Issue 995

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eUpdate

03/14/2024

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. First hollow stem update - March 14, 2024

Cattle should be removed from wheat pastures when the crop reaches first hollow stem (FHS). Grazing past this stage can severely affect wheat yields (for a full explanation, please refer to the eUpdate article "Optimal time to remove cattle from wheat pastures: First hollow stem").

First hollow stem update

To screen for FHS during this critical time in the growing season, the K-State Extension Wheat and Forage's crew measure FHS on a weekly basis in 16 different commonly grown wheat varieties in Kansas. The varieties are in a September-sown replicated trial at the South Central Experiment Field near Hutchinson.

Ten stems are split open per variety per replication (Figure 1), for a total of 40 stems monitored per variety. The average length of the hollow stem is reported for each variety in Table 1. As of 11 March 2024, the average first hollow stem length was 0.39 cm and ranged from 0.09 to 0.75. While no variety had reached first hollow stem, all varieties had started to elongate their stems.

Figure 1. Ten main wheat stems were split open per replication per variety to estimate first hollow stem for this report, for a total of 40 stems split per variety. Photo by Romulo Lollato, K-State Research and Extension.

Table 1. Length of hollow stem measured on February 19, 26, March 4, and March 11, 2024 of 16 wheat varieties sown mid-September 2024 at the South Central Experiment Field near Hutchinson. The critical FHS length is 1.5 cm (about a half-inch or the diameter of a dime). Value(s) in bold indicate the highest FHS group.

	First hollow stem (cm)			
Variety	**2/19/2024**	**2/26/2024**	**3/4/2024**	**3/11/2024**
AP Prolific	0.00	0.00	0.07	0.12
AP24 AX	0.00	0.02	0.41	0.63
AR Iron Eagle 22AX	0.00	0.00	0.19	0.70
CP 7017AX	0.00	0.00	0.14	0.53
CP 7266AX	0.00	0.00	0.12	0.37
CP 7869	0.00	0.00	0.06	0.22
CP 7909	0.00	0.01	0.18	0.62
Croplan CP15CW3388#011	0.00	0.00	0.11	0.32
Guardian	0.00	0.00	0.18	0.28
Kivari AX	0.00	0.00	0.19	0.65
KS Ahearn	0.00	0.00	0.08	0.09
KS Providence	0.00	0.00	0.07	0.16
Limagrain LCH16AC403-1	0.00	0.00	0.09	0.36
Polansky XP24-11	0.00	0.00	0.12	0.27
Roadrunner	0.00	0.00	0.27	0.75
WB4347	0.00	0.00	0.02	0.13
Average	0.00	0.00	0.00	0.00
Min.	0.00	0.00	0.02	0.09
Max.	0.00	0.02	0.41	0.75

We will report FHS updates during the next few weeks until all varieties are past this stage. Additionally, FHS is generally achieved within a few days of the stem starting to elongate, so we advise producers to monitor their wheat pastures closely at this time.

This report provides producers with an update on the progress of the first hollow stem development in different wheat varieties. Producers should use this information as a guide, but it is extremely important to monitor FHS from an ungrazed portion of each individual wheat pasture to decide whether to remove cattle from them.

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2. Managing spring-planted cover crops for grazing

The following is a summary of "Managing Spring Planted Cover Crops for Livestock Grazing under Dryland Conditions in the High Plains Region," a fact sheet produced in collaboration with extension specialists and research scientists at K-State, Colorado State University, and the University of Nebraska. The comprehensive publication details recommended practices for species selection, adjusting stocking rates, and grazing management. The entire fact sheet can be viewed and downloaded at https://www.bookstore.ksre.ksu.edu/pubs/MF3443.pdf.

Quick Facts

- Cool-season species should be chosen for spring-planted cover crops to optimize growth and take advantage of winter and early spring moisture.
- Cool-season grasses tend to dominate, often to the detriment of other species, when planting cover crop mixtures in the spring.
- Yield variability is high when growing cover crops under dryland conditions in the High Plains Region, ranging from under 1,000 lbs/ac in dry years to almost 5,000 lb/ac in wet years.
- Stocking rates must be flexible because of the large year-to-year variability in cover crop productivity.
- Spring-planted cover crops can provide an average of 30 to 40 days of grazing.
- Start grazing spring-planted cover crops when they reach 6 to 8 inches of growth to take advantage of their high nutrient content and palatability.

Selection of Species

Determining what to plant can be daunting with all the varied species available for use as cover crops. For Kansas and Nebraska producers, local Land Grant Universities and the Midwest Cover Crops Council have developed a **decision tool** to help select species based on specified goals. When cover crops are grazed, one needs to choose species that will not only benefit soil health but will also be palatable and safe as forage for livestock. Fortunately, many of the species currently recommended for use as cover crops are also good for forage production. Factors such as nutritive content and potential toxicities must be considered.

While a number of potential problems can occur with various forages, most can be managed. The most frequent problem is the accumulation of nitrates that is common with oats and brassicas but can occur in a variety of species under certain growing and management conditions. Prussic acid is another toxicity to beware of when grazing, particularly with sorghums, but these species are less common in spring planted mixtures. Refer to publications on nitrate and prussic acid toxicities for more information. For a more complete overview of forage crops with potential toxicities, please see the publication **Grazing Management: Toxic Plants**.

For spring-planted cover crops, most, if not all, of the species planted should be classified as cool-season in order to be able to plant early and take advantage of winter and early spring moisture. Species that fall into this category include small grains (e.g., wheat, barley, oats, triticale, and cereal rye), brassicas (e.g., turnip, rapeseed/canola, and radish), and legumes (e.g., field/winter peas, winter lentils, vetch, and sweetclover).

Complex mixtures of 6 or more species, often referred to as "cocktails," are commonly recommended. The benefits of cocktails relative to single species or simple mixtures of 2 to 4 species depend on your specific management goals. Competitive cool-season grass species tend to be the highest biomass producers, which can optimize weed control and forage production. Mixtures are often used for benefits other than biomass production, such as providing nitrogen fixation by including legumes or soil pest suppression by including brassicas. From a grazing perspective, mixtures can produce forage with a range of palatability that can provide benefits and limitations.

Variability in Forage Production

Forage productivity will vary from year-to-year under dryland conditions, which makes this one of the biggest challenges facing producers that graze cover crops in the High Plains Region because stocking rates will need to be adjusted annually.

