Issue 1082

K-STATE Research and Extension

Extension Agronomy

eUpdate

12/04/2025

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. Cleaning Yield Monitor Data Matters for Better Farm Decisions

Yield monitor data is one of the most essential datasets growers use in multiple decision-making processes. This data is in point-based geospatial format, collected by harvesters using yield monitor systems. Yield monitor data can provide information on grain flow, moisture, speed, swath width, time and date, and GPS locations.

While harvesting in the field, yield data points are typically collected every 1 to 2 seconds. The harvester travel speed and data logging rate determine the distance between two yield monitor points (usually 5 to 10 feet). The header width (swath width, ranging from 15 to 40 feet) determines the spacing between two adjacent harvest passes. This yield monitor data is used to create maps that help growers understand crop performance based on the field variability in nutrients, topography, moisture, management, varieties, and pest/disease pressure. Using historical field yield maps, growers can select the appropriate seeding rate, site-specific fertilizer rates, or choose the proper variety/hybrid by identifying yield zones, such as high-, medium-, or low-performing areas within the field (Figure 1).

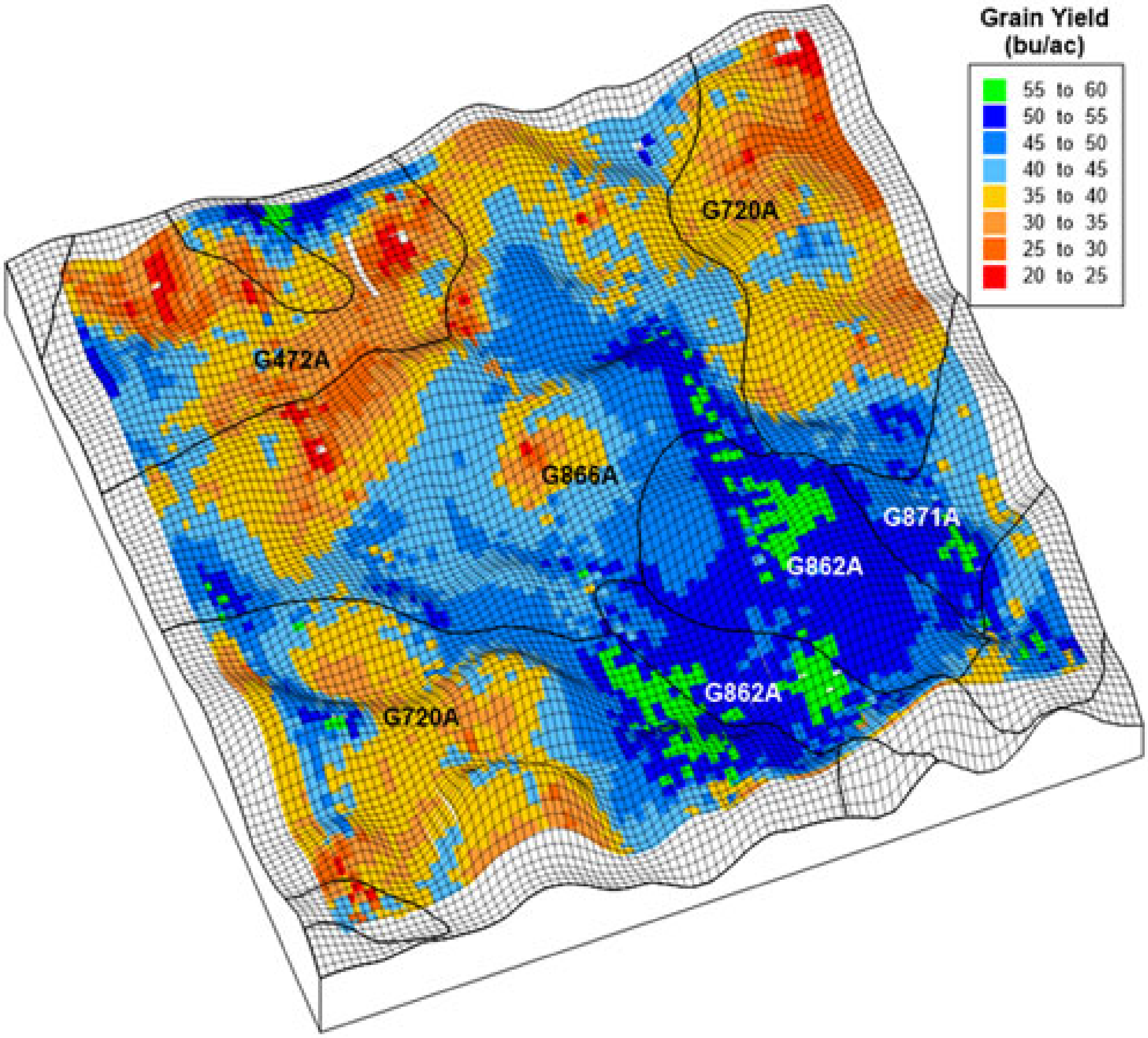

Figure 1. Spatial distribution of soybean yield across a quarter-section field. The yield variability map was created using yield monitor data, and such maps illustrate the variability of yield, which is influenced by within-field topography (such as summits, backslopes, and foot slopes) and different soil types. Soybean yields ranged from 20 to 60 bushels per acre. Image provided by Deepak Joshi, K-State Extension.

