K-STATE
Research and Extension

Extension Agronomy

eUpdate

03/23/2023

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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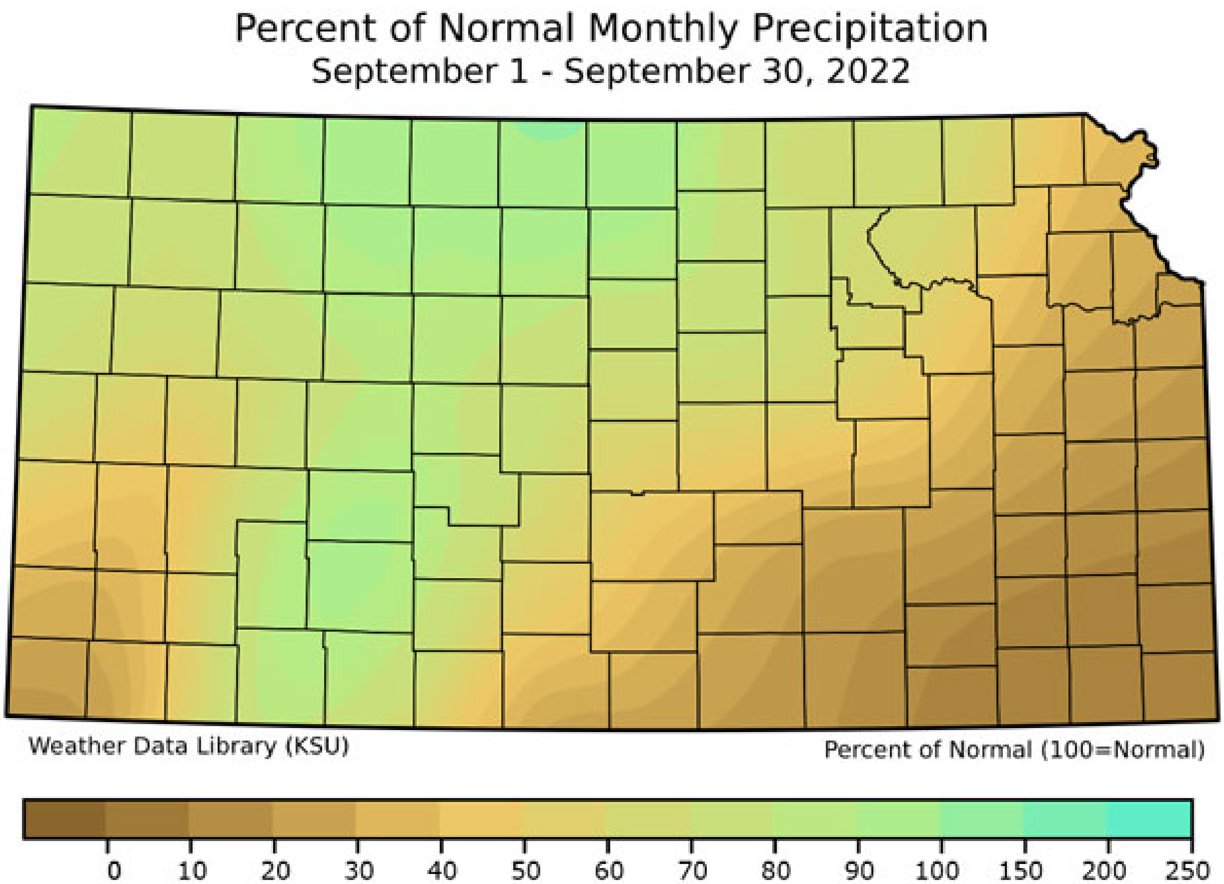
1. Expectations for a late-emerged winter wheat crop

Many fields in Kansas failed to emerge in the fall of 2022. Emergence has been highly variable all winter and spring, and some fields are still trying to emerge. Ideally, emergence would occur in October when the bulk of the wheat is planted around the state. However, precipitation has been low and highly variable, resulting in some portions of counties affected having established stands, while other portions of the county have very little establishment. Figure 1 shows the percent of normal precipitation for Kansas during September and October. The southwest portion of the state was the most affected, but portions of northwest and western south central Kansas also have fields that are yet to emerge.