Producers have several options to manage this variability in forage production. A flexible herd size where animals can be added or subtracted based on a given years productivity is the ideal situation. If it is difficult to adjust herd size, then the number of days a field can be grazed will have to be shortened or lengthened to achieve residue goals. In reality, expect to graze spring planted cover crops for about 30 days in most years. This resource should be viewed as supplemental forage during the late spring and early summer to help relieve dependence on other forage resources such as native rangeland and baled hay. In most years, native pasture growth is sufficient for turn-out when cool-season cover crops near maturity. High stocking rates can help suppress stem elongation and heading, but producers need to be careful to not overgraze and leave sufficient residue for soil health benefits.

As a final note, in years with minimal precipitation and forage productivity (i.e. ~1,000 lbs/ac or less), the best choice might be to not graze at all if your primary goal is soil protection. Ideally, you want to maintain a minimum of 30% ground cover, and approximately 1,000 lbs/ac is needed to achieve that goal.

Grazing Management

When it comes to managing grazing of cover crops, numerous options can be considered. The ultimate strategy that is chosen will be influenced by your overarching goal(s) for the cover crop. Cover crops are generally grown for more reasons than just achieving high levels of harvest efficiency (i.e. percent utilization of available forage) as you would if this were a dedicated forage crop. You want to leave enough residue behind to maintain most of the benefits associated with planting cover crops (Figure 1).

Figure 1. Example of grazing and trampling impacts when predominantly cool-season grain cover crops are grazed during the heading stage. Regrowth is minimal and utilization is light (<30%) at this point, but trampling has left more than the target minimum of 30% ground cover.

Grazing management options include:

- **Continuous grazing**: Calculate a stocking rate based on the estimated yield and put the whole herd in one large field to graze. Advantages associated with this system of grazing are that no fences are moved and only one water source is needed (i.e. labor and inputs are minimal). However, if the field is large, livestock will tend to overgraze the forage closest to the water source while underutilizing the forage farthest from the water, unless you are able to move the watering location. Harvest efficiency will generally be around 30% with continuous grazing.

- **Rotational grazing:** A large field is divided into two or more smaller units, or paddocks, and the animals are rotated from one paddock to the next. This is also a good option that has some advantages and disadvantages. The more paddocks that the field is divided into, the higher the stocking density (i.e. number of animals per acre). Maintaining residue levels and minimizing soil compaction are two issues to consider with this method. The need to move fences every day or every few days and how to handle watering the animals are two of the biggest hurdles to overcome that keep many producers from practicing rotational grazing.

- **Strip grazing**: Similar to rotational grazing, where a temporary fence is set up to allow animals access to one to a few days' worth of feed, but differs in that there is no back fence, and animals can graze both fresh, residual, and regrowth forage. This method is convenient for watering animals as the fence can be set up so they have continuous access to a single water point. One drawback is increased compaction near the water source. Unlike rotational grazing, little regrowth accumulates when strip grazing because animals will continually

search out and graze any new growth in the previously grazed strips.

Once you have settled on a method of grazing, the next decision you need to make is when to start grazing your cover crop. If you are grazing steers and heifers and your goal is to achieve a given level of weight gain, then you need to start early to take advantage of high forage quality. The mixes we have been using for spring planted cover crops tend to be dominated by cool-season cereal grains like oats and barley. Once these species achieve 6 to 8 inches of growth, you should think seriously about starting to graze (Figure 2). Alternatively, some producers are more concerned about meeting their biomass goals for soil health and delay the start of grazing until plants are fairly mature.

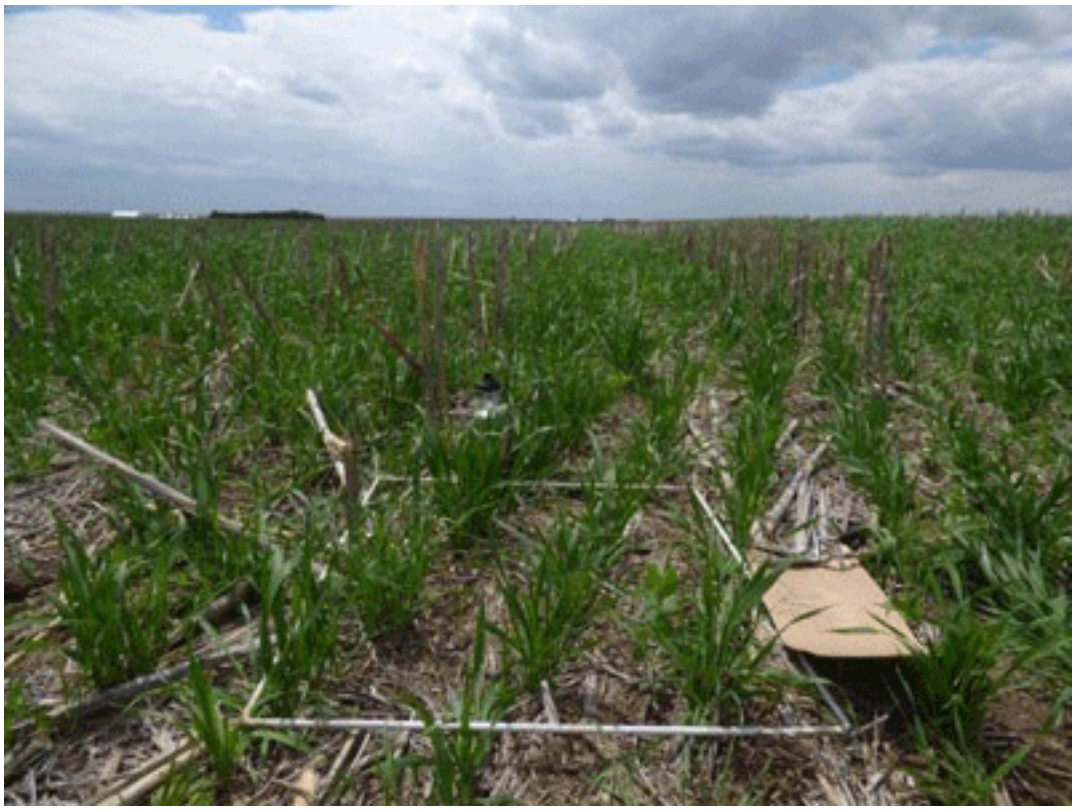

Figure 2. The above photo illustrates the proper time to start grazing (6 to 8 inches).