Sources of error in the yield monitor data

Before implementing variability maps, it is crucial to clean them properly to remove any erroneous data that may be present. There are multiple ways in which data recorded by yield monitoring systems might be less reliable or may contain inaccurate data, such as:

- **Speed change**: Inconsistent harvester speed, such as high speed at the beginning of a harvester pass or slow speed at the end while turning the harvester from one harvest pass to another, can result in extremely low or extremely high yield readings.

- **Turn and overlap areas**: Driving the harvester with the header down in the harvesting position across already harvested fields may result in zero yield readings if the grain flow sensor is activated and no grain flows through it.
- **Incomplete harvest pass**: When a field is nearly harvested, some passes may not utilize the full header width. For example, suppose a 40-foot-wide harvester typically combines 16 corn rows in a single pass. In that case, the final remaining section may be narrower, such as only 11 corn rows, resulting in an incomplete full-width pass. This may result in inaccurately low yield-per-acre values.
- **Flow delay**: Flow delay is the travel time of grain through the combine to reach the flow sensor after a short delay. Typically, flow delays are 5 seconds, and these delays need to be corrected to obtain accurate spatial yield data.
- **Moisture delay**: Similarly, moisture delay is caused by the time lag between the harvesting of crops and the measurement of their moisture content by the moisture sensor. For accurate and quality data, it needed to be adjusted.

Case study to demonstrate the importance of cleaning yield monitoring data

A corn field was harvested in the first week of October in McPherson County, KS, using a combine harvester equipped with a yield monitoring system. The raw dataset contained yield records collected every one to two seconds as the combine moved through the field. Each harvest pass was 30 feet wide, and the distance between one yield point and another was an average of 8.6 feet within each pass (Figure 2a). The raw data included a range of operational and agronomic information such as grain yield, grain flow rate, grain moisture content, combine travel speed, swath width, time and date, and the GPS coordinates of every harvested point. In total, the raw dataset consisted of approximately 13,044 individual data points, with a mean yield of 156 bu/ac across the field. The yield range of the raw data was from 5 to 3,963 bu/ac.

The raw data were then cleaned to remove erroneous points, resulting in a more accurate representation of the true field performance (Figure 2b). Cleaning removed approximately 1,600 erroneous points, reducing the standard deviation from 67 bu/ac to 22 bu/ac (Table 1). Standard deviation is a measure of how different or variable the yield values are. The higher standard deviation in the raw data (67 bu/ac) compared to the cleaned data (22 bu/ac) indicates that many of the extreme values in the raw dataset were not representative of actual field conditions. These outliers created high inconsistency in the yield distribution. After cleaning the dataset, the mean yield changed very little (156 bu/ac in the raw data to 154 bu/ac in the cleaned data), indicating that the true yield values were preserved. However, the standard deviation dropped dramatically in the cleaned dataset, providing a far more accurate and reliable representation of the true spatial yield variability across the field.

