Issue 885

K-STATE Research and Extension

Extension Agronomy

eUpdate

12/09/2021

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. Sulfur deficiency in wheat

In recent years, sulfur (S) deficiency in wheat has become more common in many areas of Kansas, particularly in no-till wheat. The likely reasons for this are a reduction in sulfur additions to the crop from atmospheric deposition (there is less S in the air now) and cooler soil temperatures as a result of no-till which slows S mineralization in the soil. Some crops in the rotation, such as soybean, can also take up significant amounts of S resulting in an S deficit for the following wheat crop.

Historically, S deficiency was most common on high-yielding crops grown on irrigated, sandy soils that are low in organic matter and subject to leaching. However, due to reasons discussed above, an increasing number of finer-textured soils have shown S deficiency in recent years.

Identification of S deficiency

The photos below are good representations of S deficiency in wheat. Generally, S-deficient wheat is yellow and stunted and is observed in patches in the field, especially in areas where there has been previous soil erosion or soil movement (Figure 1). The patchy S-deficient areas of the field are often found on hilltops or sideslopes where erosion has occurred and soil organic matter is reduced, or where leaching is more pronounced. Wheat in areas where topsoil was removed or significant cuts were made (i.e. terraced or leveled fields) also commonly shows symptoms.

Figure 1. Patches of sulfur deficiency in a wheat field. Photo by Dave Mengel, K-State Research and Extension.

Sulfur deficiency in growing crops is often mistaken for nitrogen (N) deficiency. However, unlike N deficiency where older leaves show firing and yellowing, with S deficiency, the pale-yellow symptoms often appear first on the younger or uppermost leaves. Wheat plants with S deficiency eventually become uniformly chlorotic (yellow leaf tissue; Figure 2).

Figure 2. Close-up of sulfur deficiency in wheat. The wheat is exhibiting yellowing (chlorosis) which is a sign of insufficient sulfur. Photo by Dorivar Ruiz Diaz, K-State Research and Extension.

Sulfur deficiencies in wheat have been showing up early in the spring, shortly after green-up, before organic S is mineralized from soil organic matter, and before wheat roots can grow into the subsoil to utilize any available S (sulfate) accumulations. Deficiencies of S are often difficult to identify because the chlorosis is not always obvious. Crops lacking S also may be stunted, thin-stemmed, and spindly. In the case of wheat and other cereal grains, maturity is delayed. Winter annual weed competition is also enhanced due to the slower growth and lack of good tillering.

At present, many fields in north central and northeast Kansas have an established history of S deficiency for wheat. In this situation, rather than waiting for symptoms to appear in the spring, farmers may want to consider a winter topdress application of S as a preventive measure.

Forms of sulfur in soil

The majority of sulfur in soils is present in organic forms in surface soils and as sulfate (SO_4^{2-}), an inorganic form. Sulfate is relatively soluble, so it tends to leach down into the subsoil. In many of our Kansas soils, it will accumulate in the B horizon (subsoil) in two forms. Clay surfaces and coatings will retain some sulfate, and sulfate will also be present in the subsoil of many Kansas soils as gypsum (calcium sulfate).

Testing soil for sulfur

There is a soil test for available sulfate-S in the soil profile. For proper interpretation of this test, soil texture, soil organic matter, , the crop to be grown, and the expected yield level all need to be considered. Accurate estimates of S needs cannot be made from a surface sample alone. Since sulfate is mobile, sampling to a **24-inch depth** is important. However, due to the relatively high demand for S during the rapid vegetative growth phase of wheat, and relatively shallow rooting by the wheat crop at this time, the S measured in the deeper, subsoil levels by the test may not be available to wheat in the early spring, especially where soils are cold.

Choosing a fertilizer material

There are many S-containing fertilizer materials. Several dry materials are available that can be blended with dry phosphorus or nitrogen fertilizers for winter/spring topdressing. However, some of these products are best used in pre-plant applications.

