the residual products listed above.

Be very careful to follow label directions regarding plant-back restriction when applying group 4 herbicides ahead of soybean, which can range from 7-30 days depending on the herbicide rate and formulation, as well as soybean variety, precipitation, and geography.

One additional herbicide to consider as a rescue burndown application to control bolting marestail prior to soybean planting is glufosinate (Liberty and others). Although, it would be better to control marestail at an earlier stage of growth, glufosinate has been one of the most effective herbicides to control bolting marestail. Glufosinate also has broad spectrum non-selective activity on other broadleaf and grass species if treated at a young growth stage. Glufosinate is primarily a contact herbicide, so a spray volume of 15 gallons per acre or greater generally provides the most consistent weed control. Glufosinate tends to work best under higher humidity and warm, sunny conditions at application.

Post-emergence options

Controlling marestail in the growing soybean crop can be the biggest challenge for producers, especially in soybeans without herbicide-resistant traits or in glyphosate-resistant soybeans (if marestail is glyphosate resistant). The most successful treatments for large marestail in Roundup

Ready soybeans have been tank-mixes of glyphosate with herbicides containing chlorimuron or cloransulam. However, marestail may also be ALS-resistant, and thus not controlled by those herbicides either.

If Roundup Ready 2 Xtend or XtendFlex soybeans are planted, Xtendimax, FeXapan, and Engenia should be some of the most effective herbicides for post-emergence control of marestail in soybeans. Remember that Xtendimax, FeXapan, and Engenia can only be applied to Xtend soybeans. Similarly, Enlist One or Enlist Duo will be effective control options in Enlist E3 soybeans. One final post-emergence option to consider is glufosinate. Glufosinate resistance is in Liberty Link, Enlist E3, and XtendFlex varieties.

For more detailed information, see the "2021 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/SRP1162.pdf or check with your local K-State Research and Extension office for a paper copy.

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2. World of Weeds - Foxtails

Green foxtail (*S. viridis*), yellow foxtail (*S. pumila*), and giant foxtail (*S. faberi*) are three closely related annual weeds that can be found throughout Kansas. This article will discuss identification and control of these troublesome grasses. Other names for these plants include bristlegrasses or millets.

Ecology of foxtails

The foxtail species discussed in this article are all annual plants native to Eurasia. There is one foxtail species native to North America, knotroot foxtail, a perennial that is more commonly found in pastures. The annual foxtails discussed here are found on every continent (except Antarctica) and in every state. They can be found throughout Kansas in cultivated fields, pastures, lawns, roadsides, and other disturbed areas. Annual foxtail species were most likely introduced with European immigrants. Giant foxtail quickly became established in agronomic systems as 2,4-D became widely used to remove broadleaf weed species in corn and cereal grains. Foxtail seed can survive up to 30 years in the soil, but typically persist for three years or fewer. Seeds are eaten by many birds and the plants provide some habitat for pheasants and quail; however, bristles may injure grazing animals.

Foxtail species are able to emerge in soil temperatures as low as 33 F, but most emerge in early April. Seedlings have first leaves that are wider than they are long and nearly parallel to the ground.

Identification

There are two keys to identifying foxtail seedlings, ligules and leaf hairs (Figure 1). All three species have a fringed ligule; however, there are some differences among them (Table 1). In addition, all three species have hairs either on the leaf blade or sheath, with giant foxtail having short hairs covering the upper leaf surface and yellow foxtail have a few wispy hairs at the base of the leaf, while green foxtail leaves are hairless.

Foxtails are easily identified by their bristly, cylindrical panicles that develop as the days get shorter. Panicles are made of many spikelets, which each produce one ovate-shaped, wrinkly seed. Several bristles are attached at the base of each spikelet.

Figure 1. Giant foxtail collar region (left) and panicle (right). Note the membranous ligule with

a fringe of hairs and the hairy sheath margins. Photos by Sarah Lancaster, K-State Research and Extension.