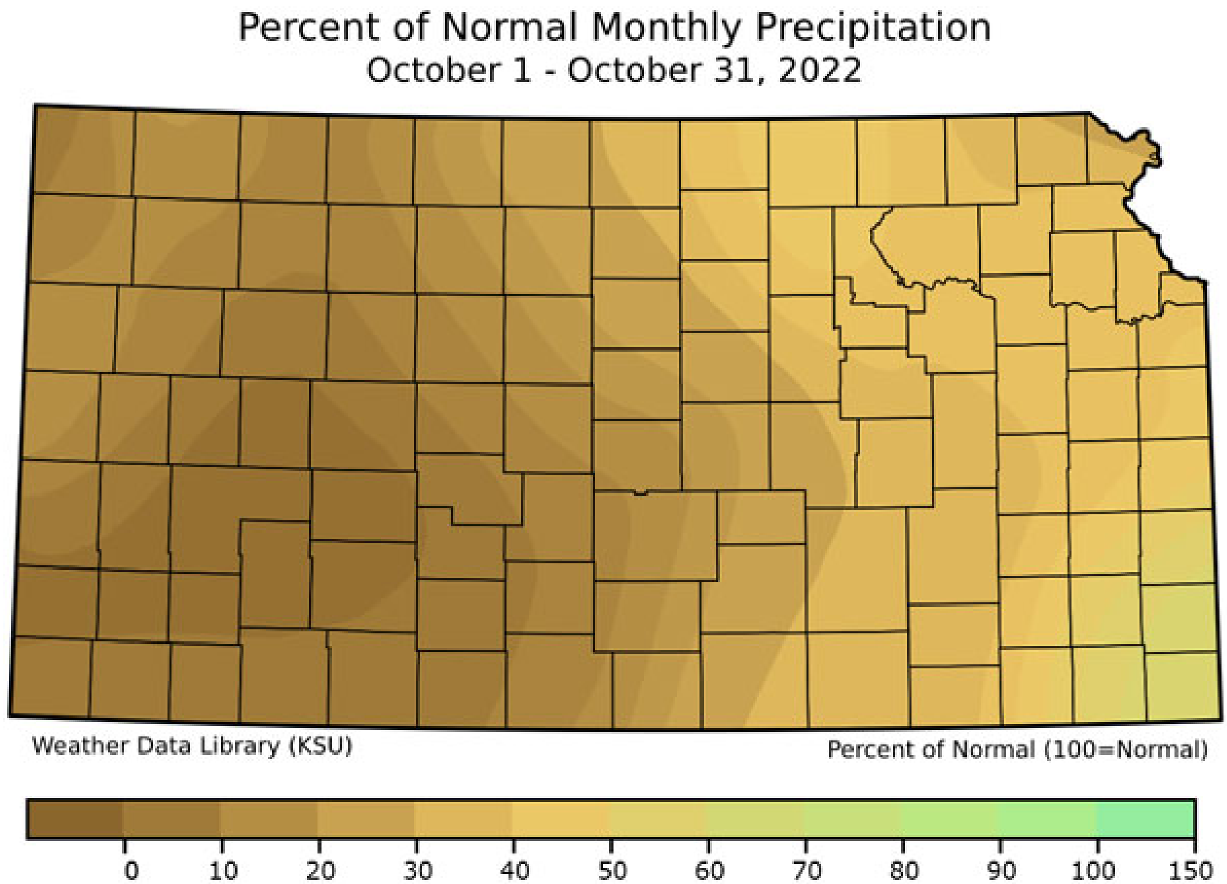


Figure 1. Percent of normal precipitation during the months of September and October 2022. Maps courtesy of the Weather Data Library.

Given that the last wheat season was already extremely dry, and it was followed by a majority dry summer as well, the dry conditions have persisted for over a year in some places of the state, meaning that subsoil moisture is very likely not available or very limited. Consequently, even wheat fields that were planted timely can have poor and variable emergence, with some seedlings that have emerged and died (some that germinated but met a surface crust, forming a yellow accordion-like shape below ground and perishing), and some seed has yet to germinate/emerge. Late-emerged winter wheat has considerably less yield potential than a crop that emerged at the optimum time. Late-emerging wheat may have experienced more winter injury and will have fewer tillers. Producers will have to decide whether maintaining the crop is a viable option.

Reasons for the generally observed decreased yield potential with a delay in sowing date include:

- **Less fall tillering potential**: fall-formed tillers are generally more productive than spring-formed tillers. When wheat is sown late, it will have less time to tiller in the fall, which decreases the production of higher-yielding tillers as well as total tiller production.
- **Delayed cycle**: late sowing often delays the entire crop cycle as compared to a crop sown earlier. As a consequence, the grain filling period might occur a few days later and under hotter air temperature conditions, which decreases yield and test weight.
- **Greater exposure to winterkill**: a wheat crop with 3 – 5 fall-formed tillers has greater cold

tolerance than a crop that has only one or two tillers. As a consequence, late-sown fields might be more exposed to winterkill, especially in dry conditions. Since many fields didn't emerge until spring they avoided winter injury.

- **Vernalization:** the process where winter wheat plants need exposure to cool temperatures to produce grain production. Seedlings do not require emergence for vernalization, but the seed must imbibe water. It is quite possible, as dry as conditions were, that seed did not imbibe water. The crop needs 6-8 weeks of soil temperatures below 49F to turn reproductive. Depending on how late the crop emerges, it may not even vernalize on time meaning that if this cold criterion is not met, the head may not be formed.

Research conducted by Merle Witt with late-sown wheat in Garden City from 1985 through 1991 is summarized in Figure 2. Averaged across all these years, delaying wheat sowing from October 1 to November 1 delayed the heading date by 6 days and decreased wheat yields by 23%. The grain-filling period was progressively shortened by about 1.7 days and occurred under hotter temperatures (about 1.5°F) for every month of delay in sowing date. Wheat planted on April 1 produced no grain yield and several fields are yet to emerge. Those fields will produce little to no grain yield.