Determining Stocking Rates

Several key pieces of information are needed to estimate a stocking rate. The first is an estimate of the forage yield your field will produce during the period it will be grazed on a dry matter basis. How much forage will be consumed each day will depend on animal body weight and forage quality. For green and growing forages, intake will run from 2.5 to 3% of body weight on a dry matter basis. Another key input is the percent utilization desired. In dryland systems, 30% is a conservative starting point unless it appears to be an excellent moisture year with above average yields. Calculations can be made to estimate days of grazing for a given number of animals or the number of animals for a set grazing period. A **Carrying Capacity Calculator** is also available to help with these calculations. Example calculations to determine stocking rates are detailed in the full publication linked in the first paragraph of this article.

Example Timeline

An example timeline is shown below with suggested planting, start grazing, and end grazing dates for spring planted cover crops. This timeline will allow cover crops to effectively utilize winter and spring moisture to produce the highest yields possible under dryland conditions while providing livestock with high quality forage.

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3. Start monitoring alfalfa weevils using degree days and scouting

Degree day accumulations for Kansas alfalfa weevils are well ahead of normal for the entire state this year (Table 1). A similar trend occurred in 2023. There were reports of treatable infestations in south-central Kansas during the last week of March, and in mid-April of 2023, fields were being treated, or close to being treated, in the central, southeast, and northeast regions of the state. It is recommended that scouting for weevil activity should be occurring right now in all regions of the state.

Table 1. Alfalfa weevil degree days as of March 12, 2024. Kansas Mesonet, 2024: Kansas Mesonet Alfalfa Weevil Degree Days Accessed 12 April 2023, http://mesonet.k-state.edu/agriculture/degreedays/

	Accumulated Alfalfa Weevil Growing Degree Days			
	Station	**Actual**	**Normal**	**Departure**
Northwest	Cheyenne	204	29	176
	Colby	213	26	187
Southwest	Garden City	274	61	214
	Meade	336	64	272
North-central	Hays	271	32	239
	Osborne	244	15	229
South-central	Hutchinson	278	36	242
	Harper	343	64	279
Northeast	Manhattan	274	28	246
	Corning	246	13	233
Southeast	Cherokee	352	58	298
	Woodson	312	43	269

Alfalfa weevil degree days are a great way to estimate what might be going on in the field and serve as a useful tool to know when to time scouting. Alfalfa weevil eggs begin hatching after 300 degree days have accumulated (Table 2). Since we cannot determine if eggs present were laid the previous fall or the current spring, in Kansas, scouting should start after 180 degree days have accumulated starting from January 1.

Table 2. Approximate degree days required for alfalfa weevil development. Excerpt from Whitworth et. al., Alfalfa Weevils, Kansas State University, October 2022 (MF2999).

Degree Days or Thermal Units	Stage	Importance
25-300	Eggs hatch	In stems
301-450	1st and 2nd instars	Leaf pinholing – start sampling
450-600	2nd and 3rd instars	Defoliation
600-750	3rd and 4th instars	Defoliation
750+	Pupa to adult	Adults – some feeding - oversummering

Be aware of insecticide resistance

While warmer spring temperatures allow for faster alfalfa weevil development, be aware that dramatic temperature drops can slow down alfalfa growth, making the plants unable to keep up with feeding damage. Treatment may be warranted in shorter fields between 3 and 7 inches tall when feeding is evident on the top inch of growth and 1 to 2 larvae are present. If a field is treated, it is important to verify that the expected amount of control was achieved. In 2020, populations of alfalfa weevil resistant to lambda-cyhalothrin were verified in northwest and southwest Kansas and Oklahoma. While this resistance has not appeared to become a widespread problem for Kansas producers, a couple of fields reported in central Kansas last year where lambda-cyhalothrin had reduced efficacy. Oklahoma continues to have resistance statewide. Numerous products are available for alfalfa weevil control in Kansas (Table 3). When making management decisions, it is important to rotate modes of action as this is an effective way to prevent the development of resistance.

Table 3. Products registered in Kansas for control alfalfa weevil. Treatments listed are mainly used for treating alfalfa weevil larvae; products with an asterisk are also recommended for adult alfalfa weevil control. For more specific information relative to any insecticide, always refer to the actual label on the product.

Trade Name	Chemical Name	Mode of Action Class
Fastac CS	*Alpha-cypermethrin*	3A
Baythroid XL	*Beta-cyfluthrin*	3A
Lorsban	*Chlorpyrifos*	1B
Cobalt Advanced	*Chlopyrifos + lambda-cyhalothrin*	1B+3A
Stallion	*Chlopyrifos + zeta-cypermethrin*	1B+3A
Tombstone	*Cyfluthrin*	3A
Proaxis	*Gamma-cyhalothrin*	3A
Steward	*Indoxacarb*	22A
Warrior II w/Zeon Tech	*Lambda-cyhalothrin*	3A
Beseige	*Lambda-cyhalothrin + chlorantraniliprole*	3A+28
Lannate	*Methomyl*	1A
Imidan 70-W*	*Phosmet*	1B
Mustang MAXX	*Zeta-cypermethrin*	3A

One update to control options to be aware of for 2024 is the reversal of the EPA's ruling to ban chlorpyrifos (Lorsban and others). On November 2, 2023, the Eighth Circuit issued a ruling vacating EPA's final rule and sending the issue of chlorpyrifos tolerances back to EPA for further proceedings. Following that, the EPA issued a technical correction in which 11 special uses of chlorpyriphos were allowed. Among the 11 special uses pertinent to Kansas are alfalfa, cotton, soybean, and winter wheat.

For the most up-to-date alfalfa weevil degree day accumulations, visit the Kansas Mesonet Alfalfa Weevil Degree Day Calculator (https://mesonet.k-state.edu/agriculture/degreedays/). For a complete guide to alfalfa weevil management recommendations, please refer to the upcoming 2024 Alfalfa Insect Pest Management Guide that will be available online soon.