Table 1. Key features that distinguish among common foxtail species

	Giant foxtail	Green foxtail	Yellow foxtail
Height	Commonly 1.5 to 3 feet, up to 6.5 feet	10 inches to 2 feet	Commonly 1 to 2.5 feet, up to 4 feet
Leaves	Fine hairs cover upper surface	No hairs	Long hairs at base
Sheath	Round, hairy margins	Margins hairy	Flat, no hairs, base may be red/purple
Ligule	Membrane with fringe of hairs, 1 to 3 mm	Dense fringe of hairs,1 to 2 mm	Membrane with fringe of hairs, <1 mm
Panicle	1 to 8 inches long, often droopy, 2 to 6 bristles per spikelet	1 to 6 inches long, 1 to 3 bristles per spikelet	Erect, stiff, 4 to 12 bristles per spikelet

<u>Management</u>

Foxtail species are especially troublesome in grass crops, such as corn and sorghum, where they compete for water and nutrients, especially nitrogen. Yield reductions between 20 and 80% have been reported for foxtail interference in corn grown in Colorado, Minnesota, Nebraska, South Dakota, and Michigan (Lindquist et al. 1999).

Chemical control of foxtails starts with residual herbicides in Group 15 (Dual Magnum, Harness, Zidua, others) or Group 3 (Prowl H2O, others). Timely application of poste emergence herbicides including glyphosate or herbicides in Group 1 (Select Max, Assure II, others) or Group 2 (Accent, Raptor, others). Several herbicide resistant biotypes of foxtails have been reported in the United States (Table 2).

Table 2. Herbicide resistant annual foxtail biotypes confirmed in the United States

	Herbicide site of action (group)	Example herbicide(s)	State(s)
Giant foxtail	ACCase inhibitors (1)	Select Max, Assure II	IL, IA
Giant foxtail	ALS inhibitors (2)	Pursuit, Accent Q	IL, IA, MI, MN
Giant foxtail	PSII inhibitors (5)	Atrazine	IA, MD
Green foxtail	ACCase inhibitors (1)	Select Max, Assure II	MN, WI
Green foxtail	ALS inhibitors (2)	Pursuit, Accent Q	PA, WI
Green foxtail	Microtubule inhibitors (3)	Treflan	ND
Yellow foxtail	ALS inhibitors (2)	Raptor	MN

(Source: www.weedscience.org)

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

For more information on controlling foxtails, see 2021 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, K-State publication SRP-1162.

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3. 2020 Kansas Performance Tests with Grain Sorghum Hybrids

The *2020 Kansas Performance Tests with Grain Sorghum Hybrids* report is now online. In this report, you will find a recap of the 2020 grain sorghum crop, with a detailed discussion summarizing the statewide growing conditions, diseases, and insects. More importantly, the results of the 2020 grain sorghum performance tests are also shown.

Grain sorghum performance tests, conducted annually by the Kansas Agricultural Experiment Station, provide farmers, extension workers, and seed industry personnel with unbiased agronomic information on many of the grain sorghum hybrids marketed in Kansas. Because entry selection and location are voluntary, not all hybrids grown in the state are included in tests, and the same group of hybrids is not grown at all test locations.

The online version of the 2020 Kansas grain sorghum performance tests can be found at: https://bookstore.ksre.ksu.edu/pubs/SRP1161.pdf.