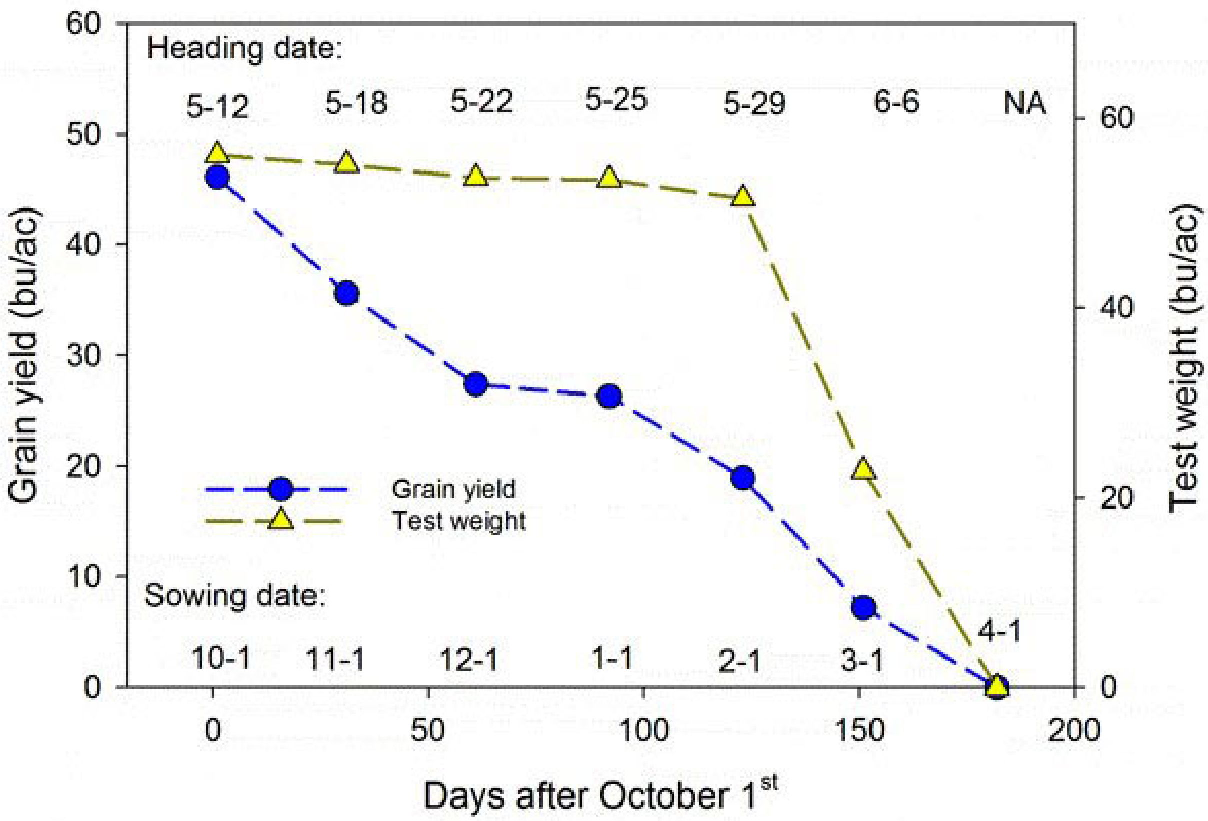


Figure 2. Wheat grain yield, test weight, and heading date responses to sowing date between 1985 and 1991. Data adapted from Kansas Agric. Exp. St. SRL 107.

In summary, the potential consequences of the delayed progress of the Kansas wheat crop include greater exposure to winterkill, a delayed crop cycle for grain filling under warmer conditions, a lower yield potential due to decreased fall tillering, and no vernalization required for grain production. Research evaluating the effects of weather conditions on long-term wheat yields were influenced the most by favorable precipitation conditions during the fall that promoted stand establishment and tillering by moist soil conditions (Holman et al., 2011). However, if there is a good stand established and weather conditions during the remaining season are favorable (mild winter, and cool and moist spring), the crop might still produce a decent yield. Unfortunately, the long-range outlook for spring precipitation is not favorable.

Even if the wheat crop yield outlook is poor, leaving the crop growing might be the best option at this point. Many fields have experienced blowing soil and having some ground cover established would help reduce soil erosion. If moisture conditions improve a summer forage or grain crop could be planted. Some fields have had emergency tillage implemented to reduce soil erosion (Figure 3). See this past eUpdate article on emergency tillage to mitigate wind erosion.

Figure 3. Emergency tillage implemented in a poorly established winter wheat field to prevent soil erosion in Finney County, KS taken 3/22/2023 by John Holman.

Holman, J.D., A.J. Schlegel, C.R. Thompson, and J.E. Lingenfelser. 2011. Influence of Precipitation, Temperature, and 56 Years on Winter Wheat Yields in Western Kansas. Crop Management 10(1), available at: https://dl.sciencesocieties.org/publications/cm/abstracts/10/1/2011-1229-01-RS

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2. Weed management considerations for thin wheat stands

Prolonged drought in much of Kansas has resulted in marginal wheat stands and a difficult decision for many farmers, especially with reasonably strong prices.

On one hand, wheat did not have many fall tillers form and is heavily reliant on spring tillers (Figure 1). This will likely result in slow canopy closure and will give weeds a chance to become established. Because of this, thin wheat stands will require residual herbicides to limit competition from weeds. On the other hand, if a wheat field with a poor stand might be planted to another crop this spring, some residual herbicides will limit options for a subsequent crop.

Figure 1. Thin wheat stand in northwest Kansas. Photo by Jeanne Falk Jones, K-State Research and Extension.

Some residual herbicides that can be applied to wheat before jointing are listed in Table 1, along with their half-lives and replant intervals for corn and sorghum.

Table 1. Residual herbicides, field half-lives, and crop rotation intervals.

Herbicide	Rate	Half-life (days)	Rotation interval (corn)	Rotation interval (sorghum)	Comments
Ally	0.1 oz	13	12 months	4 months	Apply with MCPA after 2-leaf, apply with 2,4-D after tillering
Amber	0.28 to 0.47 oz	39	4 to 36 months	14 to 24 months	
Dicamba	2 to 4 fl oz	4	22 days per pint applied	22 days per pint applied	
Everest	2 oz	12	11 months	18 months	
Metribuzin	2 to 10 oz	19	30 to 120 days	18 months	Varieties vary in tolerance
Prowl H2O	1.5 to 3.0 pts	101	0 days	10 months	Rainfall or irrigation required for incorporation

Some additional herbicide premixes are available. All products will require some precipitation or irrigation for incorporation into the zone of weed seed germination. In addition, some products (i.e., dicamba, metsulfuron, Ally) have postemergence activity. It is important to know adjuvant requirements. Some products can be applied with UAN, while others cannot. Because of this, check labels for guidance.

For more detailed information, see the "2023 Chemical Weed Control for Field Crops, Pastures, and Noncropland" guide available online at https://bookstore.ksre.ksu.edu/pubs/SRP1176.pdf or check with your local K-State Research and Extension office for a paper copy.