Dry fertilizers

- **Elemental S** (typically 90-95 percent S) is a dry material marketed by several manufacturers. Before it becomes available for plant uptake, elemental S must first be oxidized by soil microorganisms to sulfate. This can be a slow process when surface-applied. As a result, elemental S is not well suited for corrective applications to S-deficient wheat in the spring, due to the time required for oxidation to sulfate.
- **Ammonium sulfate**, AMS (21-0-0-24S) is a dry material that is a good source of both N and S. However, it has high acid-forming potential and soil pH should be monitored. Ammonium sulfate is a good source to consider for either pre-plant or topdressing to correct existing sulfur deficiencies.
- **Gypsum** (analysis varies) is calcium sulfate and is commonly available in a hydrated form containing 18.6 percent S. This material is commonly available in a granulated form that can be blended with other materials. Since it is a sulfate source, it would be immediately available

and is another good source for spring topdressing. However, gypsum is not as water soluble as many fertilizer materials such as ammonium sulfate.

- **New N-P-S products** such as Microessentials, 40-rock, MAP+MST, and others that are typically ammonium phosphate materials formulated with S, and in some cases micronutrients such as zinc. In most of these products the S is present as a combination of elemental S and sulfate.

Liquid fertilizers

- **Ammonium thiosulfate,** ATS, (12-0-0-26S) is the most popular S-containing product used in the fluid fertilizer industry as it is compatible with N solutions and other complete liquid products.

- **Potassium thiosulfate**, KTS, (0-0-25-17S) is a clear liquid product that can be mixed with other liquid fertilizers.

Topdressing with thiosulfate and UAN can be done early, before Feekes 5 growth stage (green up), and at temperatures below 70 degrees F. Be aware that some leaf burn may be expected with some of these liquid fertilizers. These products would be good sources for pre-plant application as well.

Supplemental resources

- Sulfur in Kansas *(*MF 2264), http://www.ksre.ksu.edu/bookstore/pubs/MF2264.pdf
- For estimations of required application rates of S - Soil Test Interpretation and Fertilizer Recommendations, (MF2586) http://www.ksre.ksu.edu/bookstore/pubs/mf2586.pdf

Dorivar Ruiz Diaz, Soil Fertility and Nutrient Management Specialist
ruizdiaz@ksu.edu

2. Learn how to examine soil for signs of compaction

Every year, questions arise about soil compaction. Compaction can reduce plant growth, reduce root penetration, restrict water and air movement in the soil, result in nutrient stresses, and cause slow seedling emergence.

Now is a good time to get out and investigate soil profiles for signs of compaction. There is much you can learn by pushing a tile or soil probe into the ground. First, if you have never done so, you can learn something about the soil profile. How many inches of topsoil do you have? At what depth do you encounter changes in soil textures? Topsoil thickness and soil texture are two properties you can't really control, at least not in the short term. One thing you can certainly look for and work on improving, however, is whether there are any layers of compaction.

Using a spade, soil probe, or tile probe is a good way to learn something about your soil profile and whether there may be a compaction layer. One approach is to dig a small hole about a foot deep, as if you were digging a post hole (Figure 1). You can take a knife and poke into the side of the hole, feeling for layers that seem denser, or that visually have a platy, compressed soil structure (Figure 2). Use a tape measure to determine the depth at which the dense layers occur. Then walk to a nearby fence row or waterway and do the same thing. Does this soil look and feel different? How does this compare to the end rows?

Figure 1. Digging a small hole with a spade is the best way to learn about the soil's natural and unnatural layers, such as compacted layers. Use a knife to feel for any unusually dense layers, and a tape measure to determine the depth of the layer. Photo by of DeAnn Presley, K-State Research and Extension.

Figure 2. Large pieces of soil that are horizontally oriented, or "platy," are a sign of compaction. **Photo by DeAnn Presley, K-State Research and Extension.**

Once you determine the depth at which the compaction occurs, you can work on solutions for improving (decreasing) the density of the compacted layer, or the soil in general. If compaction seems limited to the upper 3 inches of the soil profile, then the most likely culprit is traffic. Limiting traffic as much as possible when the soil is wet is a good practice for reducing soil compaction (Figure 3). Running properly inflated tires, using floatation tires, and having more tires in general helps to decrease surface compaction.