Test results also can be found at: http://www.agronomy.k-state.edu/services/crop-performance-tests/grain-sorghum

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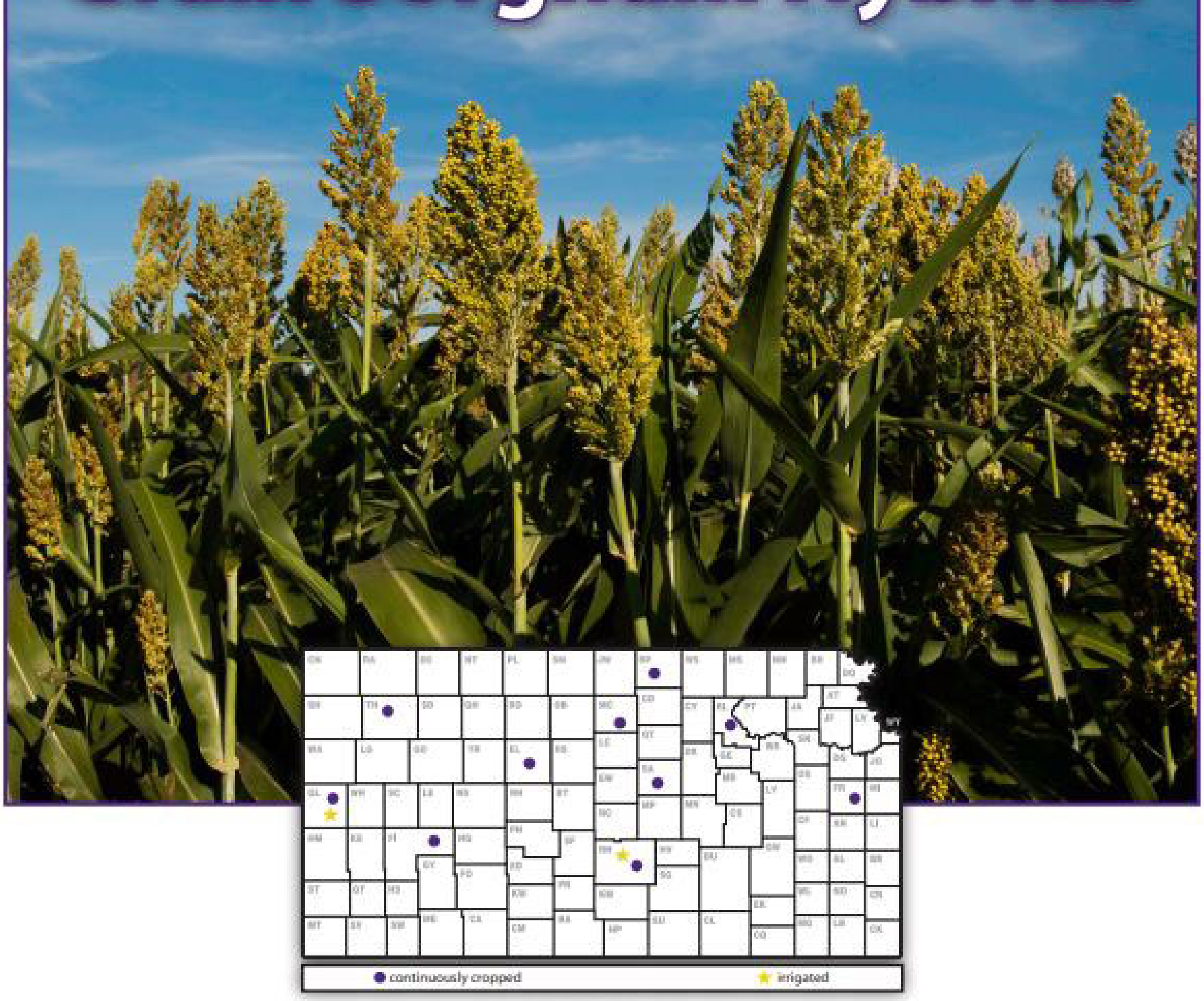
2020 Kansas Performance Tests with Grain Sorghum Hybrids



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4. Soil versus air temperatures: Understanding the relationship

The recent cold weather experienced by Kansas and surrounding states has sparked some interest in the relationship between air temperatures and soil temperatures. Some areas of Kansas experienced over 240 consecutive hours of below freezing air temperatures. Despite air temperatures as low as -30°F, weekly minimum soil temperatures at 2 inches remained between 15 to 32°F across Kansas (Figure 1). This difference between soil and air temperatures is complex and due to the interaction of multiple factors.