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.

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3. First hollow stem update - March 23, 2023

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

In order to screen for FHS during this important time in the growing season, the K-State Extension Wheat and Forage's crew measures FHS on a weekly basis in 22 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 hollow stem is reported for each variety in Table 1. As of March 20, no variety had reached first hollow stem, but all varieties had started to elongate their stems. The most advanced variety (LCS Atomic AX) had reached 0.6 cm, while the least advanced (Guardian) was at around 0.2 cm. If temperatures are warm following the initiation of the first hollow stem elongation, varieties can reach first hollow stem fairly quickly.

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 22, 27, March 6, 13, and 20, 2023 for 22 wheat varieties sown mid-September 2022 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	**2/20/2023**	**2/27/2023**	**3/6/2023**	**3/13/2023**	**3/20/2023**
AM Cartwright	0	0	0.08	0.19	0.26
AP EverRock	0	0	0.08	0.29	0.35
AP Prolific	0	0	0.04	0.16	0.2
AP Roadrunner	0	0	0.06	0.28	0.38
AP18 AX	0	0	0.06	0.3	0.31
ARMOR EXP55	0	0	0.05	0.24	0.31
ARMOR EXP6 AX	0	0	0.05	0.29	0.36
CP7017 AX	0	0	0.06	0.29	0.31
CP7050 AX	0	0	0.06	0.27	0.42
CP7266 AX	0	0	0.07	0.2	0.27
CP7869	0	0	0.08	0.26	0.35
CP7909	0	0	0.11	0.23	0.31
KS Ahearn	0	0	0.09	0.21	0.28
KS Hatchett	0	0	0.06	0.18	0.38
KS Providence	0	0	0.07	0.2	0.31
LCS19DH-152-6	0	0	0.02	0.17	0.32
LCS Atomic AX	0	0	0.06	0.32	0.58
LCS Galloway AX	0	0	0.06	0.22	0.33
LCS Steel AX	0	0	0.05	0.25	0.3
Guardian	0	0	0.05	0.22	0.21
Kivari AX	0	0	0.08	0.21	0.35
Whistler	0	0	0.05	0.25	0.28

We will report first hollow stem during the next few weeks again until all varieties are past this stage. Additionally, first hollow stem is generally achieved within a few days from when the stem starts to elongate, so we advise producers to closely monitor their wheat pastures at this time.

The intention of this report is to provide producers with an update on the progress of 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 take the decision of removing cattle from wheat pastures.

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4. Optimal corn seeding rate recommendations

The optimal corn seeding rate is a management (M) variable that depends on the hybrid (genotype, G), and the interaction with the environment (E). Researchers termed this as the G x E x M interaction. To evaluate whether the corn seeding rate they have used was adequate, producers may look back to their corn crop from the previous growing season, or wait until the current growing season is nearly complete, also known as an *ex-post* approach. It is worth also considering additional M factors that are often overlooked such as planting date, nitrogen fertilization, row spacing, and crop rotation.

Although specific hybrids can respond differently, the following guidelines may help in deciding if the selected corn seeding rates need to be adjusted.

1. **Few kernels per ear**: if more than about 5% of the plants are barren or if most ears have fewer than 250 kernels per ear, the corn seeding rate may be too high.
2. **Too many kernels per ear**: if there are consistently more than 600 kernels per ear or if most plants have a second ear contributing significantly to grain yield, the corn seeding rate may be too low. Of course, the growing conditions will influence ear number and ear size as well, so it is important to factor in the growing conditions for that season when interpreting these plant responses.
3. **Tipping back**: don't be too concerned if a half-inch or so of the ear tip has no kernels. If kernels have formed to the tip of the ear, there may have been room in the field for more plants contributing to higher grain yield. Again, this "tipping back" will vary with the G x E x M interaction.
4. **Irrigation**: optimal corn seeding rates may need to be adjusted if fertilizer or irrigation rates are significantly increased or decreased. For example, research at the Irrigation Experiment Field near Scandia (North Central) has shown that if fertilizer rates are increased, corn seeding rates also have to be increased to attain the maximum yield benefit.
5. **Nutrient status**: in addition to the growing conditions, nutrient status can also influence the final number of grains per ear. For example, severe nitrogen (N) deficiency will have a high impact on the final number of grains, ear size, and ear number.

Keep in mind that the potential ear size and the potential number of kernels (1,000-1,200 per ear) are set before silking (R1), but the actual final number of kernels is not determined until after pollination and early grain fill (R2-R3) due to relative success of fertilization and degree of early abortion.

Always keep long-term weather conditions in mind. In a drought year, almost any corn seeding rate is too high for the available moisture in some areas. Although it's not a good idea to make significant changes to seeding rates based only on what has happened recently, it is worthwhile taking into consideration how much moisture there is currently in the soil profile and the long-term forecasts for the upcoming growing season.

For this growing season, if you think weather conditions will be more favorable for corn this year than the past years, stay about in the middle to the upper part of the range of seeding rates in the table below. If not and you expect dry subsoils, you might want to consider going towards the lower end of the range of recommended seeding rates, with the warning that if growing conditions improve, you will have limited your top-end yield potential.

The recommended corn seeding rate and final plant population in the following tables attempt to factor in these types of questions for the typical corn growing environments found in Kansas. Adjust within the recommended ranges depending on the specific conditions you expect to face and the hybrid you plan to use. Of course, do not forget to consult seed company recommendations to determine if seeding rates for specific hybrids should be at the lower or upper end of the recommended ranges for a given environment.

