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These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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1. Control annual weeds with fall-applied herbicides

With row crop harvest well underway, it is time to start planning fall herbicide applications. Herbicide applications in late October through November can improve control of difficult winter annual weeds. Fall weed control is associated with warmer soils and easier planting in the spring. However, it is important to remember that fall-applied herbicides may limit your crop options in the spring. Also, remember that herbicides should not be applied to frozen ground.

For residual activity, some of the key herbicides to consider for fall herbicide applications include chlorimuron (Classic, others), flumioxazin (Valor, others), suflentrazone (Spartan, others), and Autumn Super. Even though these herbicides provide residual activity, additional spring application of pre-emergence herbicides will be needed to extend the duration of residual weed control. One thing to remember about residual activity from fall herbicide applications is that weather conditions will influence the length of residual control and weed emergence patterns. Warm, wet winters are associated with shorter periods of weed control, while cool, dry winters are likely to allow for longer periods of weed control.

For burndown activity, glyphosate, 2,4-D, or dicamba are good options to consider. Alternatives for grass control include Group 1 herbicides like clethodim (Select, others) or quizalofop (Assure II, others). Alternatives for controlling broadleaf weeds include paraquat (Gramoxone, others) tiafenacil (Reviton), saflufenacil (Sharpen), and Scorch EXT, which is a combination of dicamba, 2,4-D, and dichlorprop that was commercialized in 2025. Remember that Gramoxone is a restricted-use pesticide that can only be applied by certified applicators who complete the training at a minimum of every three years.

Some key weeds to target with fall herbicide applications are marestail, henbit, dandelion, prickly lettuce, pepperweed, field pansy, evening primrose, mustard species, and recently-emerged cool-season grasses. When higher rates of herbicides are used, some suppression of early spring-germinating summer annual broadleaf weeds such as kochia, common lambsquarters, Russian thistle, wild buckwheat, and Pennsylvania smartweed can be achieved. Recent data comparing kochia control with fall and spring applications are included in Figure 1.

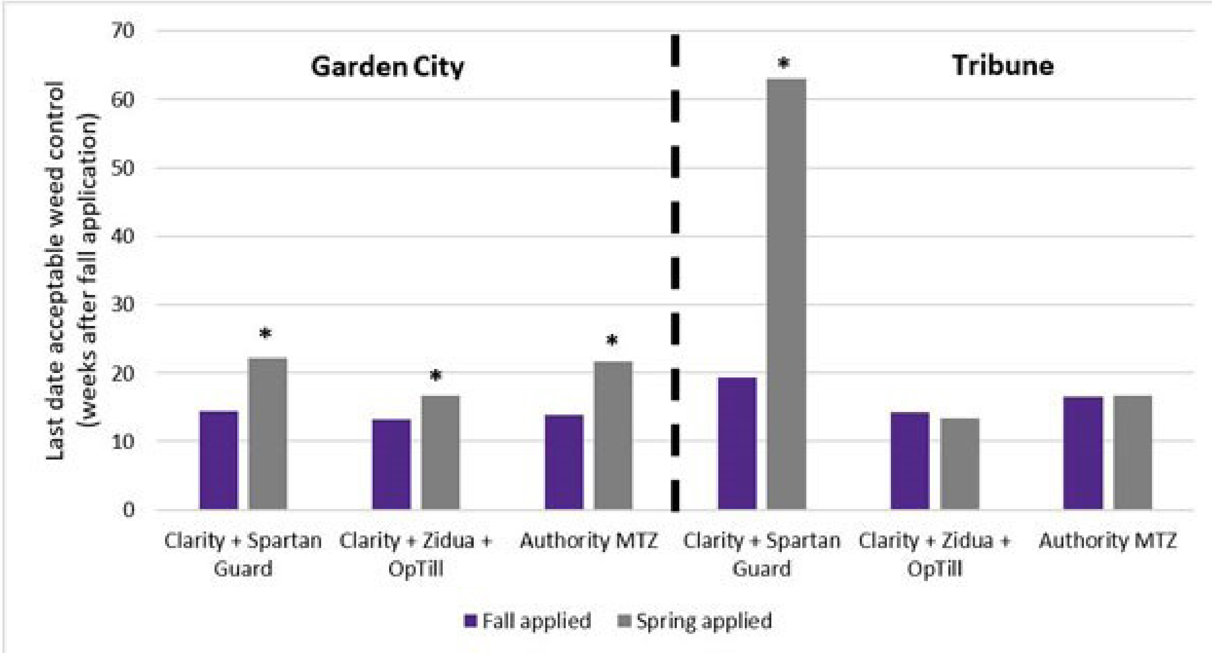

Figure 1. Estimated weeks of kochia control greater than 80% following fall (early December 2014) and spring (early February 2015) herbicide applications at Garden City and Tribune, KS. An asterisk (*) indicates that the spring application provided acceptable weed control at a later date than a fall application. Data from Kumar et al.,2019.