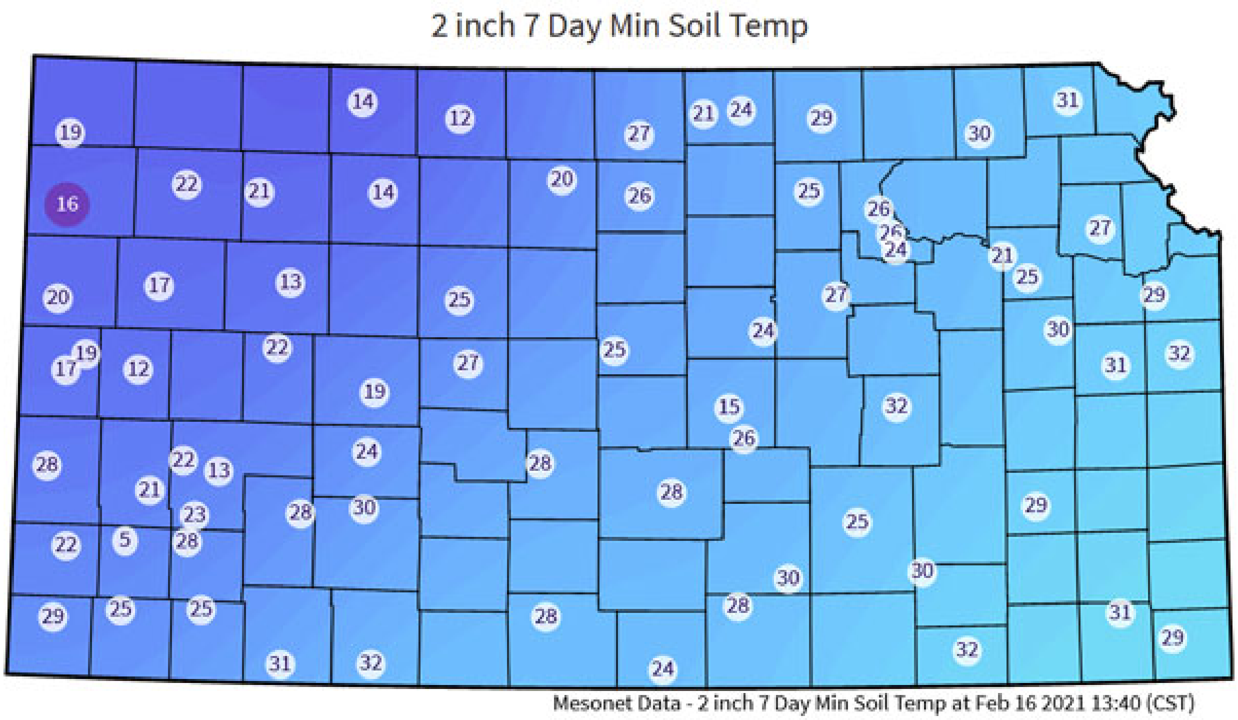

Figure 1. Minimum weekly soil temperatures at the 2-inch soil depth recorded by the Kansas Mesonet (mesonet.ksu.edu/agriculture/soiltemp).

Soil properties that control changes in soil temperature

There are multiple, interacting factors that control soil temperature fluctuations. Conduction is the predominant mode of heat transfer in soils. Conduction is how the handle of an iron skillet gets hot when on the stove. Conduction is largely controlled by two other soil properties: *heat capacity* and *thermal conductivity*. Simply put, heat capacity is the amount of energy required to raise the temperature of a substance (e.g. water or soil particles) by 1 degree Celsius. Soil particles have a low heat capacity and water's heat capacity is relatively high. This mean that dry soils are more easily heated or cooled than wetter soils. Dry soils also tend to exhibit larger temperature swings as compared to wetter soils. Soils of different textures (sandy vs. clayey) have similar heat capacities when dry, but because of the strong effect of soil texture on soil water storage, there is a strong indirect effect of soil textural class on the heat capacity via its influence on soil moisture status. In short, soil water is the major driver in controlling heat capacity.