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4. Winter 2023-2024 for Kansas: The Season in Review

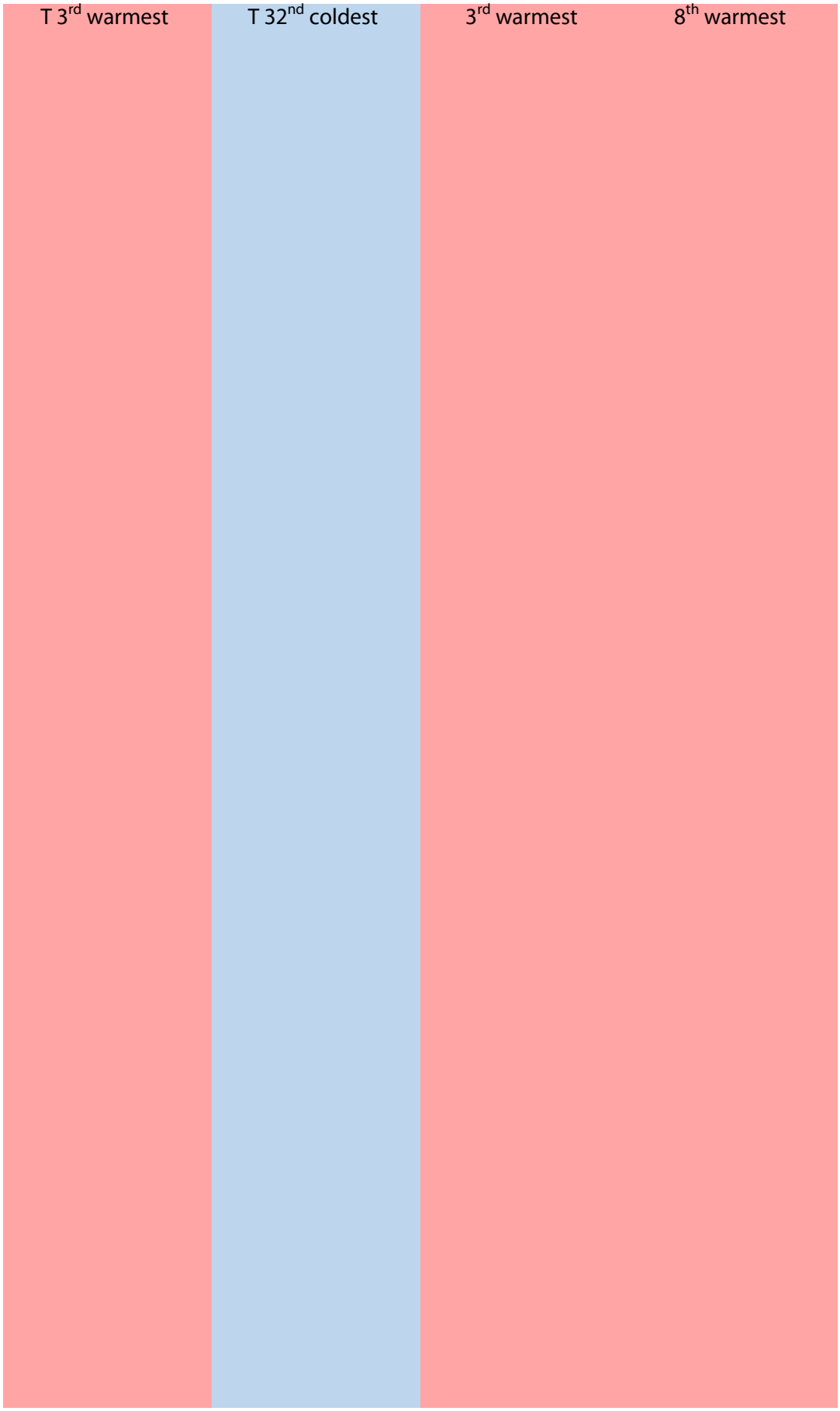
The meteorological winter of 2023-24 began on December 1, 2023, and ended on February 29, 2024. This past winter was the 129th in the National Centers for Environmental Information (NCEI) climate record, which is continuous all the way back to the winter of 1895-96. NCEI's records include average temperature and precipitation information for the entire state, each of Kansas' nine climate divisions, and for all 105 counties. In this report, we take a look back at the winter of 2023-24 and where it ranks compared to previous winters.

December 2023

December was an unseasonably mild month. There were only 7 days in December when the average temperature was below normal. The temperature never fell below zero anywhere in the state; the coldest reading was 5°F at the Hamilton County Mesonet site on the 10th. The 6th and 7th were the warmest days of the month, when highs were in the 60s and 70s statewide, with a few locations reaching nearly 80 degrees. Over 40 daily record highs were set on the 7th. This helped to make December 2023 the second-warmest on record, with a statewide average temperature for the month of 39.2°F, or a departure from normal of +6.0°F. The only December warmer than 2023 was two years ago in 2021 (41.1°F). Divisional departures from normal for the month ranged from +4.8°F to +6.7°F (Table 1). While no county experienced its warmest December on record, it was the second warmest in 43 counties. All counties finished in the top 8 warmest on record.

Table 1. Average monthly/seasonal temperatures (bold), in degrees Fahrenheit, departures from normal (in parentheses) and ranks of each amongst all years, dating back to 1895, by Kansas climate division. Source: National Centers for Environmental Information. Ranks preceded by a "T" indicate a tie with at least one other year.

Division	Dec 2023	Jan 2024	Feb 2024	Winter
Northwest	**36.0°** (+5.0°)	**24.0°** (-5.8°)	**41.4°** (+8.8°)	**33.8°** (+2.8°)
North	5th warmest **37.3°** (+6.2°)	31st coldest **23.2°** (-5.2°)	T 2nd warmest **43.2°** (+10.7°)	8th warmest **34.6°** (+4.0°)
Central Northeast	2nd warmest **38.2°** (+6.7°)	32nd coldest **23.6°** (-4.1°)	2nd warmest **43.4°** (+11.0°)	4th warmest **35.1°** (+4.6°)
West	T 3rd warmest **36.9°** (+4.8°)	T 34th coldest **24.9°** (-6.1°)	2nd warmest **42.5°** (+8.5°)	2nd warmest **34.8°** (+2.5°)
Central Central	6th warmest **39.0°** (+6.1°)	27th coldest **24.7°** (-6.0°)	3rd warmest **44.4°** (+9.7°)	10th warmest **36.0°** (+3.3°)
East	2nd warmest **40.5°** (+6.7°)	27th coldest **25.6°** (-4.6°)	3rd warmest **45.5°** (+10.7°)	6th warmest **37.2°** (+4.3°)
Central Southwest	2nd warmest **39.2°** (+5.4°)	29th coldest **28.2°** (-4.7°)	2nd warmest **44.5°** (+8.1°)	2nd warmest **37.3°** (+3.0°)



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South	**41.2°** (+6.4°)	**28.1°** (-4.9°)	**46.1°** (+9.1°)	**38.5°** (+3.6°)
Central	2nd warmest	30th coldest	3rd warmest	2nd warmest
Southeast	**42.4°** (+6.3°)	**28.3°** (-4.8°)	**47.4°** (+9.8°)	**39.4°** (+3.8°)
	2nd warmest	27th coldest	T 1st warmest	T 3rd warmest
STATE	**39.2°** (+6.0°)	**25.9°** (-5.2°)	**44.5°** (+9.5°)	**36.5°** (+3.5°)
	2nd warmest	28th coldest	3rd warmest	4th warmest