Marestail is a problem that merits special attention. It is much easier to control in fall or early spring while still in the rosette growth stage (Figure 2). A companion article in this eUpdate issue provides additional information about controlling marestail: "Get control of fall-emerged marestail before next spring".

Figure 2. Marestail rosettes in a recently harvested soybean field. Photo from Dallas Peterson, K-State Research and Extension.

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

For additional information, see the *2025 Chemical Weed Control for Field Crops, Pastures, and Noncropland* or check with your local K-State Research and Extension office for a paper copy. https://bookstore.ksre.ksu.edu/item/2025-chemical-weed-control-for-field-crops-pastures-rangeland-and-noncropland_SRP1190

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2. Get control of fall-emerged marestail before next spring

Marestail or horseweed (*Erigeron canadensis*) is a challenging weed to manage in no-till or minimum-till soybean systems. This weed is classified as a winter annual, but it germinates well into spring and summer, making it even more difficult to manage. In addition to an extended germination window, marestail can produce up to 200,000 seeds/plant, with approximately 80% of those seeds being able to germinate immediately after maturation. Kansas producers also face the added difficulty of trying to manage glyphosate-and ALS-resistant marestail (Figure 1).

Figure 1. Fall-emerged marestail in the rosette stage in wheat stubble in Manhattan, KS. Photo by Sarah Lancaster, K-State Research and Extension.

Acceptable control of fall-emerged marestail with herbicide applications at planting will be unlikely because marestail plants are generally too large, but control can be achieved with both fall and early spring herbicide applications. Other control options include tillage and cover crops.

Residual herbicides for marestail control include chlorimuron (Classic, others), flumioxazin (Valor, others), sulfentrazone (Spartan, others), and metribuzin (Tricor, others) products. Group 4 herbicides such as 2,4-D, dicamba, fluroxypyr (Starane Ultra), or haluxifen (Elevore) are good options to control emerged marestail, especially populations that are resistant to glyphosate or ALS-inhibiting herbicides. Control of marestail in the rosette stage (Figure 1) is similar among the Group 4 herbicides, but dicamba controls bolted marestail better than 2,4-D. Saflufenacil (Sharpen) or glufosinate (Liberty, others) can also control bolted marestail.

Fall and spring tillage has been shown to be effective in controlling marestail for a spring-planted crop. When tillage is not utilized in the fall, marestail will establish and be present in the spring. If minimum tillage is the goal, research suggests that marestail can be controlled when a fall herbicide application is followed by shallow tillage in the spring or vice versa.

Utilizing **cover crops** can result in fewer and smaller marestail plants in a field. Research in Kansas has shown control of marestail with a cereal rye cover crop paired with spring herbicide applications. The key to achieving effective suppression of marestail with cover crops is the accumulation of adequate cover crop biomass before marestail emerges, so timely cover crop planting is important for this strategy to succeed. An accompanying eUpdate article in this issue has more information about cereal rye as a cover crop: "Planting cereal rye after corn harvest".

For additional information, see the *2025 Chemical Weed Control for Field Crops, Pastures, and Noncropland* or check with your local K-State Research and Extension office for a paper copy. https://bookstore.ksre.ksu.edu/item/2025-chemical-weed-control-for-field-crops-pastures-rangeland-and-noncropland_SRP1190

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3. Planting cereal rye after corn harvest

Incorporating cereal rye after corn, in a corn soybean rotation, can be a valuable management tool to scavenge residual nitrogen (N), reduce soil erosion and evaporation, and suppress weeds. Cereal rye can be part of an effective weed management program in soybean production. The growing cover crop competes with weeds that emerge early in the spring, and residue from the terminated cereal rye can suppress weed growth (see companion eUpdate article about fall-emerged marestail). Cereal rye roots scavenge residual nitrogen in the soil profile, reducing N leaching and anchoring soil in place, reducing erosion. Cereal rye residue can also protect the soil surface from erosion caused by rain and runoff water, as well as reduce evaporation from the soil during the growing season (Figure 1).

A publication from K-State and the Midwest Cover Crop Council, "Post Corn, Going to Soybean: Use Cereal Rye", provides helpful information for producers looking to incorporate a cereal rye cover crop following corn harvest. This fact sheet is an excellent resource for farmers who are new to cover crops. This publication covers various topics, which are summarized in this article. The complete factsheet can be viewed at: https://bookstore.ksre.ksu.edu/pubs/MF3504.pdf.

Figure 1. Residue from a terminated cereal rye cover crop helps manage weeds throughout the

growing season. Photo by DeAnn Presley, K-State Research and Extension.

Planning and Preparation

- **Residual corn herbicides**—Fall-seeded cereal rye can be established successfully following the application of most herbicides used in corn production, but success is influenced by herbicide rate and environmental conditions that follow the herbicide application. If cereal rye will be grazed or fed to livestock, there are some restrictions. See the USDA-NRCS Cover Crop Termination Guidelines, or consult your agricultural chemical supplier or agronomist for potential carryover herbicide concerns, and always read and follow the instructions on the herbicide label.
- **Seed purchase**—Order cereal rye seed early. Named varieties can produce substantially more growth or more predictable growth and maturity, but are more expensive than VNS

(variety not stated) seed. Choose seed (named variety or VNS) that has been cleaned (free of weed seeds and other contaminants), tested for germination, and has a seed tag, even if it is VNS.