A perhaps less obvious factor contributing to relatively warm soil temperatures compared to the low air temperatures is heat flow from deeper soil layers. During this long cold spell, heat from deeper in the profile was likely being conducted upwards, back toward the surface layer. This phenomenon is driven in large part by the thermal conductivity of the soil. The soil thermal conductivity represents the ability of the soil to conduct (or move) heat. Like the heat capacity, the thermal conductivity is strongly influenced by the soil water content. Dry soil is less conductive than moist soil.

Canopy, plant residue, and snow cover

The Kansas Mesonet focuses on obtaining soil temperature measurements using a standardized approach including site selection, sensors, sensing depth, and installation procedures. As a result, all sensors are located under native grass cover and mowed twice a year. With few exceptions, like where grass cover has been nearly impossible to get established, all soil temperature sensors are positioned about eight feet to the south of the main weather station.

Assuming similar soil moisture conditions, sensors under bare soil typically exhibit greater soil temperatures during the daytime and colder temperatures during the nighttime resulting in greater temperature fluctuations compared to sensors under grass or residue cover. Also, an even layer of snow can insulate the ground from the frigid air temperatures. Snow is one of the best insulating materials in nature since it contains a large fraction of trapped air space that creates a high resistance to heat flow.

A crop residue study was conducted near Moscow, KS in 2009-2010 by graduate student Nick Ihde and is summarized in Figure 2. Corn residue was either left in the field (retained) or chopped, raked, and baled (removed). Soil temperature measurements were recorded at the 2-inch soil depth and the soil type was a Bigbow fine sandy loam. Of note, soil moisture values between the retained and removed plots were only different from each other 8 days out of 120 days. In other words, soil moisture content was nearly equal (data not shown). Also, soil texture and soil organic matter content were the same in all plots. The take home message from the data shown in Figure 2 is that the crop residue helped insulate the soil from fluctuations in air temperature. Where residue was removed, the soil cooled and warmed more during the winter.