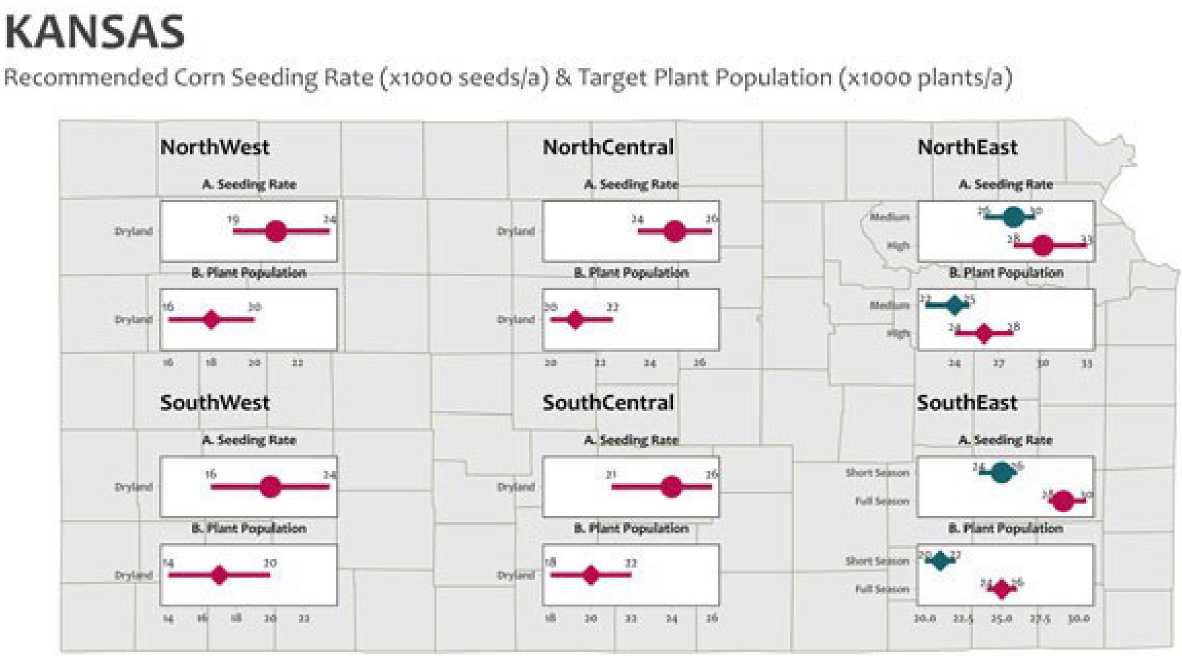

Figure 1. Suggested dryland corn final populations and seeding rates. Map created by A. Correndo, K-State Research and Extension.

Table 1. Suggested irrigated corn final populations and seeding rates

Environment	Hybrid Maturity	Final Plant Population (plants per acre)	Seeding Rate* (seeds per acre)
Full irrigation	Full-season	28,000-34,000	33,000-40,000
	Shorter-season	30,000-36,000	35,000-42,500
Limited irrigation	All	24,000-28,000	28,000-33,000

* Assumes high germination and that 85 percent of seeds produce plants. Seeding rates can be reduced if field germination is expected to be more than 85%.

K-State research on corn seeding rates

An intensive review of a large database from Corteva Agriscience (2000-2014 period) was utilized to synthesize yield response to plant population under varying yield environments (<100 bu/acre to >200 bu/acre). Overall, yield response to plant population depended on the final yield environment (Figure 2). In yield environments below 100 bu/acre, yield response to plant population was slightly negative. Yield response to plant population tended to be flat when the yield environment ranged from 100 to 150 bu/acre; positive and quadratic with the yield environment improving from 150 to 180 bu/acre; and lastly, increasing almost linearly with increasing plant populations when the yield environment was more than 200 bu/acre (Figure 2).