Precipitation was well above normal during the month. Much of the precipitation that fell in the state in December came from two events. The first event lasted from the 13th to the 15th, and the other from the 24th to the 26th. Southwest Kansas had the most precipitation with the first event, and with mild temperatures in place, it was primarily a heavy rain event rather than snow, but there were some reports of freezing rain at the onset of the event. Rainfall totals of 2 to 3 inches were common across many counties in the southwest, with a 3.59" total from Meade County, the highest storm total reported. Eastern Kansas received the most rainfall from the second event, with most areas picking up from 1 to 2 inches of rain, but there were isolated higher amounts of over two inches in the Kansas City, Topeka, and Emporia areas. The second event was primarily rain, but colder air behind the departing storm system brought snow to some areas. Heavy snow fell in the northwest, where as much as 8.5" was measured in Cheyenne County. Totals from 3 to 5 inches were common in north central Kansas, with 1 to 2 inches in northeast Kansas.

The average statewide precipitation for December was 2.16", or 1.09" above normal. This ranked as the 9th wettest December on record in Kansas. The highest-ranked division was southwest Kansas (3rd wettest) (Table 2). The remaining divisions finished in the top 15 except for northwest Kansas, where it was the 22nd wettest December. Nearly half of Kansas' 105 counties 45 had a top 10 wettest December, and 16 of those ranked in the top five. The highest ranking was third wettest, shared by seven counties: Cowley, Gray, Greenwood, Haskell, Meade, Seward, and Stevens.

Table 2. Average monthly/seasonal precipitation (bold), in inches, departures from normal (in parentheses) and ranks of each amongst all years, dating back to 1895, by Kansas climate division. Source: National Centers for Environmental Information (NCEI). Ranks preceded by a "T" indicate a tie with at least one other year.

Division	Dec 2023	Jan 2024	Feb 2024	Winter
Northwest	**0.85"** (+0.30")	**0.54"** (+0.13")	**1.09"** (+0.55")	**2.48"** (+0.98")
	22nd wettest	T 33rd wettest	T 17th wettest	12th wettest
North Central	**1.68"** (+0.75")	**1.04"** (+0.40")	**1.03"** (+0.18")	**3.75"** (+1.32")
	12th wettest	T 17th wettest	38th wettest	13th wettest
Northeast	**2.33"** (+1.03")	**1.74"** (+0.95")	**0.57"** (-0.60")	**4.64"** (+1.39")
	14th wettest	11th wettest	35th driest	T 18th wettest
West	**1.19"** (+0.61")	**1.00"** (+0.57")	**0.93"** (+0.36")	**3.12"** (+1.54")

Central	10th wettest	12th wettest	23rd wettest	9th wettest
Central	**2.18"** (+1.12")	**1.34"** (+0.63")	**1.01"** (+0.00")	**4.53"** (+1.76")
	11th wettest	11th wettest	48th wettest	T 8th wettest
East	**2.83"** (+1.32")	**2.20"** (+1.23")	**1.03"** (-0.39")	**6.06"** (+2.18")
Central	13th wettest	12th wettest	T 56th driest	7th wettest
Southwest	**2.14"** (+1.41")	**0.87"** (+0.38")	**0.64"** (+0.14")	**3.65"** (+1.93")
	3rd wettest	18th wettest	48th wettest	5th wettest
South Central	**2.65"** (+1.50")	**1.30"** (+0.51")	**0.90"** (-0.19")	**4.85"** (+1.85")
	9th wettest	T 18th wettest	57th wettest	12th wettest
Southeast	**3.12"** (+1.35")	**1.84"** (+0.62")	**1.52"** (-0.07")	**6.48"** (+1.93")
	15th wettest	T 28th wettest	T 49th wettest	14th wettest
STATE	**2.16"** (+1.09")	**1.31"** (+0.59")	**0.98"** (+0.01")	**4.45"** (+1.70")
	9th wettest	T 16th wettest	48th wettest	4th wettest

January 2024

Unlike December, January was colder than normal, thanks partly to an Arctic air mass that plunged the state into a deep freeze in the middle of the month. There were thirteen consecutive days with below-normal temperatures, from the 9th through the 21st, with the period from the 13th through the 15th being the coldest days in the state in nearly three years. The average high in Kansas on all three of those days was below zero, some 35 degrees below normal readings. Morning lows fell to -10°F or colder at most locations, with a few places registering four consecutive mornings below that mark from the 13th through the 16th. The Wallace County Mesonet site dropped to -22°F on the 15th, the coldest reading in the state since February 2021. Temperatures rebounded starting on the 22nd and stayed above normal for the remainder of the month. The month finished 5.2°F below normal, placing January 2024 as the 28th coldest on record. All nine divisions finished the month below normal; departures ranged from -6.1°F to -4.1°F.

There was more snow in January than in December. Early in the month, an event on the 4th and 5th brought as much as 5 inches of snow to southern and eastern Kansas. The most significant precipitation event during the month was a major winter storm on the 8th. Precipitation fell entirely as snow in the west and changed from rain to snow in the northeast quarter of the state as colder air overspread the state. Up to 14" of snow was measured in Scott County. Totals from 10 to 12 inches were reported in parts of western and eastern Kansas. Dodge City's 8.1" of snow on the 8th was their second-highest 1-day snow total in the last 15 years. High winds accompanied the snow in the west, leading to blizzard conditions. Additional rounds of light snow accompanied the Arctic air, adding up to as much as 8" of snow in Washington County. Precipitation on the 21st through the 23rd fell into warmer air, but with surface temperatures near to below freezing, the result was freezing rain in some parts of southeast Kansas. The combination of all the precipitation events resulted in above-normal precipitation in all divisions for the month. The average precipitation for January across Kansas was 1.31", or 0.59" above normal, ranking it as the 16th wettest January on record. Divisional

rankings for wettest January ranged from 11th in both northeast and central Kansas to 33rd in northwest Kansas. Four counties had their fifth wettest January on record: Geary, Pottawatomie, Stafford, and Wabaunsee. Seventeen additional counties had a top 10 wettest January. Every county finished in the top 30.