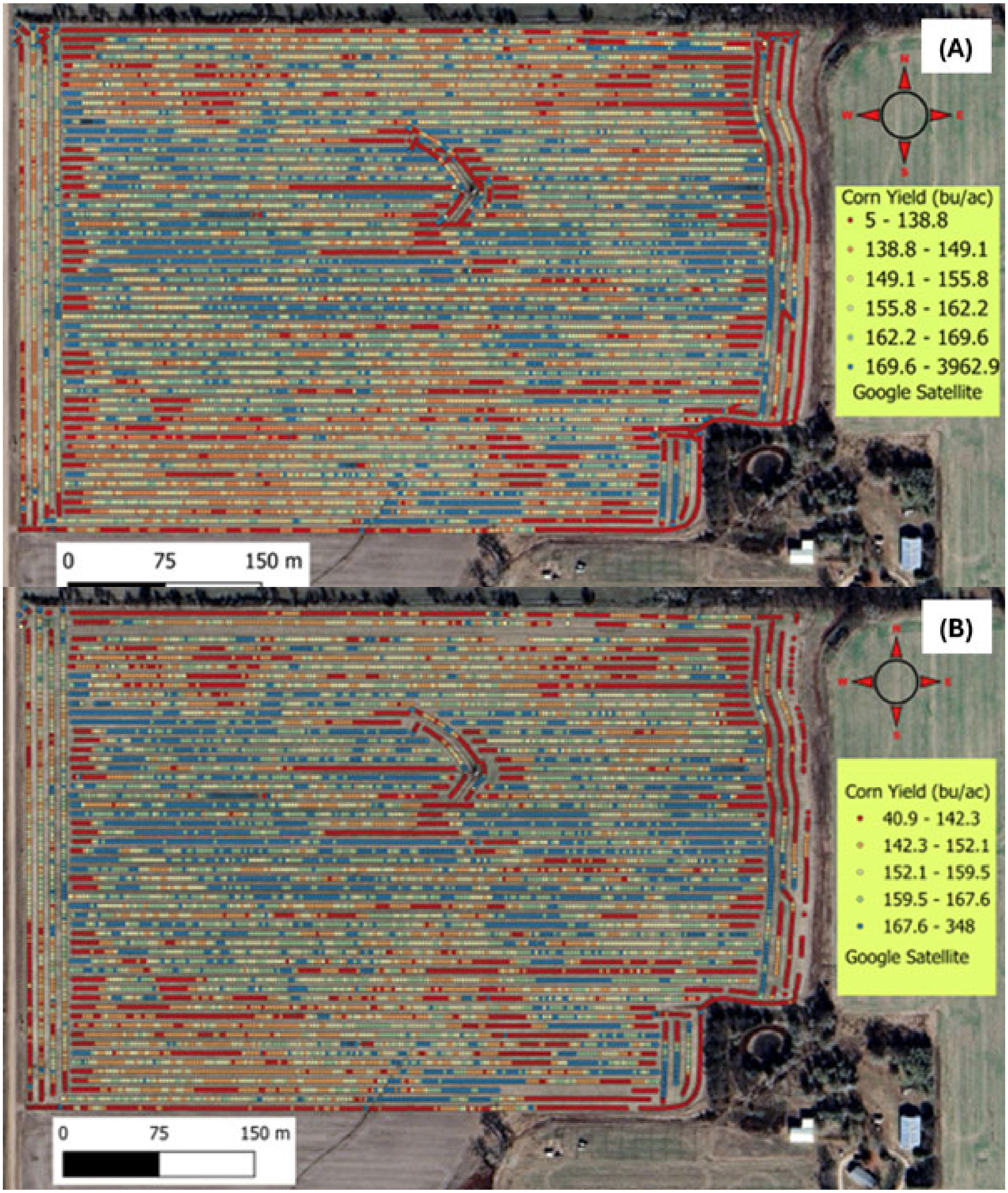

Figure 2. Yield monitor data before cleaning (A) and after cleaning (B), highlighting the improvement in data quality for spatial analysis. Images by Deepak Joshi, K-State Extension.

Table 1. A comparison of statistical summaries for raw and cleaned yield monitor data highlights the importance of removing erroneous observations prior to analysis.

Statistics	Total data points	Mean (bu/ac)	STD* (bu/ac)	CV* (%)	Min (bu/ac)	Max (bu/ac)	Range (bu/ac)

Raw data	13,044	156	67	43	5	3963	5 to 3963
Cleaned data	12,434	154	22	15	41	348	41 to 348

*STD (standard deviation) and CV (coefficient of variation) are measures of variability.

Take-home message

Overall, yield monitor data is essential in understanding the field's spatial variability. It enables the making of various agricultural decisions, including seeding and fertilizer rates based on within-field variability, as well as many other decisions. However, the real value of such data can be effectively understood through its cleaning and analysis. Raw or uncleaned data may create inaccurate yield maps, leading to poor decisions.

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2. Identifying Herbicide Resistance in the Field

Herbicide resistance is one of the most serious problems in Kansas and across global agriculture.

Since the first report of resistance to 2,4-D in wild carrot in 1957 (Switzer), the problem has ballooned to include 273 species worldwide involving 21 modes of action, including numerous species in Kansas, which were described in a recent eUpdate article. When weed control fails, it is essential to determine the cause. If herbicide resistance is the cause, herbicide programs need to be adjusted accordingly. Herbicide resistance occurs with the repeated use of herbicides with the same or similar mode of action (MOA)at the same site for several years. This leads to selection pressure favoring the survival of resistant individuals within a previously susceptible population. Timely and accurate diagnosis, regular field scouting, and early detection not only help reduce yield losses but also allow for tracking resistance across larger regions.

What does herbicide resistance look like in the field?

According to the Weed Science Society of America (WSSA) and Take Action on Weeds (2015), there are three broad indicators of possible herbicide resistance that could be used to evaluate the potential case of resistance:

1. **Species-specific survival**. If a particular individual weed survives an herbicide treatment while other adjacent individuals are controlled well by the same herbicide.
2. **Spreading patch**. Resistant weeds appear as clustered patches within a field. These patches may spread next season after seed production with tillage equipment or wind.
3. **Mixed injury response**. A single weed species may show a mixed response to the herbicide, where some plants are either completely dead, moderately affected, or some remain totally healthy without any damage.

This heterogeneous response within a single weed population suggests a genetic diversity within the species, which could allow the evolution of multiple herbicide resistances in the future.

However, not all weed control failures can be attributed to herbicide resistance. Nine out of ten herbicide failures are due to factors other than resistance. Other factors, such as unfavorable weather conditions, incorrect rates, poor coverage, or application timing, skips, weed size and density, soil moisture, and equipment malfunctions, can also cause poor weed control or allow weeds to escape.

Normally, growers rely on pre-emergence (PRE), post-emergence (POST), or residual herbicides - either individually or in combination to achieve broad-spectrum weed control. Despite having a proper herbicide program in place, weeds may still escape due to the evolution of herbicide resistance. In addition to the three indicators discussed earlier, accurate identification in the field also requires an understanding of how each herbicide MOA behaves and what symptoms, or the lack thereof, indicate a failure. For instance, POST herbicides should produce visible symptoms, such as yellowing, burning, drooping, or complete plant death. On the other hand, residual herbicides are expected to suppress the new flushes of emergence weeks after treatment. When weeds continue to emerge and survive despite proper and timely spraying with no other factors to blame, it could suggest resistance and should be promptly investigated.

Table 1: Weed species and field indicators of resistance to specific herbicide groups

Application Timing	Herbicide Group	Herbicide Example	Weed Species	Field Symptoms of Resistance	Reference
POST	Group 2	Imazamox, Chlorsulfuron	Kochia	Kochia patches survive ALS inhibitors; no chlorosis or stunting observed	Burgos et al. (2013)
PRE	Group 3	Trifluralin	Rigid ryegrass	Ryegrass emerges uniformly despite PRE trifluralin; normal root development	Holt (1992)
POST	Group 9	Glyphosate	Horseweed	Survivors after POST application; no injury while adjacent weeds were controlled	Heap (2025)
POST	Group 14	Fomesafen	Waterhemp	Waterhemp survives POST fomesafen with regrowth and no necrosis	Burgos et al. (2013)
Residual	Group 15	S-metolachlor	Waterhemp	Late-emerging flushes 3–4 weeks after PRE S-metolachlor under moist conditions	Heap (n.d.)