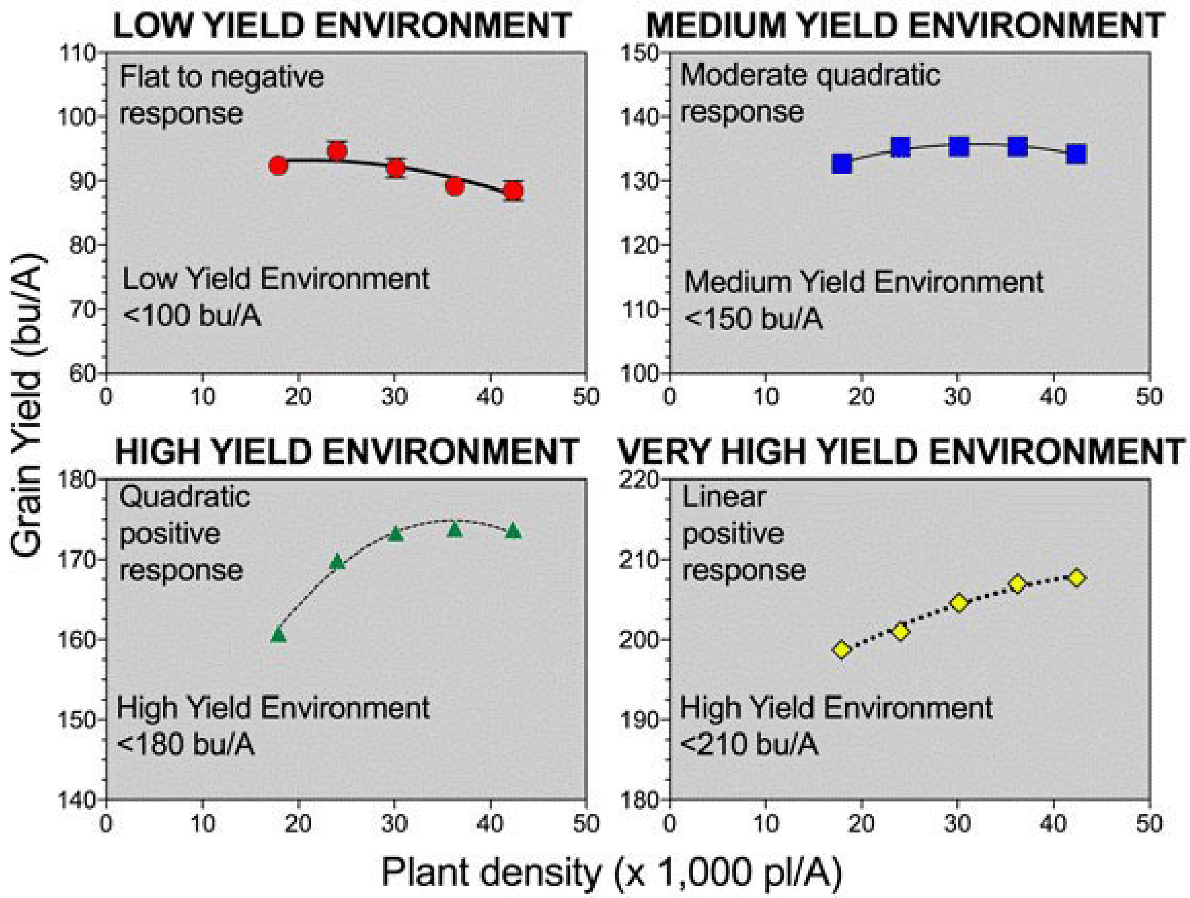

Figure 2. Corn grain yield response to plant density in four yield environments, a) <100; b) 100-150; c) 150-180; and d) > 180-210 bu/acre (Assefa, Ciampitti et al., 2016, Crop Science Journal). Figure created by I.A. Ciampitti, K-State Research and Extension.

As a disclaimer, the "agronomically" optimum plant population does not always match with the "economically" optimal plant population. The final seeding rate depends on genetics (hybrid), the environment, and other production practices (e.g., planting date, crop rotation, tillage). Also, keep in mind the corn yield response to plant density curves are merely indicative as they represent simplified models that carry uncertainty (error).

Stay tuned to future eUpdate articles related to other relevant topics for the coming season.

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5. Several crop-specific publications on insect pest management updated for 2023

Several K-State Research and Extension publications related to insect management in Kansas were recently updated and are available to the public.

These publications were prepared to help producers manage insect populations with the best available methods proven practical under Kansas conditions. They are updated every year and intended for use during the current calendar year. The user should know that pesticide label directions and restrictions are subject to change, and some may have changed since the date of publication.

Full versions of each fact sheet are available online with links provided below.

Alfalfa Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF809.pdf

Corn Insect Pest Management - https://www.bookstore.ksre.ksu.edu/pubs/MF810.pdf

Cotton Insect Pest Management - https://www.bookstore.ksre.ksu.edu/pubs/MF2674.pdf

Sorghum Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF742.pdf

Soybean Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF743.pdf

Sunflower Insect Pest Management - https://www.bookstore.ksre.ksu.edu/pubs/MF814.pdf

Wheat Insect Pest Management - https://bookstore.ksre.ksu.edu/pubs/MF745.pdf

The economics of control should be considered in any pest management decision. Because costs vary greatly over time and are influenced by factors beyond the scope of this publication, product cost is not a consideration for including or omitting specific insecticide products in these recommendations. Growers should compare product price, safety, and availability when making treatment decisions. Growers also need to consider the impacts of insecticides on non-target organisms like pollinators and natural enemies. Rotating insecticide groups can help combat insecticide resistance issues by leveraging different modes of action. The user bears ultimate responsibility for correct pesticide use. For proper use, always read label directions carefully before applying pesticides. Remember, using a pesticide in a manner inconsistent with the label is illegal.

More information on pests covered in these publications is available at:

www.entomology.k-state.edu/extension/insect-information/crop-pests/

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6. Join the CoCoRaHS Network...because every drop counts!

March Madness is upon us! While many folks' thoughts turn towards basketball, brackets, and buzzer-beaters, the weather community has its own March Madness event: a challenge amongst US states to get the highest number of new observers signed up for a program called CoCoRaHS.

CoCoRaHS, the Community Collaborative Rain, Hail, and Snow Network, is a citizen-based project where observers measure precipitation at their home or business using a standard, high-quality rain gauge (Figure 1), and report their daily totals each morning via the project's web site or through the CoCoRaHS mobile app. CoCoRaHS aims to obtain an accurate picture of where and how much precipitation falls across North America. CoCoRaHS began in 1998 at Colorado State University. Kansas was the third state to join back in 2004. 2023 marks the 25th anniversary of the project.

Figure 1: The official CoCoRaHS rain gauge. Photo by Matthew Sittel, K-State Research and Extension.

CoCoRaHS in Kansas

There are about 760 active observers in Kansas, but we need more. Despite a count that averages out to around 7 observers per county, there are five counties in Kansas with no active observers:

Atchison, Chase, Cherokee, Haskell, and Woodson (Figure 2). There are around two dozen more counties with three or fewer observers. Why is statewide coverage so important? The Kansas Climate Office uses precipitation reports (rain, snow, and ice) to assess drought conditions across Kansas. Without reports, we have no idea exactly how much rain fell, or exactly where it fell and where it didn't, which makes it more difficult to properly determine drought status. It's important to also report when it **does not** rain at your location. Documenting the fact that a part of the county missed a precipitation event helps improve our understanding of drought conditions. That information is also useful in improving radar and satellite rainfall estimates.

We occasionally hear from people who comment that the weekly US Drought Monitor map, which our office contributes to weekly, doesn't accurately reflect conditions at their location. When we ask if they have reported rainfall (lack of rainfall) from their location, they say they haven't. We are only as good as the data we receive!