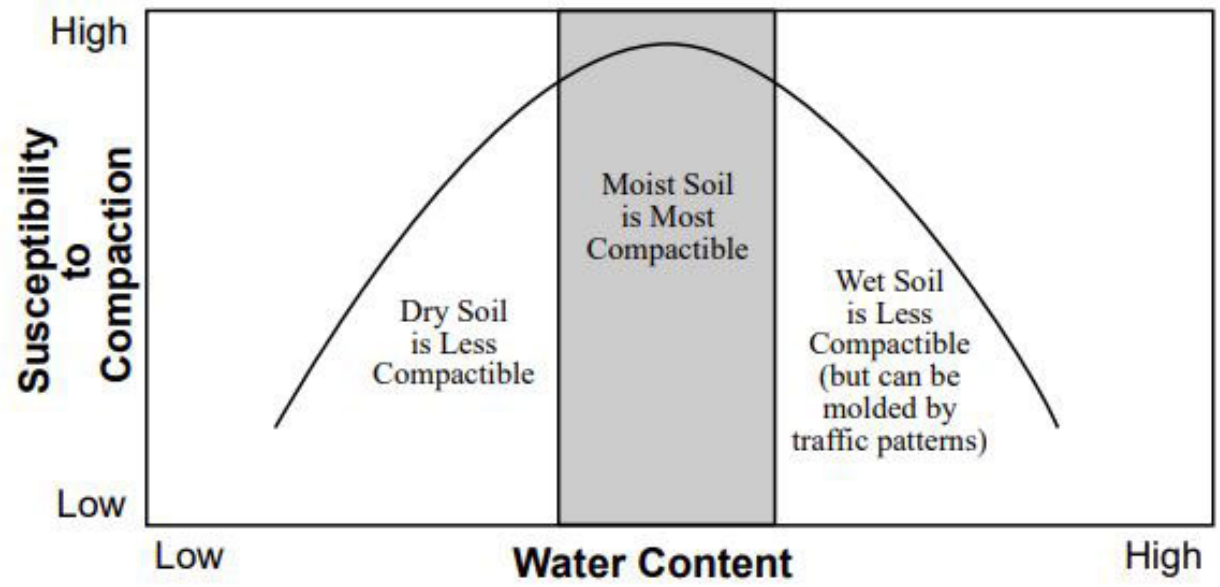

Figure 3. The amount of soil water is a critical factor in soil compaction potential. Moist soil is the most compactible. Graphic from K-State Research and Extension publication AF115.

A tougher problem to solve is subsurface compaction. If you can feel a layer that is compacted at depths greater than 6 inches, you may be dealing with subsurface compaction. Subsurface compaction should not be confused with a change in the soil texture. It is common to observe changes in the soil texture as you go deeper in the soil profile. Many soils have an increase in clay content in the upper part of the subsoil, which is natural and took a very long time to form. Some soils, such as those in floodplains, might have sandy layers present beneath the surface. This is the reason why the spade/post hole method is really the best, because it allows a person to discover so much more about the soil profile than using a tile probe alone.

DeAnn Presley, Soil Management Specialist
deann@ksu.edu

3. Kansas experiences a warm start to winter

After a very warm finish to November the heat continued into early December. While this paled in comparison to summer heat, it still had big impacts. The most substantial impacts have been warm soil temperatures, increased evaporation, drought expansion/intensification, and a slowly growing fire season concern.

Since Thanksgiving, 111 maximum temperature records have been broken in Kansas as of December 4 (Figure 1). In addition, another 19 records were tied. Of these records, nine different locations broke their record by nine or more degrees. Seventeen monthly records were broken during the period (with another seven tied). Lastly, seven record high low temperatures (warm overnights) were set.