These observations may not be definitive for identifying resistance, but they serve as the initial red flag for further scrutiny. Contacting the local extension agent or an expert about the issue may help in evaluating the problem more scientifically if further investigation is needed.

Target Site vs Non-Target Site Resistance in the Field

Identification of herbicide resistance at the field level may also provide early insights into management. Generally, weeds have two mechanisms to evolve resistance: **target site resistance** (TSR) and **non-target site resistance** (NTSR). In target site resistance, a single change in the gene encoding an herbicide target protein prevents the binding of the herbicide, thus preserving the normal enzymatic function. Non-target site resistance involves changes in the physiological mechanisms aimed at reducing the amount of herbicide reaching the target site, either by altered uptake or enhanced metabolism.

Weeds with confirmed TSR often appear as uniform survivors across a population, with plants showing little to no herbicide injury and a reduced chance of cross-resistance to more than one herbicide group. However, weeds that exhibit patchy, irregular survival patterns with partial injury symptoms most likely have NTSR. NTSR is usually more challenging to identify and can be more daunting to manage due to cross-resistance across multiple groups of herbicides. These distinctions form the basis for field diagnosis prior to greenhouse or molecular confirmation in the laboratory.

What is next if herbicide resistance is suggested?

It is imperative to take immediate action to manage a population suspected of herbicide resistance. Some of the recommendations that may help mitigate the spread of herbicide resistance include:

- **Post-spray scouting**. Soon after the initial spraying, walk the field to observe weed responses. It is important to look for survivors and compare injury across the weed species.
- **Mix multiple effective herbicides**. When possible, use different herbicide modes of action for re-sprays.
- A second application may not be effective if weeds are too large. In this case**, cultivation or hand-weeding may be necessary**.
- **Scout for weed escapes during and after harvest**. Adjust herbicide and/or crop rotations for long-term resistance management.
- **Contact your extension agent, input supplier, or commercial applicator** if you suspect herbicide resistance in your field.

Take-home message

Herbicide resistance is a growing challenge that poses a serious threat to effective weed management on farms. Although herbicide failure is a key sign, other agronomic or environmental factors must first be ruled out. Knowing the mode of action of different herbicides and then identifying when weeds do not respond as they should is crucial for early detection of resistance.

Watch closely for warning signs in your field, as early detection is key to preventing the spread of herbicide resistance. Some key signs that may indicate herbicide resistance include:

- Dead plants next to live plants after an herbicide application
- Weeds that were controlled in previous years are surviving and increasing in density.
- Patches or trails of living plants following an application.

Should resistance be suspected, use alternate methods to control those surviving plants and prevent reproduction. Report any cases that may be concerning to your local area agents, regional Extension Agronomists, or Weed Scientists at K-State.

References

Switzer, C. M. 1957. The existence of 2,4-D–resistant strains of wild carrot. Proc. Northeast. Weed Control Conference. 11:315-318.

Weed Science Society of America (WSSA), & Take Action on Weeds. (2015). *Field identification and control of suspected herbicide-resistant weeds*. United Soybean Board. Retrieved from https://iwilltakeaction.com/uploads/files/Field-Identification-of-Suspected-Herbicide-Resistant-Weeds.pdf

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3. Kansas Fall Weather 2025: The Season in Review

Meteorological fall concluded on November 30. In this article, we take a look back at weather highlights from the past three months.

Fall Temperatures

It was a warm fall, as September, October, and November all averaged above normal. September's statewide average temperature, based on data from the National Centers for Environmental Information (NCEI), was 70.1°, or 1.3° above normal. It ranked as the 46th warmest September in 131 years of records. October was more above normal than September; NCEI's average temperature was 61.5°, or 5.3° above normal. This was good enough for the 7th warmest October. NCEI's official numbers for November won't be released until December 8, but based on data from the Kansas Mesonet, the estimated average temperature for November was 46.5°, or 3.5° above normal.

When all three months are averaged together (two official months and an estimate), the estimated average temperature for the entirety of meteorological fall is 59.4°, or 3.3° above normal (Figure 1). Based on this value, fall 2025 should be in the top 10, as the estimate would rank as the 8th warmest fall on record if this number matches NCEI's official value. Out of the 91 days of meteorological fall, 71% of them (65 days) were above normal. The longest run of above normal days was 17, from September 19 through October 5, a mark that was challenged in late November. November 11 through 25 averaged above normal, a 15-day stretch that ended when colder conditions arrived right before Thanksgiving and persisted through the end of the month.