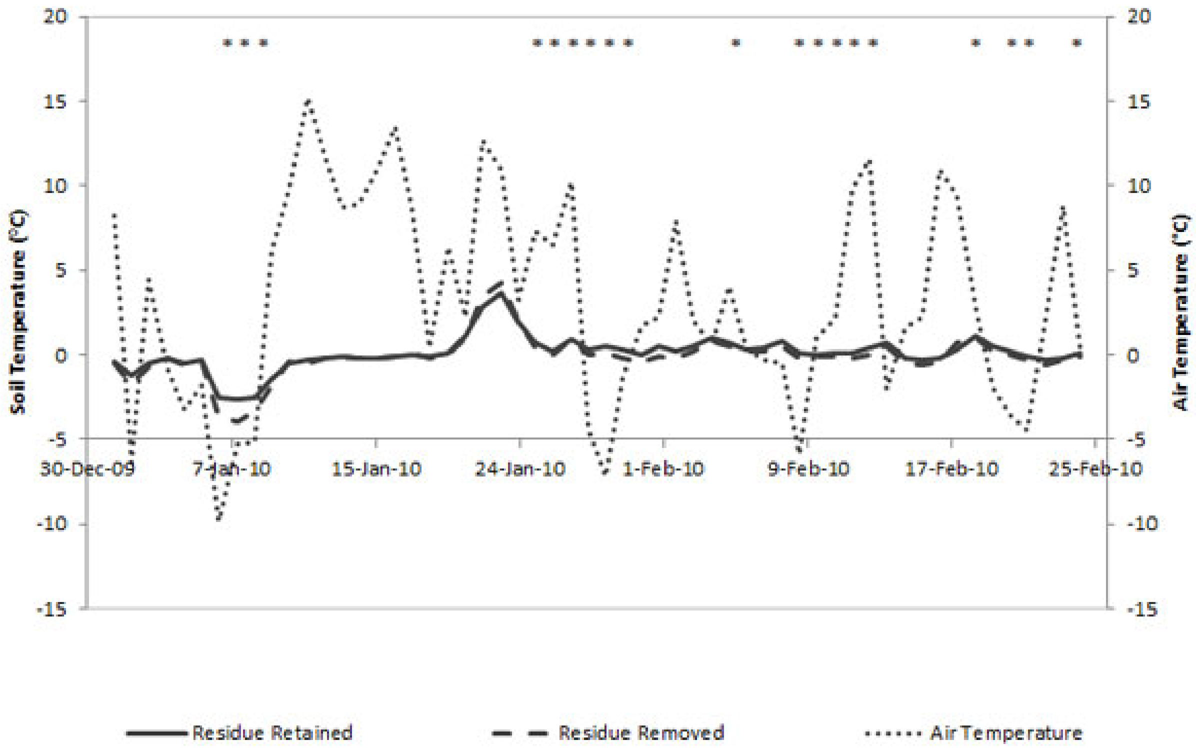

Figure 2. Crop residue insulates soils from fluctuations in air temperature. Where crop residue is present, the soil cools and warms slower. Data collected at 5 cm (2 inch) soil depth in a Bigbow fine sandy loam soil near Moscow, KS in the winter of 2009-2010 by Nick Ihde, graduate student in Agronomy.

Historical perspective of the February 2021 cold snap

Kansas is fortunate enough to have a soil temperature database back to 1987 for twelve weather stations. In context of the last 30+ years, the recent cold stretch set new record lows for the last three days (February 13, 14, and 15). Both Colby (Figure 3) and Hutchinson 10SW (Figure 4) experienced similar conditions due to the widespread nature of this event. Colby's average soil temperatures for the latter half of December and most of January hover around the freezing mark. This is the result of the above mentioned conditions making 32°F such a hard threshold to overcome. Hutchinson's average soil temperatures are just above the freezing mark. In addition, neither station was under grass the entire thirty years. Some of the early 1990s saw either bare soil or sparse grass cover. Therefore, many of the lowest values in this climatology may have a cold bias. That reinforces just how impactful the recent cold soil temperatures and how rare the cold outbreak was relative to recent history.