February 2024

February was much like December with respect to temperatures, as mild weather dominated the month. There were just four days when the average temperature across the state was below normal. On nearly half the days (14 of 29), temperatures averaged at least 10 degrees above normal. There were no subzero readings anywhere in the state; the coldest temperature recorded by the Kansas Mesonet in February was 3°F at the Decatur County site on the 17th and in Wallace County on the 28th. The warmest readings occurred in the latter half of the month. The average high temperature across the state exceeded 70°F on the 20th and 21st, and the first 80-degree reading of the year came on the 21st when Medicine Lodge in Barber County reached 82°F. The month finished with a mean temperature of 44.5°F or 9.5°F above normal. February 2024 was the 3rd warmest on record and the warmest February in 70 years, finishing behind only 1954 (44.9°F) and 1930 (45.1°F). All divisions notched a top 3 warmest February, with one superlative: Southeast Kansas tied 1930 for their warmest February on record. It was also the warmest February on record in 13 counties, and all 105 counties finished in their top 3 warmest except for Morton County in far southwestern Kansas, where 2024 ranked as 4th warmest. In 42 of Kansas' 105 counties, the average temperature in February was at least 10 degrees above normal, with Brown County the most above normal (+11.8°F). The least above normal was Greeley County, with a departure of +6.9°F.

The only significant precipitation event occurred early in the month, and with above-normal temperatures in place, there was only liquid precipitation. From the 2nd through the 4th, much of northern and eastern Kansas received over an inch of rainfall. Higher totals were reported in north central Kansas, as a CoCoRaHS observer in Rooks County measured 2.58". There were two minor snow events during the month. Western and southern Kansas picked up measurable snow on the 10th through the 12th, with the highest totals in Labette County where nearly 5" of snow fell. Additional snow fell on the 15th through the 17th, with northern and western counties generally receiving 1 to 3 inches of snow, but there were isolated totals of up to 5 inches of snow in Decatur and Rawlins Counties. The early month rainfall event ensured February would finish with above-normal precipitation in some of Kansas' climate divisions for the third straight month. The statewide average monthly precipitation was 0.98", or 0.01" above normal. Four of Kansas' nine divisions finished the month below normal, and one was exactly normal. The remaining four divisions were above normal, with northwest Kansas ranking highest at 17th wettest.

Winter 2023-24

Considering the past three months as a winter season, the winter of 2023-24 was both the fourth warmest and the fourth wettest on record. It was the warmest winter in eight years but the wettest winter in over 30 years, since 1992-93 (Table 3). While no division or county recorded their warmest or wettest winter on record, a few achieved runner-up status. It was the second-warmest winter in three divisions: northeast, east central, and south central, as well as in 18 counties (Figure 1). Southeast Kansas had its third-warmest winter, as did 21 additional counties. All divisions managed a top-10 finish, as did 95 of Kansas' 105 counties. The lowest-ranking division was west central Kansas (10th), while Greeley and Wallace Counties tied for the lowest-ranked county (13th). With respect to precipitation, four divisions recorded a top 10 wettest winter. Of these, southwest Kansas was the

highest ranked at 5th. In nearly half of Kansas' 105 counties, 48 had a top 10 wettest winter (Figure 2). Eleven of those managed a top 5 finish, and three finished in 2nd place: Osage, Seward, and Stevens. All three missed out on their wettest December by less than two-tenths of an inch.

Table 3. The five wettest and warmest winters on record in the state of Kansas. Source: NCEI.

Total Precipitation (in.)		Rank	Average Temperature (°F)	
Years	Value		Years	Value
1984-1985	5.34″	1	1991-1992	38.1°
1992-1993	5.11″	2	1999-2000	37.0°
1918-1919	4.50″	3	2015-2016	36.8°
2023-2024	4.45″	4	**2023-2024**	36.5°
2006-2007	4.44″	5	1975-1976	36.4°

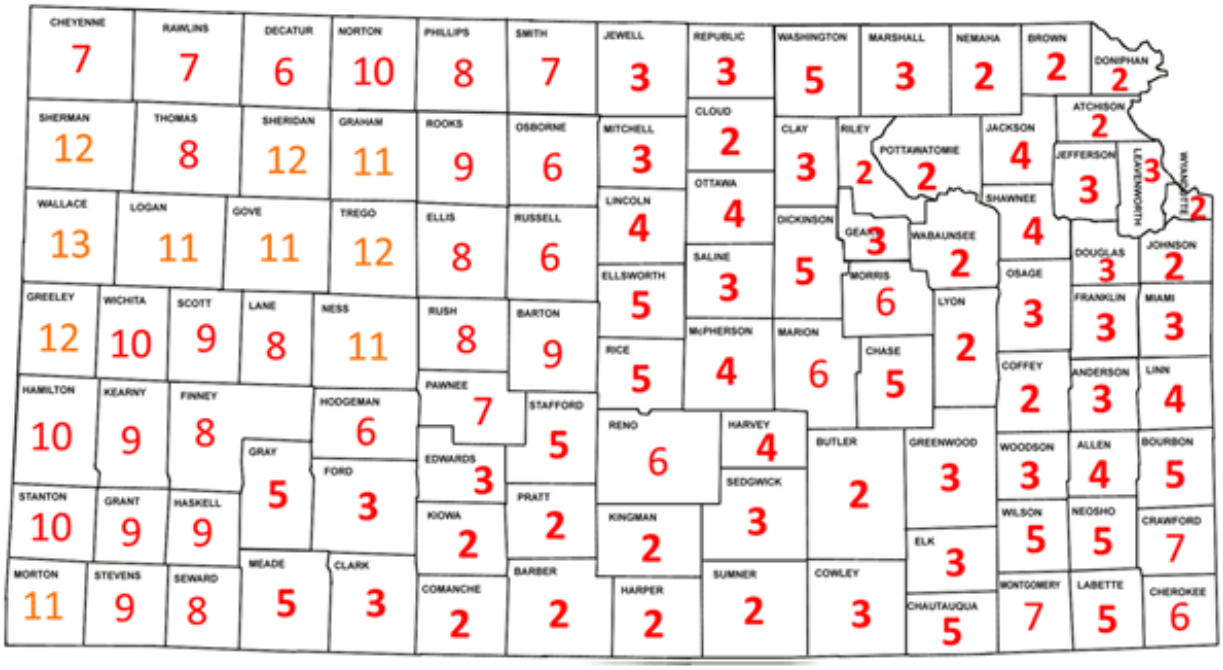


Figure 1. Rank of the winter of 2023-24 on each Kansas county's list of its warmest winters on record. Source: NCEI.