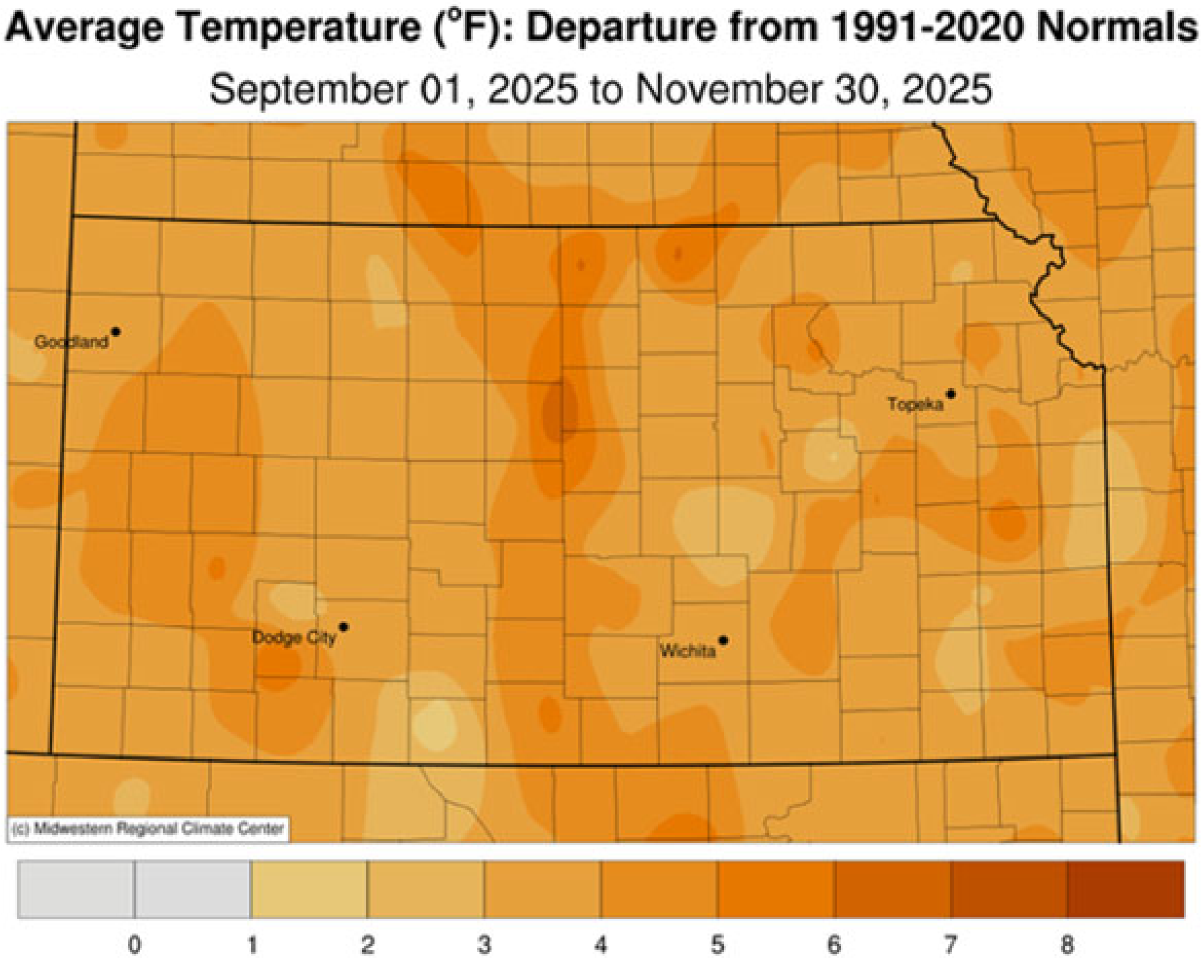

Figure 1. Seasonal departure from the average temperature for the meteorological fall. Source: Midwest Regional Climate Center.

The first freeze in Kansas was observed on October 18 in Hamilton County. It took three weeks for every other location in the state to record a freeze, as the holdouts in eastern Kansas fell to below freezing on November 9, after a push of unseasonably cold air swept across Kansas. As a result, the few stations that recorded their first freeze on the 9th recorded a hard freeze the next morning. Every Mesonet site fell to 23 degrees or colder on the morning of the 10th and remained below 28 degrees for at least four consecutive hours, the criteria for a hard freeze. In general, most locations in Kansas experienced a later freeze than normal, but the timing of southeastern Kansas' first freeze was close to normal.

Fall Precipitation

September's average precipitation was 3.40", or 0.88" above normal. October's average of 1.99" was below the normal amount of 2.32". As for November, it began on a very dry note, as most locations in the state experienced precipitation-free conditions for the first two-thirds of the month. Fall's first snowflakes were recorded on November 9 in association with the cold front passage that delivered the hard freeze to all areas. Only a trace of snow was observed at Topeka, with additional reports of flurries in the Manhattan and Kansas City areas. Two precipitation events later in the month delivered much-needed moisture to Kansas. By month's end, the estimated average precipitation was 1.79", nearly half an inch above the normal of 1.30". When all three months are combined, the estimated average precipitation of 7.18" is 1.04" above normal. Based on this value, fall 2025 would rank as the 37th wettest meteorological fall on record.

The highest departures from normal precipitation were in central Kansas (Figure 2), and in a few locations, the bulk of the surplus came from a single event. On September 8, parts of Lincoln and Ottawa Counties were drenched by over 9 inches of rainfall in just 12 hours. Nearby, at least 6 inches fell in portions of Mitchell, Ellsworth, and Saline Counties. These areas average around 6 inches of rain for the entirety of meteorological fall, so a wetter-than-normal fall was already guaranteed just eight days into the season. Eastern Kansas had the largest precipitation deficits during the fall. Areas along the Missouri border from Kansas City to Pittsburg were 4 to 6 inches in arrears by the end of November. As a result, drought conditions developed and worsened.