Fall Work

- **Corn harvest**—Harvest the crop as early as possible in fields to be planted to cereal rye.
- **Tillage or no-tillage**—To allow for adequate cover crop growth, it is best or easier if no full-width tillage is planned for after rye planting or before the intended rye termination date. Thus, it is easier to integrate cover crops into no-till or strip-till systems.
- **Timing of planting**—For maximum biomass, plant cereal rye as soon after corn harvest as possible. However, cereal rye poses a moderately high risk as a host for wheat streak mosaic virus and wheat curl mites, which means it will pose a risk to neighboring wheat crops if it emerges before wheat does. Use the Cover Crop Selector Tool (in Resources) to find planting dates for your county. For most of Kansas, plant no later than November 1.
- **Seeding rate**—The recommended drilled seeding rate is 55 to 60 pounds per acre; if seeded with an airplane, the rates should be 1.5 times the drilled rate (required if participating in USDA-NRCS programs). These rates are based on high-quality seed with germination rates of 85 to 98%. Increase rates with later plantings.
- **Planting method**—Drill seed 0.75 to 1.50 inches deep or broadcast with shallow incorporation.

Additional resources

Cover Crop Selector Tool – https://covercroptool.midwestcovercrops.org/ , available from Midwest Cover Crops Council, https://www.midwestcovercrops.org/
USDA-NRCS Cover Crop Termination Guidelines – https://www.rma.usda.gov/en/Topics/Cover-Crops

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4. Harvest aid application decisions in cotton

Harvest aids are commonly used in cotton production to prepare the crop for harvest and optimize lint yield and fiber quality. Harvest aid categories include boll openers, defoliants, desiccants, and regrowth inhibitors.

Harvest aid timing

The timing of harvest aid applications relative to crop maturity is essential. Several methods exist to determine crop maturity and defoliation readiness, including counting nodes above the highest cracked boll and the percentage of open bolls. When counting nodes above the highest cracked boll, the standard recommendation is either 4 or 5 **n**odes **a**bove the **c**racked **b**oll (NACB). However, waiting until 4-5 NACB is often too late in this thermally-limited region, where the first fall freeze of the season typically occurs in mid to late October (Figure 1).

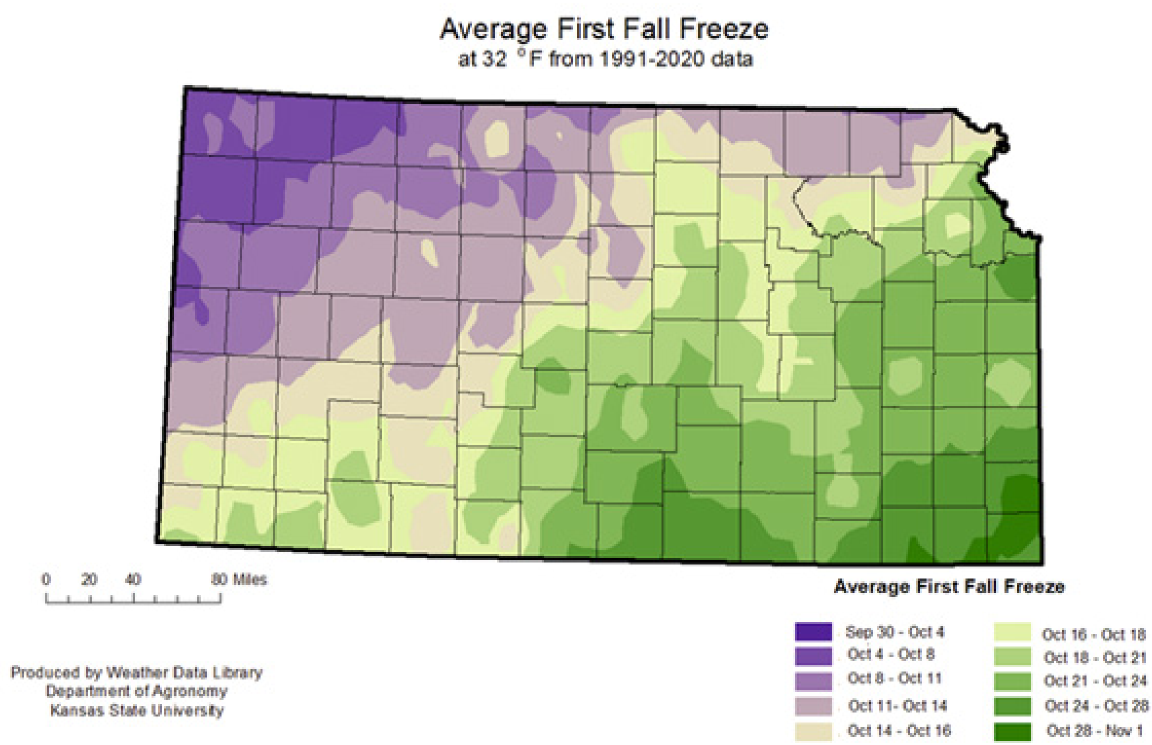

Figure 1. Average first fall freeze dates. Courtesy of the Kansas State Weather Data Library.