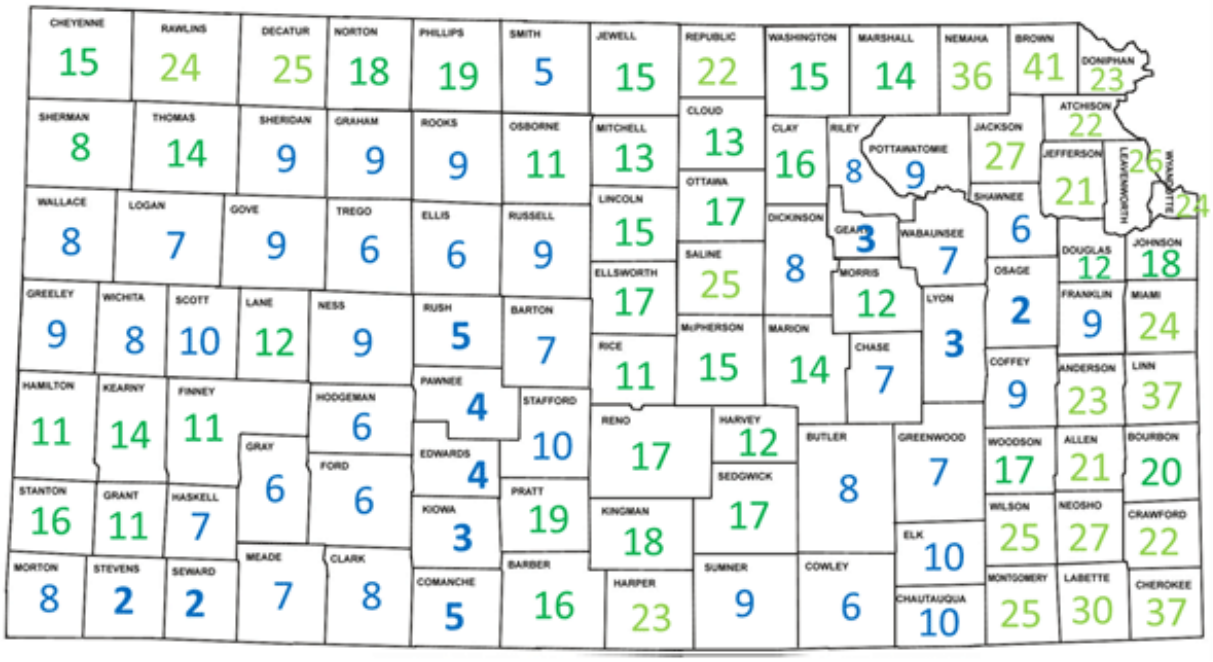


Figure 2. Rank of the winter of 2023-24 on each Kansas county's list of its wettest winters on record. Source: NCEI.

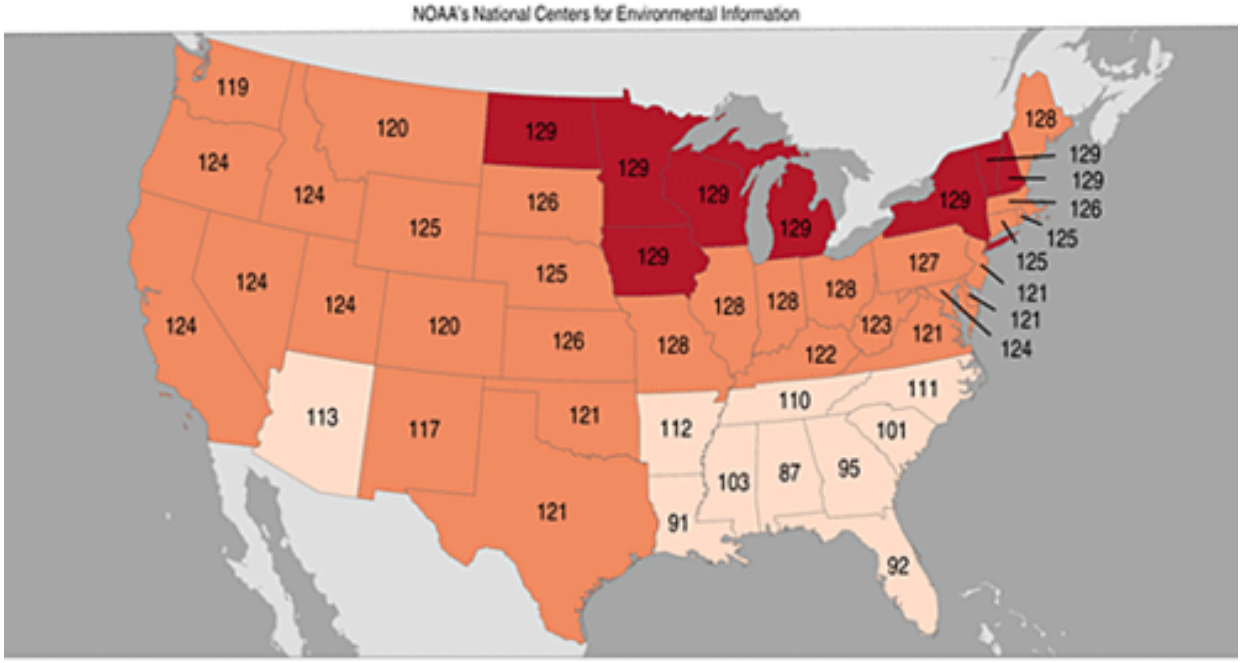
The overall departure from normal temperature for the state of Kansas this past winter was an impressive +3.5°F. As unseasonably mild as we were, Kansas was nowhere near the most above-normal state. Believe it or not, there were 25 states that finished their winter more above normal than we were! As a result, the winter of 2023-24 will go down in the record books as the warmest winter on record in the lower 48 United States. The lower 48's average temperature of 37.60°F was 0.82°F above the previous record holder, the winter of 2015-16. Eight states registered their warmest winter on record (Figure 3a), all in the northern part of the country: North Dakota, Minnesota, Iowa, Wisconsin, Michigan, New York, Vermont, and New Hampshire. Minnesota was the most above-normal state in the country this past winter; their average departure from normal was an amazing +11.3°F. This mark was 2.7°F ahead of their previous warmest winter (1997-98). Neighboring Wisconsin was next highest with an anomaly of +9.8°F, a new record by 2.2°. One reason for the record warmth in these northern states was a lack of snowfall. Duluth, MN, averages 90" of snow annually. Since July 1, 2023, Duluth has had only 19" of snow. Should no more snow fall between now and June 30th, this will be the least-snowiest year on record there by about 8 inches. Despite some areas lacking snow, it was a wet winter in many parts of the country, Kansas included. Overall, 2023-24 ranked as the 21st wettest winter for the entire lower 48 (Fig. 3b). Kansas' ranking of 4th wettest was an anomaly in this part of the country. Our neighbor to the east, Missouri, finished at 61st wettest. Our other three neighbors ranked higher on their respective lists of wettest winters on record but nowhere close to our finish: Colorado finished at 36th wettest, Oklahoma at 18th wettest, and Nebraska was highest at 14th wettest. Only two states finished higher than we did; 2023-24 was the third wettest winter in Connecticut and Delaware.