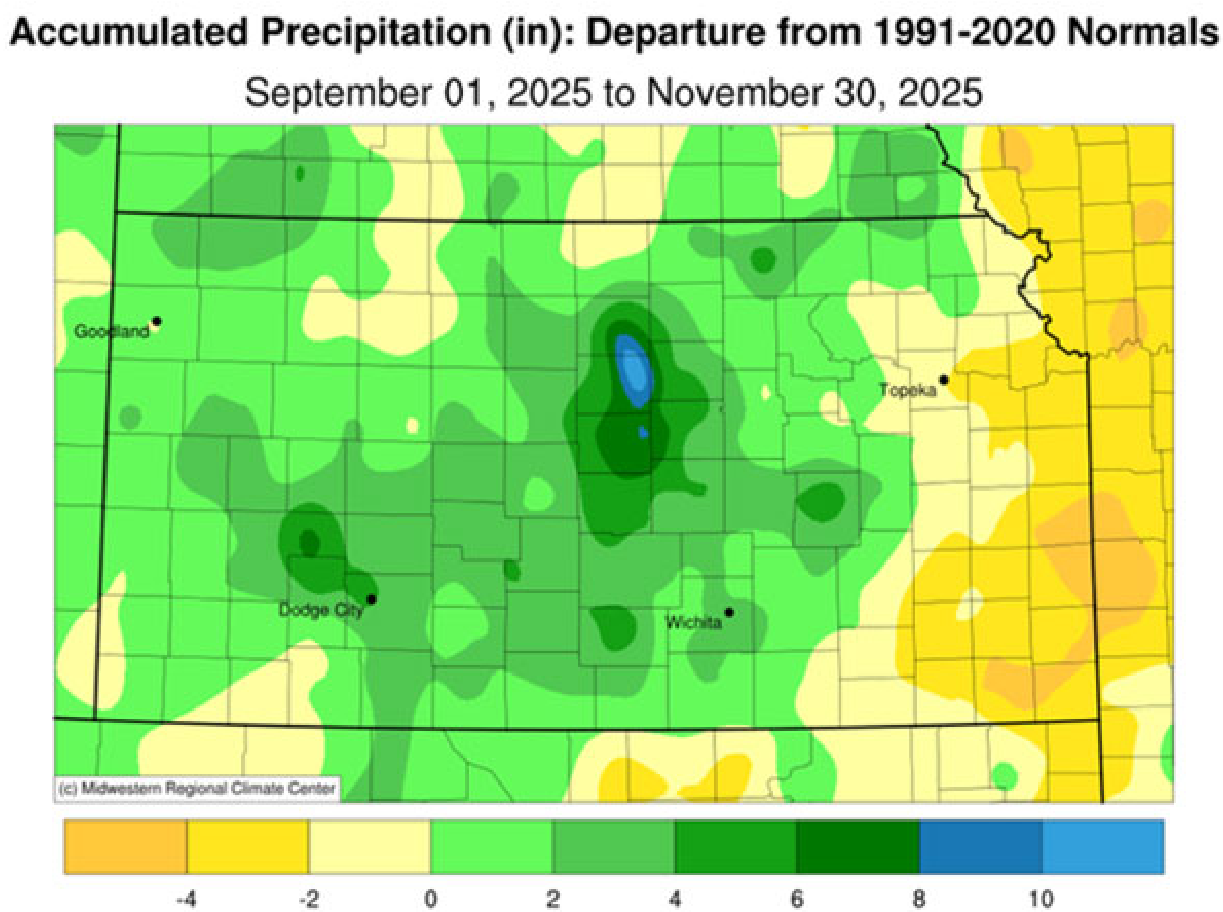

Figure 2. Seasonal departure from average precipitation for meteorological fall. Source: Midwest Regional Climate Center.

Around 10% of the state was in drought status (D1 or worse) on the US Drought Monitor (USDM) map by mid-November, an increase from 3.3% at the start of September. The precipitation in late

November improved conditions somewhat. Still, the overall change for fall was one of worsening in the east, while the west improved to or remained in drought-free status during the fall (Figure 3). The final USDM map update of the fall, issued on November 25, showed just over 75% of the state free of any drought status. This was a slight decrease from 80% at the beginning of fall. Still, the collective conditions across the state were much better than at this point last year, when 31% of the state was in drought status and just 30% of the state was drought-free.