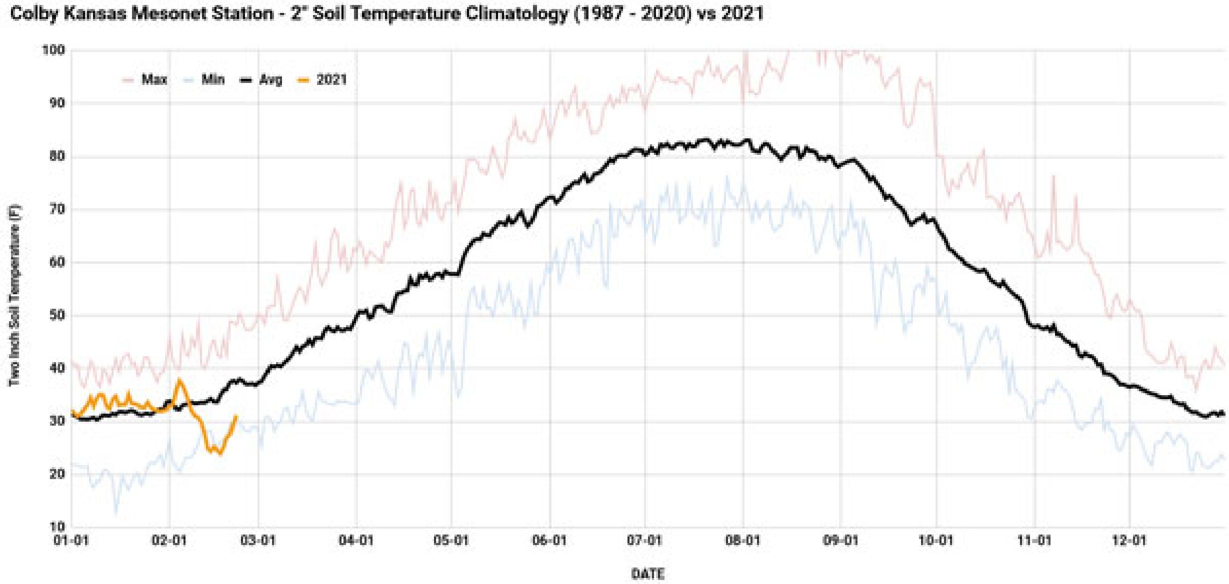

Figure 3. Climate data (daily maximum, minimum, and average two-inch soil temperatures) at the Colby mesonet since 1987 compared to the current year, 2021.

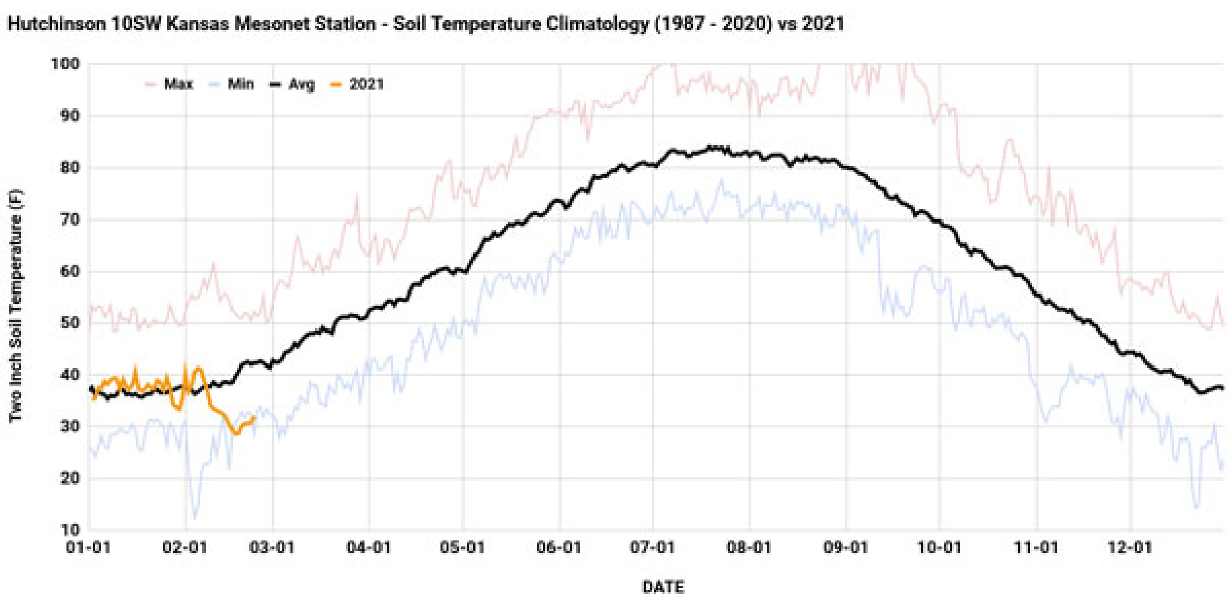

Figure 4. Climate data (daily maximum, minimum, and average two-inch soil temperatures) at the Hutchinson 10SW mesonet since 1987 compared to the current year, 2021.

At both Hutchinson and Colby, the increase in temperature and solar radiation going into late February and early March begin the normal trend towards warmer conditions. By this time next month, conditions begin to approach the 50°F mark in southern Kansas and the planting window begins to open. Thankfully, forecast outlooks are calling for warmer-than-normal temperatures going into March which should help to avoid another catastrophic cold snap.