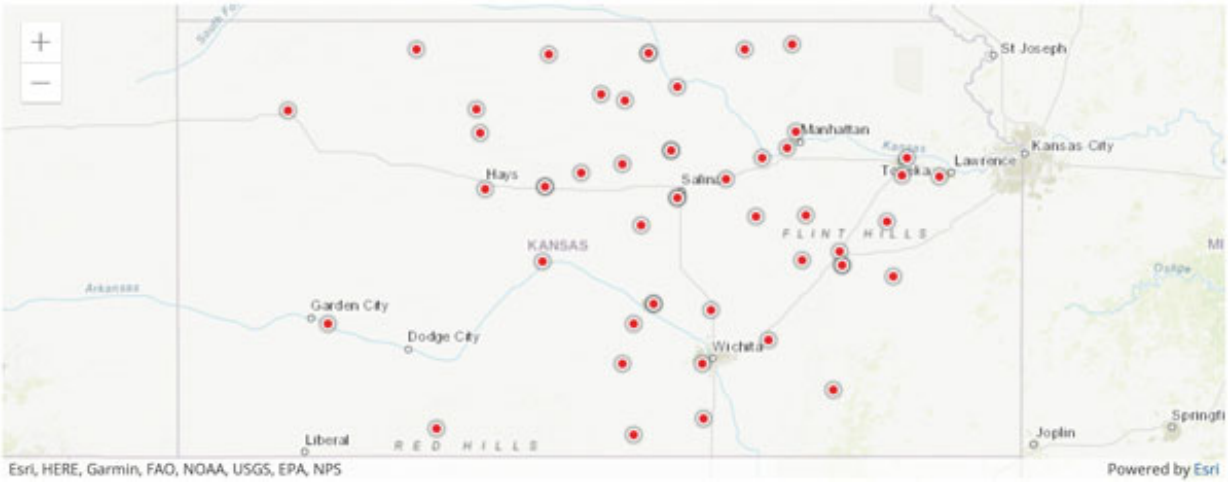

Figure 1. Locations of PROVISIONAL maximum records set from November 25 to December 4, 2021 in Kansas from National Centers for Environmental Information (NCEI). Source: https://www.ncdc.noaa.gov/cdo-web/datatools/records

On the cold side, no record low temperatures were set during this period, nor the lowest maximum (cold daytime high temperatures). The start of December is the beginning of meteorological winter (December through February), a period we would expect to be the coolest season in Kansas. The normal statewide average temperature from Thanksgiving to December 8 is 37°F. This year however, the statewide average temperature was 45°, 8 degrees above normal.

This recent warmth follows a trend that has been associated with both recent Novembers and winters. According to the National Centers for Environmental Information (NCEI), Kansas has observed as much as 0.2-0.3°/decade warmth in November and up to 0.4°/decade for all of winter (Figure 2). While these may seem like small impacts, they can have lasting results on agriculture, pests, and precipitation demand trends. This doesn't mean that there aren't outliers with cold months and seasons, just that long-term averages are indicative of slow trends over time.