To count NACB, find your top mature boll in the first fruiting position that is just splitting (not fully open), and count the number of mainstem nodes above it to the top of the plant. If that number is 4 or less, you're ready to go. If the number is greater than 4, any boll above that is likely to be less mature than you would like (ideally).

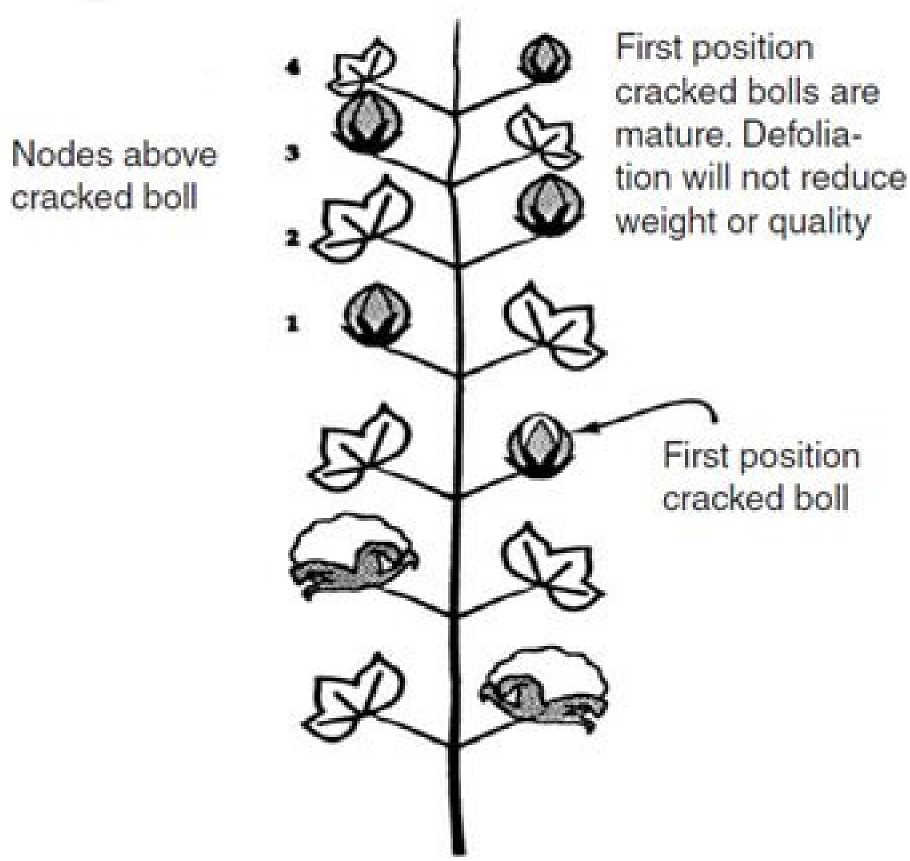

Figure 2. Determining nodes above cracked boll (NACB). Source: Guthrie, D., Cothren, T., and Snipes, C. 1993. The Art and Science of Defoliation. Cotton Physiology Today Volume 4, No. 7, National Cotton Council, Cordova, TN.

Currently, the most common method for timing harvest-aid applications used in Kansas is based on percentage open bolls. Typically, harvest aids are applied at 60% open bolls (Figure 3). However, Kansas cotton growers have been surprised to see applications at 20% or even 10% open bolls result in no or minimal differences in lint quality. Still, these early harvest aid applications could hurt the cotton seed weight and payment received for cotton seed, often 15 to 20% of total gross returns from a cotton crop. In Kansas, the value of the cottonseed is typically used to cover, at least in part, the cost of ginning, with the remainder paid to the producer, referred to as seed credit.

Figure 3. Open cotton boll. Photo by Logan Simon, K-State Research & Extension.

Immature cotton seeds may have lower seed weights as well as lower oil and protein concentrations. With this in mind, another method for timing harvest aid applications is monitoring the seed maturity of the uppermost harvestable bolls. In this case, the decision to apply harvest aids occurs when the uppermost harvestable bolls have mature seeds (seed coats have turned black) (Figure 3).

Figure 4. Cotton boll with mature seeds (seed coats have turned black). Photo courtesy of Rex Friesen, Southern Kansas Cotton Growers.