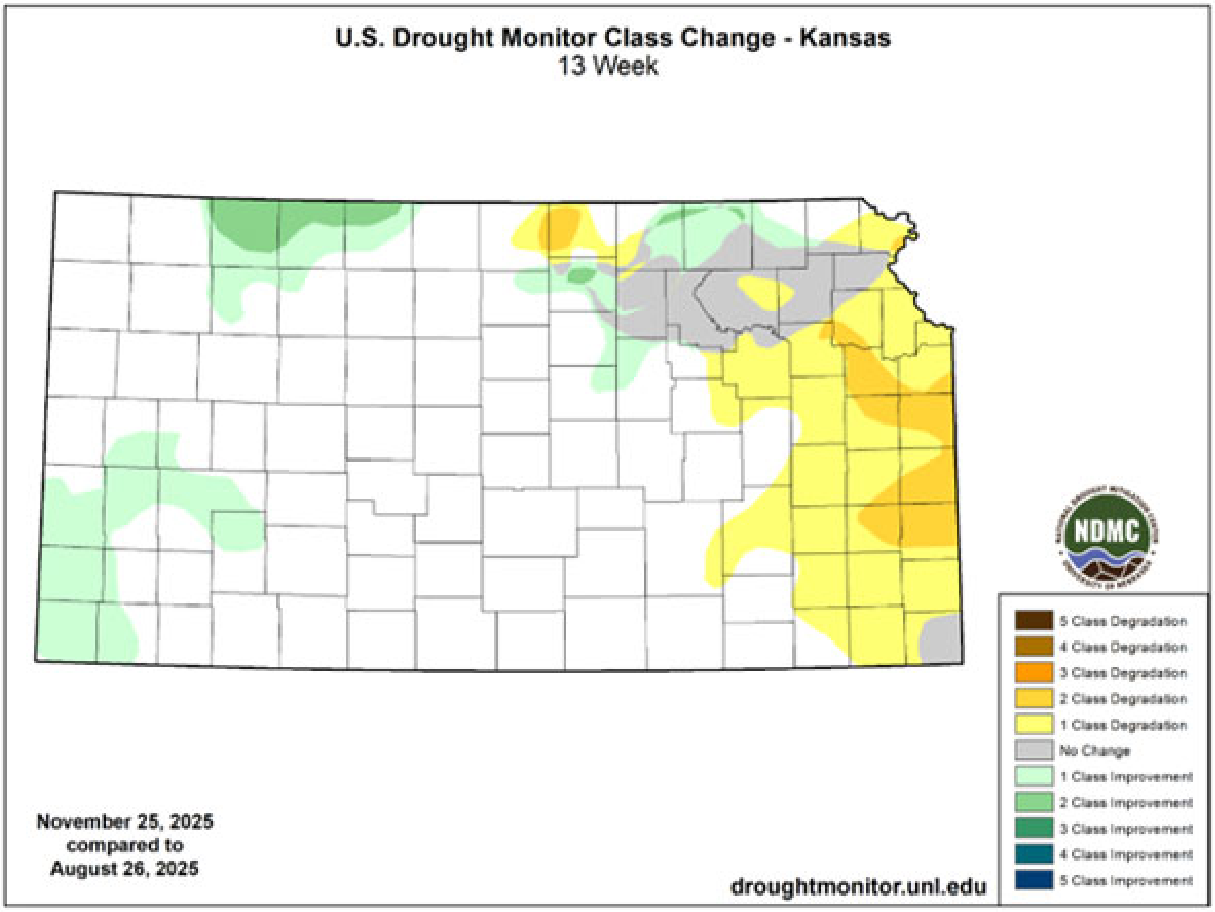

Figure 3. Changes in US Drought Monitor category across Kansas during meteorological fall 2025. Source: National Drought Mitigation Center.

What will this winter hold for Kansas? The start of meteorological winter has been a cold, snowy affair. Northeast and east central Kansas saw measurable snow on the first day of December, with as much as 5.5" reported in the Lawrence area. The Scandia and Rossville Mesonet sites fell to 0° on the morning of the 2^{nd}, the coldest readings in the state since late February. Is this a harbinger of a bad winter ahead?

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4. Don't miss the K-State Crop Pest Management Schools this December

K-State Extension invites agronomy professionals, commercial applicators, farmers, and crop advisers to attend the **2025 K-State Crop Pest Management Schools**, scheduled for **December 9–12** in Colby, Hays, and Concordia. These regional programs will focus on current challenges and emerging issues related to weeds, insects, and diseases in western and central Kansas.

Participants will gain timely, research-based updates directly from K-State specialists in agronomy, entomology, plant pathology, meteorology, and pesticide application.

2025 Meeting Dates & Locations

- **December 9 – Colby**
  City Limits Convention Center
- **December 10 – Hays**
  K-State Western Kansas Research Center Auditorium
- **December 12 – Concordia**
  Cloud County Fairgrounds Commercial Building
  (Slightly different schedule applies at this location.)

Program Schedule

Registration opens at **7:45 a.m.**, with presentations beginning at **8:15 a.m.**

Topics include:

- **Navigating the Weather**
  Chip Redmond, K-State Meteorologist & Mesonet Manager
- **Water Quality, Spray Mixtures, and Weed Control**
  Jeremie Kouame, K-State Weed Scientist
- **Is It Viral? Wheat Diseases to Watch For**
  Kelsey Andersen Onofre, K-State Wheat Pathologist
  Jeanne Falk Jones, K-State NW Agronomist
- **Herbicides in Dry Environments and Label Updates**
  Sarah Lancaster, K-State Weed Scientist
- **Making Pest Management Decisions**
  K-State Northwest Extension Agents
- **Fall Armyworms, Grasshoppers, and Others to Scout**
  Anthony Zukoff, K-State Entomologist
- **The Label Game**
  Sarah Lancaster, K-State Weed Scientist
- **Kansas Regulations (Core Hour)**
  Kansas Department of Agriculture

Each school concludes at **5:00 p.m.**

Continuing education credits:

- For **1A Commercial Applicators**: *7 credits and 1 core hour* have been applied for.

- For **CCAs**: *8 pest management credits* have been applied for.

Registration Information

Registration for the Crop Pest Management Schools is **$75**. Participants are encouraged to register in advance to help ensure that adequate materials and seating are available at each location.

Register online: https://bit.ly/KSCropPest or by scanning the QR code below.