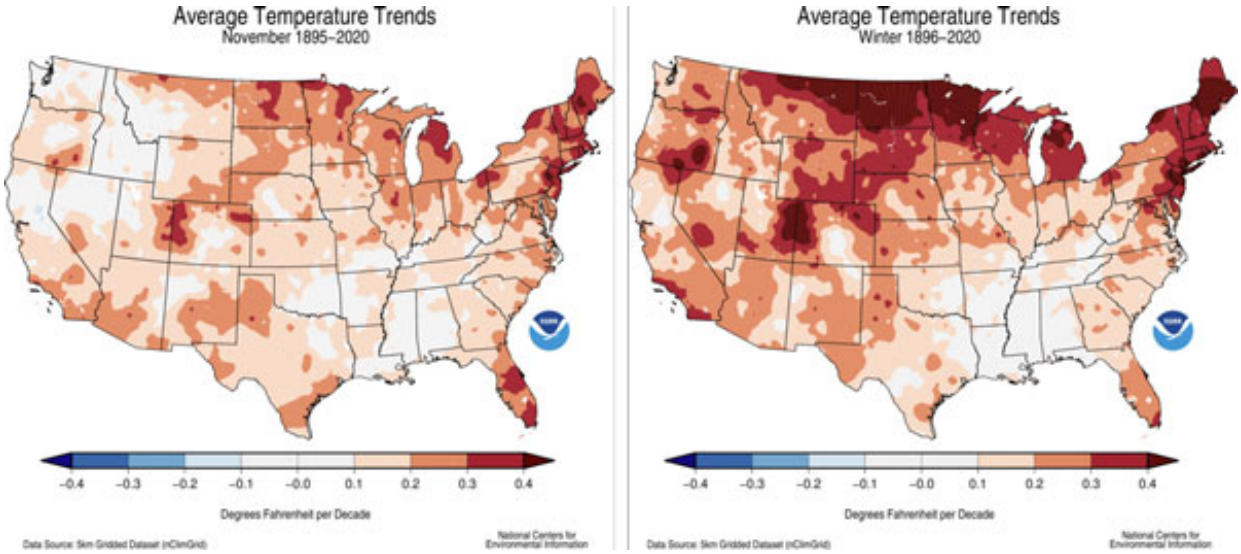

Figure 2. Average temperature change per decade for November (left) and winter (December through February). Maps from NCEI - https://www.ncdc.noaa.gov/temp-and-precip/us-trends/tavg/win.

Warm temperatures likely to continue

Looking forward to the future, the warmth isn't forecasted to end any time soon. While a few cooler days are expected, the forecast into the end of the month calls for above-average temperatures. The next 6-10 days have an unprecedented 80-90% confidence of above-normal temperatures (Figure 3). Some forecast models suggest temperatures as warm as 15-20° above normal for the upcoming week. Even beyond that period, above-normal temperatures are favored through the remainder of December.