Harvest aid products

In addition to timing, cotton producers must decide on harvest-aid product selection and sequence. Several products are available as harvest aids in cotton (Table 1). In Kansas, harvest aids are typically applied in two sequential applications. The most common and least expensive strategy used for rainfed cotton is the application of 32-40 oz/A Prep (Ethephon, a boll opener) with 3-4 oz/A Gramoxone (Paraquat, a desiccant), followed by 16-24 oz/A Gramoxone 10-14 days later. For irrigated cotton, which typically has a denser canopy than rainfed cotton, the most common strategy is the application of 32-40 oz/A Prep with 3 oz/A Folex (S, S, S-Tributyl phosphorotrithioate, a defoliant) followed by 16-24 oz/A Gramoxone 10-14 days later. This strategy is less common for rainfed cotton, primarily due to the increased expense associated with Folex.

Recent research conducted near Mount Hope and Bently evaluated the influence of harvest aid application timing on boll opening defoliation by Prep plus several defoliants. Data are presented in Table 1. The most important factor in determining defoliation and percent open bolls was application timing, with later application associated with greater defoliation and more open bolls. However, there was a trend of less defoliation and fewer open bolls when Aim or Folex were applied compared to Reviton or Sharpen. There were no differences in yield or quality among the treatments evaluated.

Table 1. Cotton percent defoliation 14 days after application of harvest aid treatments at Mount Hope and Bently, KS, in 2023.

	Rate (Ounces a.i./acre)	Application time (percent open bolls) 50%	75%
		Mount Hope (% defoliation)	
Product			
Aim†	0.2	78	80
	0.4	60	81
Folex	11	75	86
Reviton	0.3	85	84
	0.9	80	85
Sharpen	0.3	75	90
	0.6	68	93
		Bently (% defoliation)	
Aim	0.2	87	96
	0.4	86	93
Folex	11	86	97
Reviton	0.3	96	98
	0.9	95	95
Sharpen	0.3	98	99
	0.6	99	99

†Aim, carfentrazone; Folex, Tributyl phosphorotrithioate; Reviton, Tiafenacil; Sharpen, Saflufenacil. All treatments included Prep (Ethephon) at 18 oz a.i./acre as a boll opener.

Other considerations for harvest aid applications

- Spray coverage is key, with carrier volume being critically important. Increased carrier volume provides greater coverage for rapid and effective defoliation and boll opening.
- Nozzle tips that produce coarse to medium-fine droplet sizes are recommended for optimum coverage.
- Slower ground speed also typically allows for better coverage and deeper penetration through the crop canopy.
- Most boll opener labels will outline rate suggestions based on temperature ranges. Refer to the label of your specific boll opener selection for details.

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5. Common causes of late-season stalk lodging in corn

Two common causes of stalk lodging are stalk rot diseases and corn borer damage. Stalk-rotting diseases in Kansas include anthracnose stalk rot, charcoal rot, Fusarium stalk rot, and Diplodia (Figure 1). Stalk-rotting diseases are present in the soil or crop residue every year. However, these diseases only develop when plants are stressed or otherwise predisposed to infection.

Figure 1. Anthracnose stalk rot, charcoal rot, and Fusarium stalk rot. Photo courtesy of Rodrigo Onofre. K-State Research and Extension.

What are the common causes of stalk lodging in corn in Kansas?

Carbohydrate depletion in the stalk during grain fill. High-yielding, "racehorse" hybrids tend to produce superior yields at the expense of late-season stalk integrity. These hybrids translocate a high percentage of carbohydrates from the stalks to the ears during grain fill. This process, which shrinks stalk diameter from flowering to maturity, weakens the stalk and makes it more prone to breakage or infection. However, these hybrids can still be excellent choices, but they require timely harvest. Consider harvesting at 20–25% grain moisture, even if discounts apply, to avoid greater losses from stalk breakage.

Hybrid differences in stalk strength or stalk rot susceptibility. Some hybrids have genetically stronger stalks than others. This is often related to a hybrid's yield potential, as mentioned above, and how it allocates carbohydrates during grain fill. However, there are genetic differences in stalk strength for other reasons, including better resistance to stalk rot diseases. If stalk lodging occurs, hybrid choice may be part of the cause.

Poor root growth and other stresses. Poor root growth weakens stalks by limiting water and nutrient uptake. Factors such as cold or waterlogged soils, severe drought, and soil compaction can reduce carbohydrate production, forcing the ear to pull reserves from the stalk. Even under normal yields, this process can leave stalks thin and weak. The developing ear always has priority for carbohydrates within the plant.

Tar spot of corn. Tar spot is an emerging disease in Kansas that can affect stalk rot (Figure 2). Any factor that results in poor leaf health will reduce carbohydrate production. Reduced leaf area means less photosynthesis and fewer carbohydrates for the plant, forcing stalk reserves to be mobilized (see carbohydrate depletion above).

Figure 2. Premature leaf death caused by severe levels of tar spot on corn. Photo courtesy of Rodrigo Onofre. K-State Research and Extension.

Many hybrids lack good resistance to tar spot. Producers should be ready to apply a fungicide when the disease is active and in the corn canopy.