For more information or to request accommodations, contact:
Jeanne Falk Jones at jfalkjones@ksu.edu or 785-462-6281

K-State Crop Pest Management Schools

focused on weeds, insects and diseases in western and central Kansas

December 9 - Colby
City Limits Convention Center

December 10 – Hays
K-State Western Kansas Research Center Auditorium

December 12 – Concordia
Cloud County Fairgrounds Commercial Building

Who should attend?

1A commercial applicators, agronomy professional and farmers

For 1A Commercial Applicators, 7 credits and 1 core hour have been applied for

For CCAs, 8 pest management credits have been applied for

Planning to attend?

$50, if registered by Dec 2

$75, if registered after Dec 2

https://bit.ly/KSUCropPest

Scan to register

Our schedule:

7:45 Registration

8:05 Welcome

8:15 **Navigating the Weather**
Chip Redmond, K-State Meteorologist & Mesonet Manager

9:10 **Water Quality, Spray Mixtures and Weed Control**
Jeremie Kouame, K-State Weed Scientist

10:05 Break

10:20 **Is it Viral? Wheat Diseases to Watch For**
Kelsey Andersen Onofre, K-State Wheat Pathologist
Jeanne Falk Jones, K-State NW Agronomist

11:15 **Herbicides in Dry Environments and Label Updates**
Sarah Lancaster, K-State Weed Scientist

12:10 Lunch

12:50 **Making Pest Management Decisions**
K-State Northwest Extension Agents

1:45 **Fall Armyworms, Grasshoppers and Others to Scout**
Anthony Zukoff, K-State Entomologist

2:40 Break

2:55 **The Label Game**
Sarah Lancaster, K-State Weed Scientist

3:50 **Kansas Regulations (Core Hour)**
Kansas Dept of Ag

5:00 Adjourn

** Slightly different schedule in Concordia*

Kansas State University is committed to making its services, activities and programs accessible to all participants. If you have special requirements due to a physical, vision, or hearing disability, contact Jeanne Falk Jones, 785-462-6281.

K·STATE Research and Extension

5. Registration is open for the K-State/KARA Crop Production Update on Dec. 10-11

Don't miss out on the **2025 Crop Production Update**, hosted by the Kansas Agribusiness Retailers Association (KARA) and in cooperation with K-State Extension. The two-day event is scheduled for December 10-11 at the Bluemont Hotel in Manhattan, KS. This training provides the latest research and technological advances in weed and insect control, fertilizer and chemical recommendations, crop production, water management, soil fertility, and other related topics.

December 10 – Wednesday

Registration and Welcome: 8:20 AM; First presentation at 9:20 AM; Concludes at 4:30 PM

- Beyond the Drop: How Water Quality and Timing Shape Crop Productivity – Tina Sullivan
- Cover Crop Management Options to Improve Soil Health and Water-Limited Environment Profitability – Augustine Obour
- Multi-Scale Sensing for Efficient Water Management – Gaurav Jha
- Row Crop Disease Management – Rodrigo Onofre
- AI in Agriculture – Ajay Sharda
- Spray Drones: Opportunities and Challenges – Deepak Joshi
- Cover Crop/Residue Management with Erosion Factors – Peter Tomlinson

December 11 – Thursday

Registration and Welcome: 7:30 AM; First presentation at 8:30 AM; Concludes at 4:30 PM

- Kansas Cotton: Limited Water, Big Potential – Logan Simon
- Farm Bill and Agricultural Policy Update – Jennifer Ifft
- Pest Management Tools - Brian McCornack
- Research Update on Disease Management in Wheat – Kelsey A. Onofre
- On-Farm Evaluation of Targeted Herbicide Application Technology – Sarah Lancaster
- Updating Fertilizer Recommendations for Today's Crop Economics - Dorivar Ruiz Diaz
- KDA Core Hour – Kansas Dept. of Agriculture

Registration and Cost

Full program in person: $150
Full program virtual: $175
Dec. 10 in person: $100
Dec. 10 virtual: $115
Dec. 11 in person: $100
Dec. 11 virtual: $115

You can register for the conference by visiting https://www.ksagretailers.org/events-training/crop-production-update/ or by calling 785-234-0463

Across both days, 13 CCA CEUs will be offered, along with 5 Commercial Applicator 1A credits.

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6. Save the Date: K-State Agronomy Science and Solutions Virtual Conference

Make plans to join us online for the 2026 **K-State Agronomy Science and Solutions Conference: Research to Results**, a two-day virtual program designed to connect the latest K-State agronomy research with on-farm decisions.

Date and time

- **February 3–4**
- **11:00 a.m. – 1:00 p.m. (CST) each day**
- **Online via Zoom** (link and registration details coming soon)

Each day will feature **four 30-minute presentations** from K-State specialists and collaborators, focused on practical strategies for crop production in Kansas. This conference is designed to address the full spectrum of Kansas crop production, with content relevant across all major crops. Planned topics include:

- Perennial weed management
- Strategic tillage
- Turning farm data into decisions
- Irrigation timing and system maintenance
- Fertility management when crop prices are low
- Soil pH and soil health
- Spray water quality
- Using residual herbicides effectively

Participants can register for **one or both days**:

- **$20 per day**, or
- **$30 for both days**

Certified Crop Advisers (CCAs) can earn 0.5 CEUs per presentation, totaling 4 CEUs if attending all sessions over both days.

More information, including the full program schedule, speaker list, and registration link, will be shared in upcoming issues of the Agronomy eUpdate and on K-State Agronomy communication channels.

Mark your calendar now and plan to join us for this focused look at “research to results” in Kansas crop production.

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