In the wetter months, thunderstorms may impact one part of a county or just one city, and not another. Without CoCoRaHS, our knowledge is limited to the few reports we get from airports and cooperative observers. We are missing a lot of territory with so few reports. That's where CoCoRaHS is invaluable. Your reports are not just for the Kansas Climate Office; other agencies, such as the National Weather Service and county and local agencies, use the information to track flooding risk, municipal water supplies, groundwater availability, lake levels, and river stream flows.

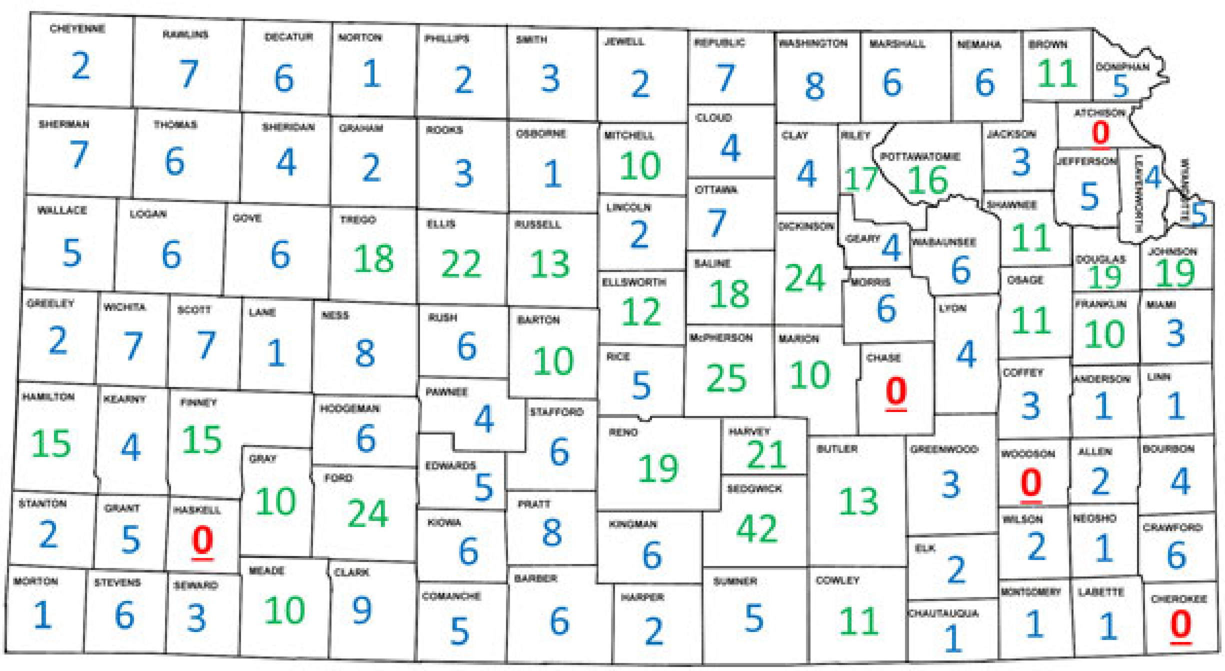

Figure 2: County-by-county totals of active CoCoRaHS observers across Kansas as of March 2023.

Users who visit the CoCoRaHS website can view tables and maps of precipitation amounts (Figures 3 and 4) for any or all locations in the United States. Users can also view totals for varying lengths of time, from days to months. Every CoCoRaHS report received further improves the quality of the products, but there are still spatial and temporal gaps in the data where there are no observers. That's where you come in-we need your help to increase coverage across the state! **The best part of CoCoRaHS, at least for Kansans, is that we provide the standard rain gauge free of charge to new observers who request one.** We are the only state in the nation that does this. The reason for this is simple: the observational data we receive from our observers is invaluable to our mission to serve Kansas. It's a great partnership: we supply the rain gauges, you supply the data, and together we help our fellow Kansans.