High plant density. When plant populations are higher than optimal, stalks are often thinner and weaker (Figure 3). In addition, plant-to-plant competition for light, nutrients, and water enhances the competition for carbohydrates between the stalk and ear, thus reducing the vigor of the cells in the stalk and predisposing them to invasion by stalk rot.

Nutrient imbalances and/or deficiencies. Adequate fertility is key to stalk health. Potassium (K) and chloride (Cl) deficiencies are strongly linked to reduced stalk quality and greater lodging risk. Excess nitrogen without sufficient potassium can further increase the problem. Maintain soil chloride levels above 20 lbs/acre, and balance nitrogen with potassium to help support stalk integrity.

Corn rootworm and corn borers. Damage caused by the corn rootworm and the European corn borer can predispose the corn plant to invasion by stalk-rotting organisms, as well as lead to outright yield loss.

Mid-season hail damage. Similar to the damage caused by insects, the physical damage caused by mid-season hail can set up the plant for invasion by stalk-rotting organisms. Stalk bruising and the resulting internal damage may also physically weaken corn stalks, making them more likely to lodge later in the season.

Take-Home Message

Stalk lodging in corn results from a combination of hybrid genetics, stress during the growing season, diseases, insects, and management practices. While not all causes can be controlled, farmers can reduce risk by:

- Selecting hybrids with strong stalk strength and disease resistance.
- Managing plant populations and soil fertility.
- Monitoring for tar spot and other foliar diseases and applying fungicides when needed.
- Performing a timely harvest; harvesting susceptible hybrids early.

Once stalk rots appear in the field, there are no curative options. The best strategy is to take note of where and why lodging occurred, whether from hybrid choice, soil fertility, disease, insect pressure, or stress conditions. Understanding those contributing factors this season is critical to making management changes that help prevent the same issues in future crops.

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6. Understanding resolution in remote sensing imagery: What farmers need to know

Satellite and drone-based remotely sensed imagery are becoming an important tool in monitoring crop health, soil nutrient and moisture status, weed identification, and pest disease stress detection to make on-farm decisions. The application, as well as the quality of decisions based on this imagery, will depend on various factors, including the resolution of the imagery or data.

Types of Resolution in Remotely Sensed Imagery

Spatial resolution refers to the ability of a sensor (such as on a drone or satellite) to distinguish different objects in the field. It is usually described by pixel size: the smaller the pixel, the more detail can be seen. In other words, smaller pixels mean higher resolution.

The resolution you need depends on your objective. For example, for stand counts, weed detection requires higher-resolution imagery, roughly 3.3 to 16.4 feet per pixel. Drones typically capture images at the centimeter (<inch) scale, allowing for analysis at the individual plant level (Figure 1). Satellites generally provide lower-resolution imagery suited for whole-field or regional monitoring, rather than plant-level detail. For comparison, Landsat 8 and 9 provide ~98 feet per pixel, Sentinel-2 provides ~33 feet, and commercial satellites such as PlanetScope provide ~10 feet.

Figure 1. Ultra-high-resolution drone imagery (0.07 inches/pixel) is used to count soybean plants at the early-emergence stage (left photo). High-resolution drone imagery (0.94 inches/pixel) reveals the within-row structure in corn, enabling clear visualization of plant spacing, gaps, and row uniformity (right photo). Images by Deepak Joshi, K-State Research and Extension.

Spectral resolution refers to how many "spectral bands", or in simpler terms, different colors, a sensor can detect. More spectral bands provide more information. For instance, most phone cameras capture three bands (red, green, and blue, or RGB), which is the same range visible to the human eye. RGB imagery is useful for tasks such as stand counts, weed detection, and assessing hail damage, but it cannot capture information beyond visible light (Figure 2, left).

Multispectral, thermal, and hyperspectral sensors can detect additional wavelengths such as near-infrared (NIR), red-edge, or thermal bands. These allow us to identify nitrogen deficiencies, drought stress, or pest-related injury earlier than what is possible with the human eye or RGB sensors (Figure 2, right).