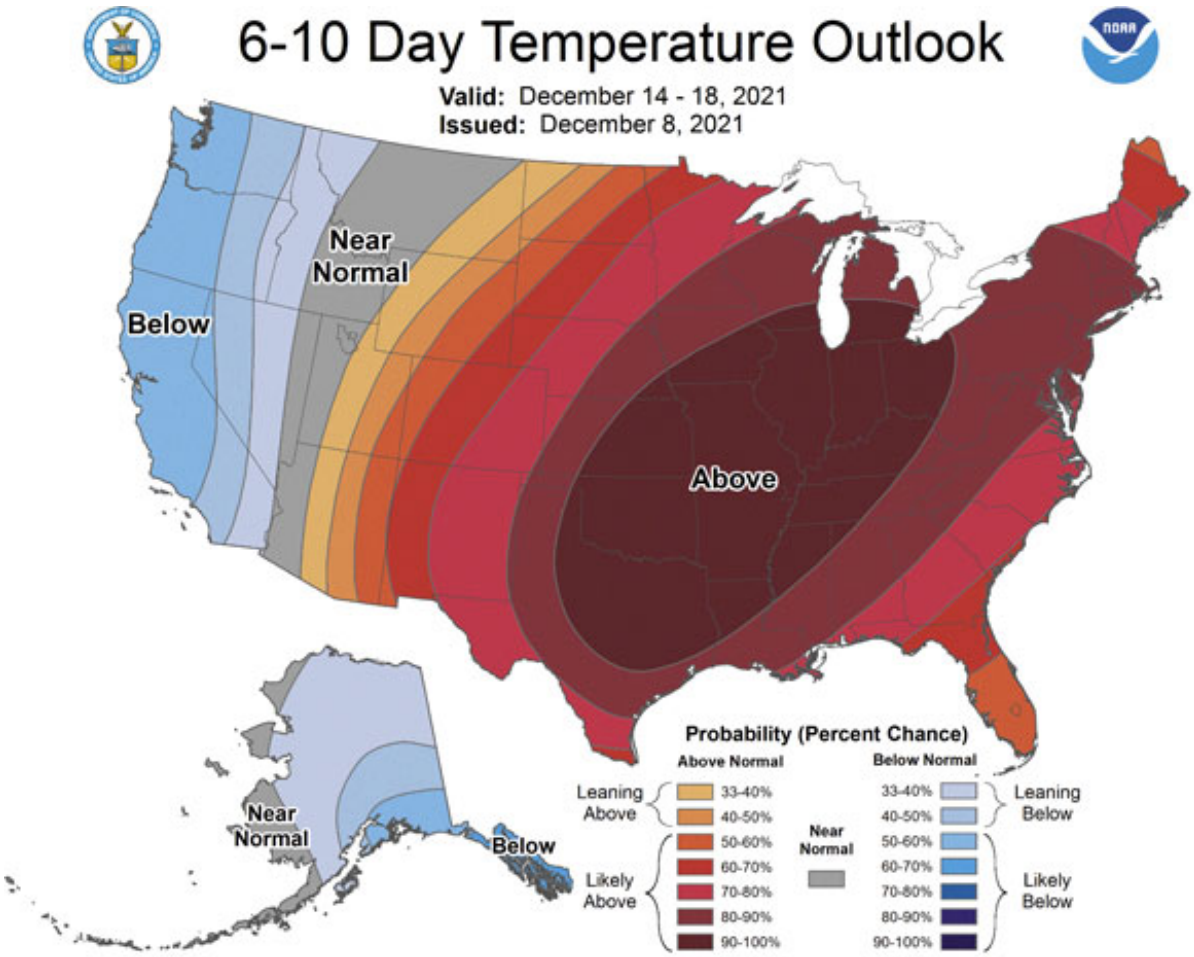

Figure 3. Climate Prediction Center outlook for December 14-18, 2021. The outlook favors above-normal temperatures for much of the continental US (cpc.ncep.noaa.gov).

Usually where there is one extreme, another exists to counter it. From Figure 3, the cooler air and below-normal temperatures are favored for the West Coast. Looking further northwest (Figure 4), very cold temperatures, as much as 12-18° below normal, persist for western Canada and Alaska. This will be an area to watch in the coming months. While current forecast models have much of this cooler air remaining over those regions, it is entirely possible that a pattern shift could usher some of that air southeastward. La Nina, combined with several other oscillations, are driving the current pattern. However, as we continue into the winter, La Nina results usually diminish. Other patterns, such as the Arctic Oscillation which drives Polar Vortex intrusions like those observed in February, can often become more dominant. With arctic air in place downstream, it'll be something that needs to be monitored closely for the coming months. However, current outlooks (Figure 5, left) and the latest model guidance (Figure 5, right) aren't optimistic on this cold air intruding the Central Plains at this time. Snow and cold lovers may hope that this outlook will change!