Be sure to monitor soil temperatures as spring approaches and thoughts turn to planting summer row crops. You can access the Mesonet soil temperature page at: https://mesonet.k-state.edu/agriculture/soiltemp/

Reference:

Ihde, Nicholas. 2011. Implications of residue removal on soil quality in southwest Kansas. M.S. Thesis. Kansas State University. http://hdl.handle.net/2097/8755

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5. Herbicide application practices in Kansas

Herbicide application practices such as sprayer speed and spray volume influence weed control as well as whole-farm efficiency. Weed science graduate students are currently investigating some of these interactions and we want the research results to have maximum value for Kansas farmers. achieve that goal, **we need your input**!

Please consider filling out a short survey on herbicide application practices. The survey can be accessed by clicking this link or copying the following address into your web browser: https://kstate.qualtrics.com/jfe/form/SV_6myk7ed81Zdi5kF.

We anticipate it will take about 10 minutes to complete on your computer or mobile device. There are approximately 20 questions and your responses will be completely anonymous.

If you have questions or would like a paper copy of the survey questions, please contact Sarah Lancaster at slancaster@ksu.edu

Thank you from the K-State Weed Science Extension Team!

6. Crop Talk webinar series for northwest and north central Kansas

A new series of hour-long webinars began in early February. This series is focused on agronomic topics targeted for northwest and north central Kansas. Topics range from soil fertility, weed management, insect management, and dryland corn dynamics. Continuing education credits have been applied for and will vary based on the subject area of each webinar. Each webinar will begin at 10:30 am (CST) and last until 11:30 am, beginning with the first one on Tuesday, February 2.

Upon registration, participants will receive an email with instructions to attend via Zoom or YouTube. These webinars are open to all and there is no cost. Visit the K-State Northwest Research and Extension Center's website to register: https://www.northwest.k-state.edu/events/crop-talk-series.

Please contact any local KSRE extension office in north central or northwest Kansas for any questions.

A complete list of webinars, with dates, topics, and speakers is detailed below.

February 2 - **Soil Fertility Questions from Growers for the 2021 Season (focused for Northwest Kansas)**
Dorivar Ruiz Diaz, K-State Soil Fertility Specialist

(1 Soil Fertility CCA Credit)

February 3 - **Soil Fertility Questions from Growers for the 2021 Season (focused for North Central Kansas)**
Dorivar Ruiz Diaz, K-State Soil Fertility Specialist

(1 Soil Fertility CCA Credit)

February 9 - **Weed Management and that Pesky Palmer Amaranth (focused in Northwest Kansas)**
Sarah Lancaster, K-State Weed Scientist
Vipan Kumar, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 10 - **Weed Management and that Pesky Palmer Amaranth (focused in North Central**

Kansas)
Sarah Lancaster, K-State Weed Scientist
Vipan Kumar, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 16 - **Corn Insect Resistance: Rootworm & Western Bean Cutworm**
Julie Peterson, UNL Entomologist

(1 Integrated Pest Mgmt CCA Credit)

February 23 - **Grain Sorghum Weed Control: Start Clean, Stay Clean**
Sarah Lancaster, K-State Weed Scientist

(1 Integrated Pest Mgmt CCA Credit)

February 24 - **Sorghum Insects: Aphids, Headworms and Chinch Bugs.. Oh My!**
J.P. Michaud, K-State Entomologist

(1 Integrated Pest Mgmt CCA Credit)

March 2 - **Alfalfa Management and Weevil Update**
Romulo Lollato - Wheat & Forage Specialist
Anthony Zukoff, K-State Extension Entomology Associate

(1 Crop Mgmt CCA Credit)

March 9 - **Dryland Corn Dynamics**
Lucas Haag, K-State NW Regional Agronomist

(1 Crop Mgmt CCA Credit)