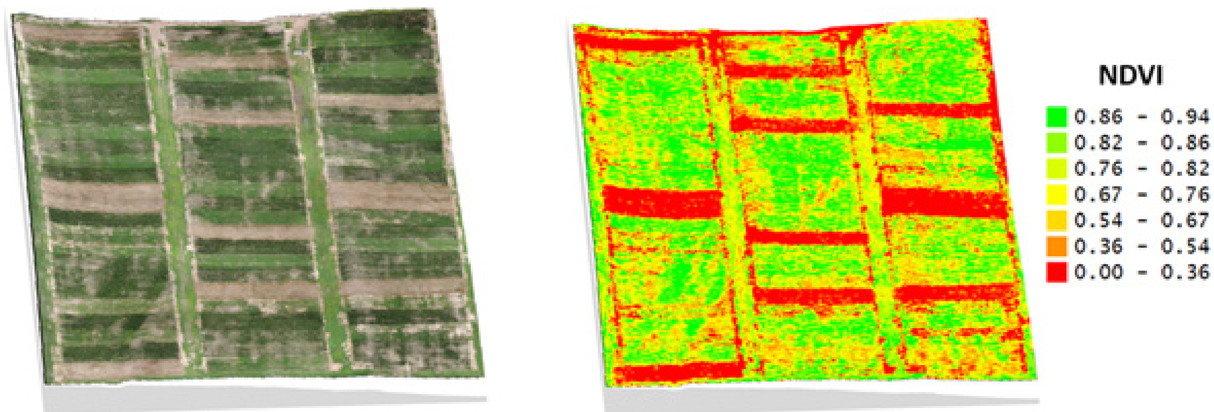

Figure 2. RGB vs. multispectral normalized difference vegetation index (NDVI) in small research plots. The RGB image (left) provides visual context of plot layout, soil/residue, and row patterns, while the NDVI map (right) quantifies canopy vigor (0–1), exposing subtle within-plot variability and stress bands that are not evident in RGB alone. Images by Deepak Joshi, K-State Research and Extension.

Temporal resolution describes how often images are captured (i.e., how many images we can get in a growing season). For example, Landsat 8/9 satellites provide images about every 8 days, while Sentinel-2 (2A+2B) provides images about every 5 days—though cloud cover often limits their usability. Drones, by contrast, can collect imagery as often as needed, provided conditions are favorable (no rain or strong winds).

Temporal resolution is especially important in agriculture, where images taken at different crop stages support better decision-making. For example:

- **Before planting:** monitor soil moisture and pre-emergence weeds.
- **Early germination:** conduct stand counts.
- **Early to late vegetative growth:** monitor nutrient status, pest pressure, disease, and moisture stress.
- **Late reproductive stages:** estimate crop yield.

Radiometric resolution refers to the different levels of brightness a sensor can distinguish in the images. It is usually measured using "bits". An 8-bit image has 256 shades (brightness levels), a 12-bit image has 4,096, and a 16-bit image has 65,536. Images with more shades have finer detail in tone, which can reveal subtle differences in the crop or soil, such as mild nutrient stress or slight changes in moisture.

Table 1. Different resolution combinations for typical farm operations are provided as starting points; however, the best combination should be determined based on weather, crop stage, equipment, and local field conditions. (NIR=near infrared)

Farm Activity	Spatial resolution	Spectral Resolution	Temporal Resolution	Radiometric Resolution	Reason for this resolution
Emergence/ stand count	0.39–1.97 in (drone)	RGB is sufficient	On-demand, ideally 3–7 days after emergence	8-bit is ok; 12-bit is better	To identify individual seedlings
Early-season weed detection	1.18–3.94 in (drone)	RGB / Multispectral with NIR and red edge	Every 7–14 days until canopy closure	12-bit	Distinguishes weeds from crops between rows
Disease/insect/ moisture stress scouting	3.94–11.81 in (drone)	Multispectral, including NIR and red-edge/ thermal	Weekly during vulnerable stages	12-bit+	Captures leaf/canopy patterns
Nutrient/zone delineation for variable rate application	0.98–32.81 ft (Drone/high resolution satellite)	Multispectral, including NIR and red-edge/ thermal	At critical growth stages of crops (e.g., V6–V8 corn; Feekes 5–7 wheat)	12-bit+	Can identify within-field variability
Whole-farm monitoring & crop progress	9.84–32.81 ft (high resolution satellite)	Multispectral, including NIR and red-edge/ thermal	Weekly during the growing season	12-bit	Field-level patterns, cost-effective
Regional benchmarking, long-term trends	32.81–98.43 ft (satellite)	Multispectral, including NIR and red-edge/ thermal	Biweekly to Monthly	12-bit	Greater area coverage and cost-effective

Conclusions

Remote sensing offers several types of resolution—spatial, spectral, temporal, and radiometric. The right choice depends on your specific objective. By matching the type and resolution of imagery (from drones or satellites) with the questions you want answered, you can make more precise and timely on-farm decisions (Table 1).

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7. Fall soil sampling: Sample collection and submission to K-State Soil Testing Lab

Soil testing provides producers and homeowners with important information about soil fertility. This information can help produce better crops and reduce costs by guiding management decisions like the type and amount of fertilizers to apply.

If you plan to collect your own soil samples and submit them to the K-State Soil Testing Laboratory, use the following guidelines for collection, handling, and shipping. For more background on how to obtain a representative soil sample, see the companion article in this eUpdate.