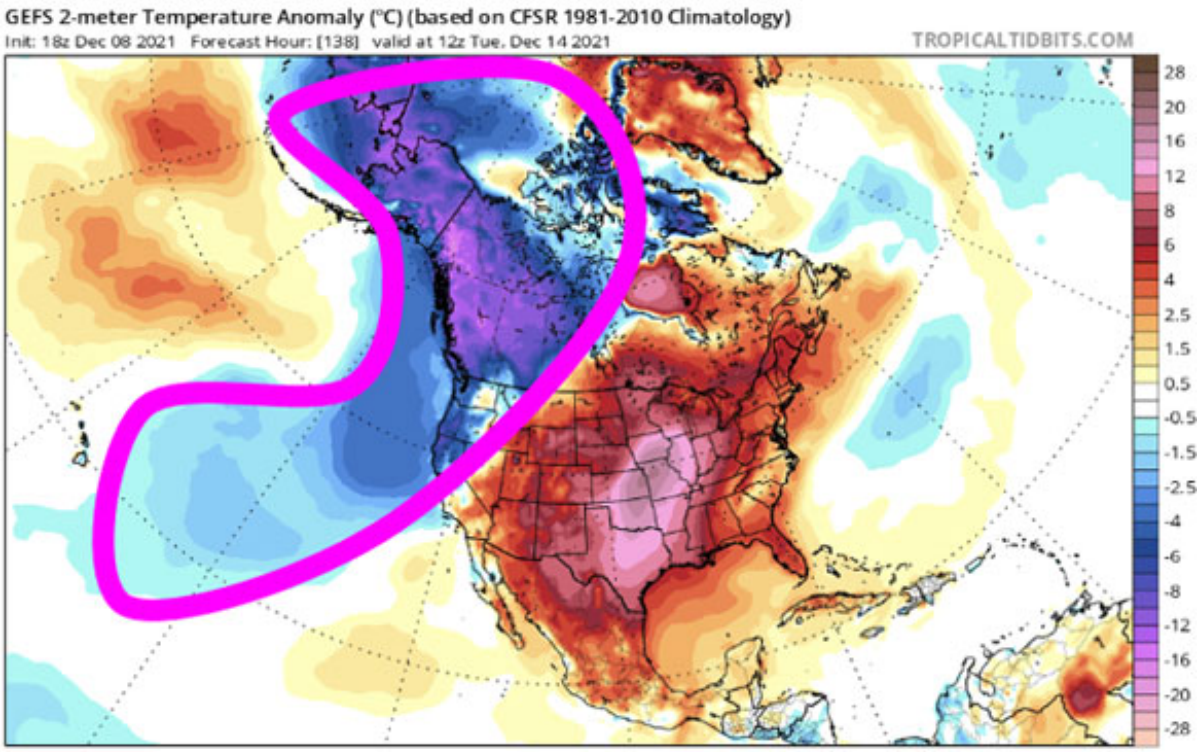

Figure 4. Forecasted surface temperature anomalies for December 14, 2021 compared to normal across North America from the GEFS model (tropicaltidbits.com).

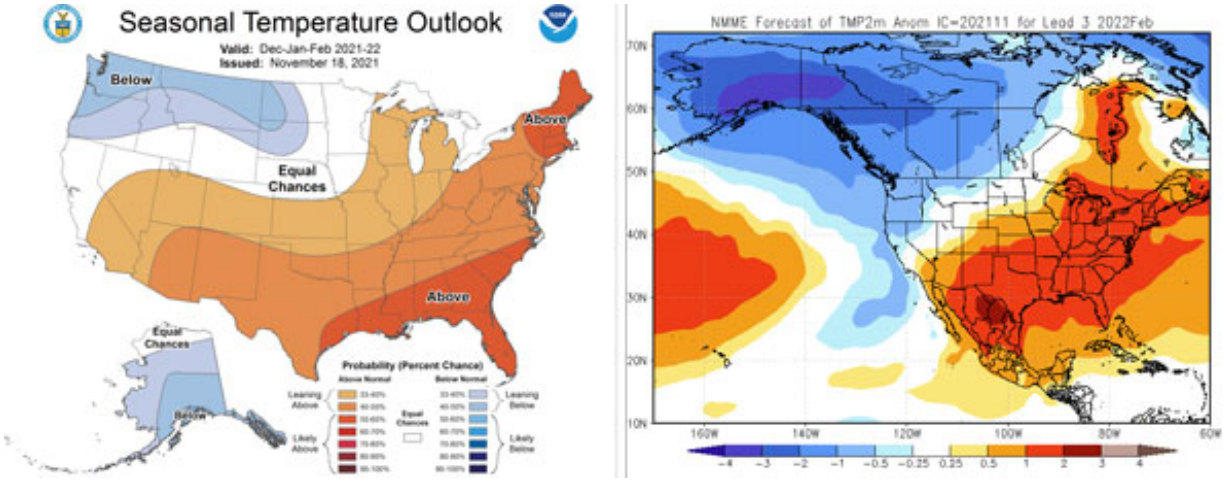

Figure 5. Winter (December through February) CPC forecast (left) and the North American Multi-Model Ensemble (NMME) temperature anomaly forecasted for February (right). Source: cpc.ncep.noaa.gov and https://www.cpc.ncep.noaa.gov/products/NMME/