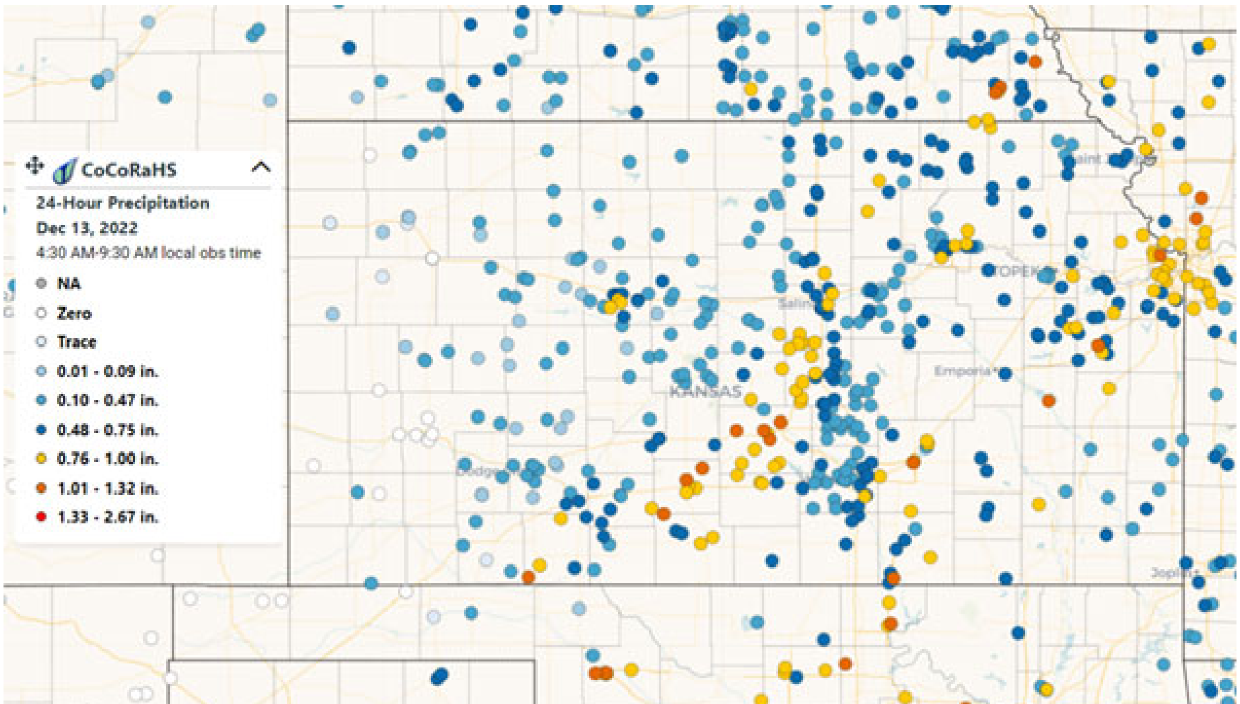

Figure 3. Total precipitation map from the CoCoRaHS web page for the 24-hour period ending at 7 AM CST on December 13, 2022.

Obs Date	Obs Time	Station Number	Station Name	Gauge Catch in. ▲
12/13/2022	7:00 AM	KS-CM-14	Protection 2.6 ENE	1.45
12/13/2022	7:00 AM	KS-PR-14	Coats 1.7 SW	1.30
12/13/2022	8:00 AM	KS-CF-1	Burlington 0.9 NNE	1.27
12/13/2022	8:00 AM	KS-BA-4	Medicine Lodge 0.4 WSW	1.17
12/13/2022	7:00 AM	KS-BA-6	Coats 6.6 WSW	1.16
12/13/2022	6:52 AM	KS-WY-11	Kansas City 4.9 WNW	1.15
12/13/2022	7:00 AM	KS-JO-74	Shawnee 4.6 WSW	1.15
12/13/2022	7:30 AM	KS-PR-4	Preston 1.2 SE	1.15
12/13/2022	11:46 AM	KS-CF-8	Le Roy 2.9 ESE	1.15
12/13/2022	7:00 AM	KS-CA-5	Englewood 3.8 WNW	1.10

Figure 4. Tabular display of precipitation data from the CoCoRaHS website.

Join CoCoRaHS

We hope you'll consider joining CoCoRaHS; visit cocorahs.org to learn more about the project and to become an observer. As of March 21, 35 new observers have been added for Kansas, and our state is in the Elite 8; we are in 8th place on the list of most new observers for any state. We added 37 new observers in March 2022; with your help, we can surpass that mark this year. Help us track the weather across Kansas; join CoCoRaHS today!

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7. Webinar to address grass turnout in Western Kansas

Kansas State University Western Kansas Research and Extension Centers will host a webinar on April 4 from noon to 1 p.m. CT on decision-making for grass turnout in Western Kansas.

In many areas of the state, grass growth was very limited last year and continuing dry conditions in recent months raise questions about how livestock producers should plan for the coming growing season.

"Throughout much of 2022 and early 2023, producers have downsized herds but also shopped for forage resources from broader areas to retain as much of their herds as possible," says Sandy Johnson, K-State extension beef specialist. "As normal grass turnout time arrives, producers are evaluating the supply of harvested forages in relationship to forage demand and when grazing will become an option again."

Jason Warner, K-State extension beef cow-calf specialist, adds "When and how grass turnout occurs is a big decision this year as we are attempting to mitigate high prices for hay and other feeds while avoiding further damage to already stressed pastures. Information presented will be applicable to producers all across Kansas and surrounding areas."

Keith Harmoney, K-State range scientist at Hays, has studied historical data from range research at the experiment station including droughts in the 1930s and 1950s as well as more recent droughts and will use all of this to share his thoughts on planning and decision-making for this spring.

The webinar is free; however, registration is required. The webinar will be recorded and available online at *KSUBeef.org* soon after the meeting. Register at https://tinyurl.com/KSUturnout.

More information is available from Sandy Johnson at 785-462-6281 or sandyj@ksu.edu

K·STATE
Research and Extension

Tues. April 4th
at 12 PM CT

WEBINAR

Decision Making for Grass Turnout in Western Kansas

No cost, registration required at https://tinyurl.com/KSUturnout .
Recorded version will be posted on KSUBeef.org

Keith Harmoney, Range Scientist
Agricultural Research Center - Hays

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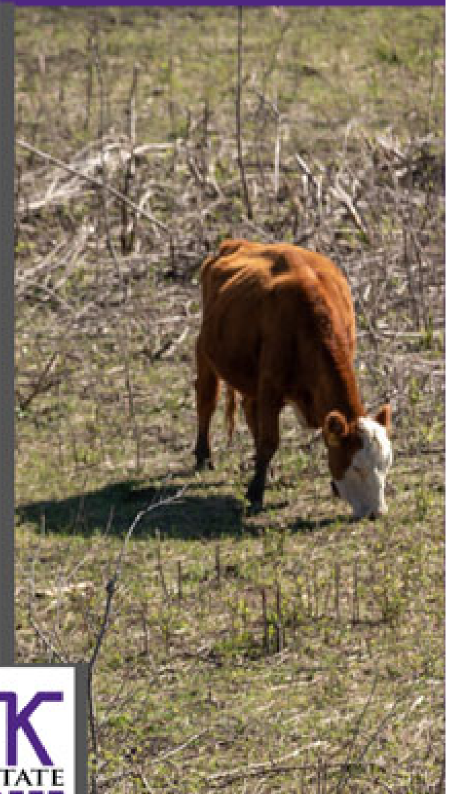

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