Statewide Average Temperature Ranks

December 2023 – February 2024

Ranking Period: 1895–2024

NOAA's National Centers for Environmental Information

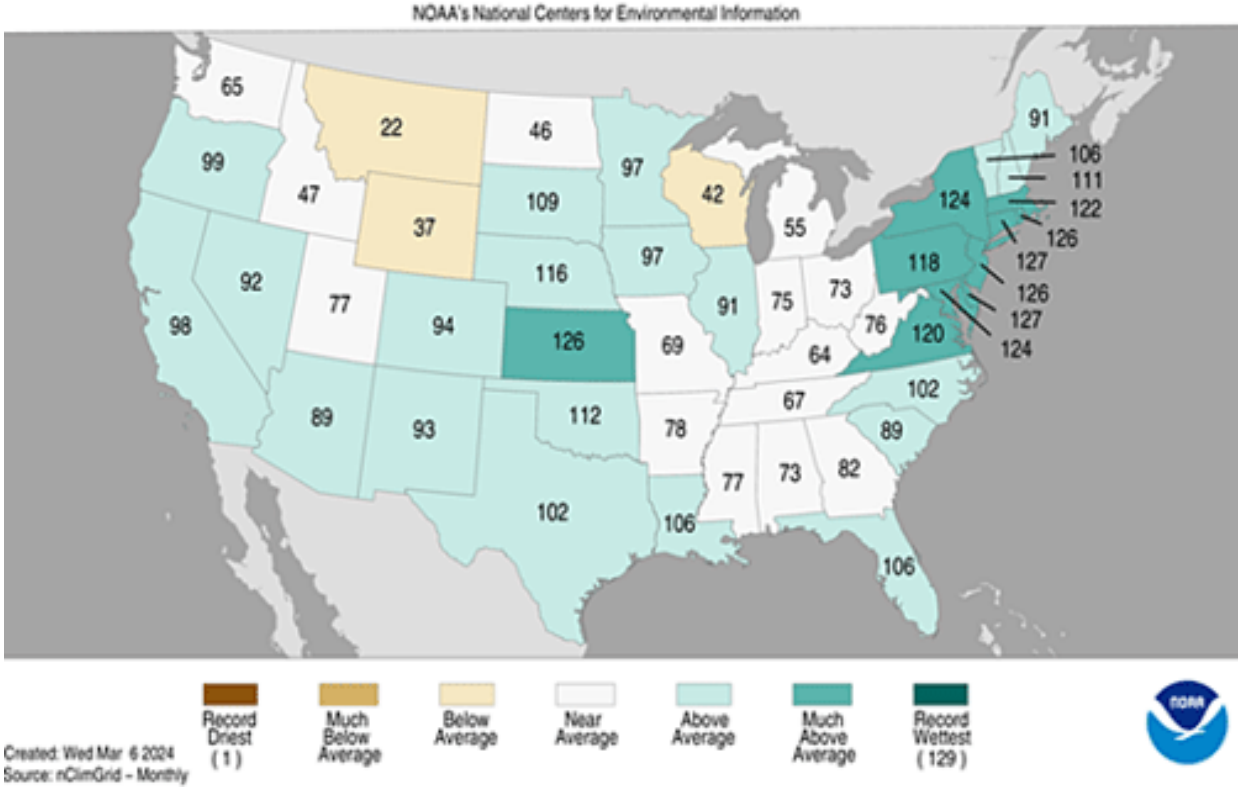


Statewide Precipitation Ranks

December 2023 – February 2024

Ranking Period: 1895–2024

NOAA's National Centers for Environmental Information



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Figures 3a-b. Ranking of each state on the list of coldest (top) and driest (bottom) winters. Kansas' ranking of 126th coldest corresponds to 4th warmest, and 126th driest corresponds to 4th wettest. Source: NCEI.

Could we be in line for the warmest spring on record? We are off to a good start. Through the first 12 days of March, the statewide average temperature is running 6.2°F above normal. If we were to finish March that much above normal, it would be the 4th warmest March on record. Time will tell if we can sustain this extended stretch of mild conditions; stay tuned!

Matthew Sittel, Assistant State Climatologist
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5. Soil Health and Cropping System Sustainability Field Day - April 5

K-State Research and Extension, in collaboration with the Department of Agronomy, Kansas Wheat, and Kansas Corn, is hosting a Soil Health and Cropping System Sustainability Field Day on April 5 from 10:30 a.m. to 2:30 p.m. The free event starts at the Kansas Soil Health Partnership research field near Solomon, KS. After some presentations in the morning, attendees will move to the Knopf Farms near Gypsum to finish the field day. Coffee and pastries will be provided at the first location, and lunch will be provided at Knopf Farms.

If you are interested in attending, please register at https://kscorn.com/shfday/.

The specific locations and agendas are:

10199 E Country Club Rd, Solomon – Kansas Soil Health Partnership Research Field

10:30 a.m. – Welcome and KSHP Background – Justin Knopf & Carlos Pires

10:40 a.m. – Soil Health and Regen Ag Principles (soil pit) – Chuck Rice & Cesar Guareschi

11:00 a.m. – 5 years of On-Farm Soil Health Data and Indicators (soil pit) – Carlos Pires & Chuck Rice

11:30 a.m. – Insights from a Cover Crop and Regen Ag Practitioner. Open conversation with researchers and Justin Knopf.

12:15 p.m. – Move to Knopf Farms

6229 S Kipp Road, Gypsum – Knopf Farms

12:30 p.m. – Lunch

1:00 p.m. – Kansas Corn update

1:10 p.m. – Kansas Wheat update

1:20 p.m. – Beyond Grain: Benefits of Wheat to Cropping Systems – Romulo Lollato

2:00 p.m. – Getting Ready for Corn Season – Ana Carcedo and Victor Gimenez

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