Christopher "Chip" Redmond, Kansas Mesonet/Weather Data Library
christopherredmond@ksu.edu

4. K-State Soybean Schools scheduled for late January and early February

A series of six K-State Soybean Production Schools will be offered in late January and early February to provide in-depth training targeted for soybean producers and key-stakeholders. The schools will be sponsored by the Kansas Soybean Commission.

The schools will cover a number of issues facing soybean growers including weed control, crop production practices, nutrient management and soil fertility, insects, risk management, and disease management. More information on specific speakers and topics will be provided soon.

The dates are set and specific locations have been chosen with schools located across the state.

Beloit, KS - January 25 (Tuesday) - 8:00 am to 1:00 pm
First Christian Church in Beloit, 321 N. Mill Street
Contact: Sandra Wick, swick@ksu.edu

Holton, KS - January 25 (Tuesday) - 3:00 to 7:00 pm
NEK Heritage Complex – Jackson County Fairgrounds (south of Holton), 12200 214th Rd
Contact: David Hallauer, dhallaue@ksu.edu

Newton, KS - February 1 (Tuesday) – 8:00 am to 1:00 pm
Meridian Conference Center, 1420 E. Broadway Ct
Contact: Ryan Flaming, flaming@ksu.edu

Parsons, KS - February 1 (Tuesday) – 3:00 to 7:00 pm
Southeast Research and Extension Center, 25092 Ness Rd
Contact: James Coover, jcoover@ksu.edu

Oakley, KS - February 8 (Tuesday) – 8:00 am to 1:00 pm
Buffalo Bill Cultural Center, 3083 US-83
Contact: Kelsi Wertz, kjwertz@ksu.edu

Great Bend, KS - February 8 (Tuesday) – 3:00 to 7:00 pm
Knights of Columbus Hall, 723 Main Street
Contact: Stacy Campbell, scampbel@ksu.edu

Lunch/dinner will be provided courtesy of the Kansas Soybean Commission. There is no cost to attend, but participants are asked **to pre-register by Friday, January 14**. Online registration is available at **http://bit.ly/KSUSoybean**. You can also register by emailing/calling the nearest K-State Research and Extension office for the location you plan to attend (contact emails for each location are listed above).

Ignacio Ciampitti, Farming Systems
ciampitti@ksu.edu

Kathy Gehl, Extension Program Coordinator
kgehl@ksu.edu

5. Kansas Corn Schools scheduled for early 2022

The popular Kansas Corn School series is returning in January and February with four one-day in-person schools to be held across the state and one virtual session. K-State Research and Extension is partnering with Kansas Corn to offer the winter learning sessions for Kansas corn farmers.

The schools will cover a number of issues facing corn producers and are tailored to each region. Topics include weed control, insect resistance, fertility management, disease management and late-planting seasons, economics, and farm policy. Morning refreshments and a hot lunch are provided at the in-person schools.

In-person schools will begin at 8:30 am with registration and the program will end around 1:00 pm. The virtual school will take place from 6:00 to 8:00 pm on ONLY February 3.

2022 Kansas Corn Schools

- **January 7 – Oakley**
  Buffalo Bill Cultural Center
- **January 14 – Salina**
  Hilton Garden Inn
- **January 18 – Parsons**
  Holiday Inn Express Convention Center
- **February 3 – Virtual**
  Online only via Zoom
- **February 24 – Hiawatha**
  Fisher Center

Registration for your school of choice is available online at https://kscorn.com/cornschool/

Ignacio Ciampitti, Farming Systems
ciampitti@ksu.edu

Deb Ohlde, Director of Grower Services
dohlde@ksgrains.com