Preparing to sample

- Gather the right tools: a probe, auger, or spade, and a clean plastic or metal pail that have not been used for feed, fertilizer, or other organic products. These can leave residues and affect the soil samples.
    - If testing for zinc, use a plastic container only to avoid contamination from galvanized buckets or rubber materials.
- Obtain soil sample bags and an information sheet from your local Extension office or fertilizer dealer. Soil bags can also be ordered online through K-State Research and Extension at https://www.bookstore.ksre.k-state.edu/Item.aspx?catId=298&pubId=6719

Collecting soil samples

- On the information sheet, sketch a simple map of your field. Divide fields into areas that share the same soil texture, color, slope, and cropping/fertilization history.
- From each uniform area, collect 20–30 cores or slices (minimum 12–15). Mix thoroughly in a clean container and transfer to the sample bag.
- For most tests, collect cores from the top 6 inches of soil.
    - For available nitrogen, chloride, or sulfur tests, a subsoil sample to a depth of 24 inches is necessary.
    - On long-term reduced tillage or no-till fields, a split sample from the top 6 inches (i.e., 0 to 3 inches and 3 to 6 inches) is encouraged to assess pH and nutrient stratification near the surface.
- Avoid sampling in unusual areas such as fencerows, dead furrows, low spots, or livestock feeding areas, unless you want information about those spots specifically, then submit a separate sample.

Handling and storing samples

- Label each sample bag clearly and record the number on both the bag and the information sheet.
- If same-day submission is not possible, refrigerate samples at 40 °F or less, or air-dry before shipment. (See the companion article, *Soil sample handling practices can affect soil nitrate test accuracy*.)
- If air-drying samples, start the process as soon as possible, especially for available nitrogen tests. Open the sample bags and place them in a temperature and humidity-controlled place with good air movement so moisture can evaporate quickly. Do not use heat for drying and also protect the samples from freezing for best results.

Submitting to the laboratory

1. Fill out the information sheet completely. It's important to fill out as much information as possible for the most accurate recommendations from the submitted soil samples.
2. Deliver samples to your local Extension office for shipping, or ship them directly to the Soil Testing Lab using next-day delivery if at all possible.
    a. If mailing directly, place samples in a sturdy container include completed information sheets. Next-day shipping labels with UPS can be printed from the Soil Testing Lab website.

Mailing address:

Soil Testing Laboratory
2308 Throckmorton PSC
1712 Claflin Road
Manhattan, KS 66506-5503

Additional resources

For a full list of analysis options and costs, visit the Soil Testing Lab website: www.agronomy.k-state.edu/outreach-and-services/soil-testing-lab

You can also contact the lab by email at soiltesting@ksu.edu and by phone at 785-532-7897.

See the K-State publication MF-734 "Soil Testing Laboratory Information" at: https://www.bookstore.ksre.k-state.edu/pubs/MF734.pdf.

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8. The challenge of collecting a representative soil sample

Collecting soil samples may seem straightforward, but variability within a field can make it difficult to obtain results that truly represent field conditions. Soil properties often differ due to natural soil formation, past management practices, or fertilizer applications. Because of this, a representative composite sample is essential for accurate test results and reliable fertilizer recommendations.

Preparing to sample

Before heading to the field to take the sample, be sure to have your objective clearly in mind. Sampling protocols differ depending on the nutrient of interest (mobile N, S, Cl, or immobile P, K, Zn) and the scale of your sampling (whole field, zone, or grid). For instance, if all you want to learn is the average fertility level of a field to make a uniform maintenance application of phosphorus (P) or potassium (K), then the sampling approach would be different than grid sampling to develop a variable rate P application map.

In some cases, sampling procedures are predetermined and simply must be followed. For example:

- Soil tests may be required for nutrient management plan compliance or environmental regulations associated with confined animal feeding operations. Sampling procedures for regulatory compliance are set by the regulatory agency, and their sampling instructions must be followed exactly.
- Collecting grid samples to use with a spatial statistics package for drawing nutrient maps could require sampling procedures specific to that program.

Regardless of the sampling objectives or requirements, some sampling practices should be followed.

Collecting soil samples

- Always take a composite sample of multiple cores:
  - Collect 12–15 cores at a minimum (Figure 1). A single core is not an acceptable sample.
  - For greater accuracy, take 20–30 cores from a relatively small area (2 – 4 acres).
  - Increase the number of cores for larger fields, but not strictly in proportion to acreage.
- Keep sampling depth consistent:
  - 6 inches for routine tests (pH, organic matter, P, K, Zn). See Figure 2.
  - 24 inches for mobile nutrients (N, S, Cl).
  - Split sample (0 to 3 inches and 3 to 6 inches) to assess pH and nutrient stratification in permanent sod or long-term no-till.
- Use a zigzag pattern when sampling across the field to avoid bias from tillage or fertilizer application patterns. With GPS, core locations can be recorded for consistent re-sampling.
- For grid sampling, collect cores within a 5–10 foot radius around each grid point.
- Avoid unusual areas such as old fencerows, low spots, or visibly different soil types. If information from these areas is needed, take a separate sample.
- Banded fertilizer application introduces more variability in soil test results. Sampling practices should be adjusted based on the spacing between bands and whether the locations of bands are known or unknown.
- If the location of bands is KNOWN, then cores should be pulled from within the bands in proportion to the area of the field that bands occupy. The number of cores pulled from

between bands is often calculated as: **8 x (Band spacing in inches/12)**

- If the location of bands is UNKNOWN, then cores should be collected in pairs from random points across the field or zone. The distance between cores in each pair should be one-half the width of the band spacing.

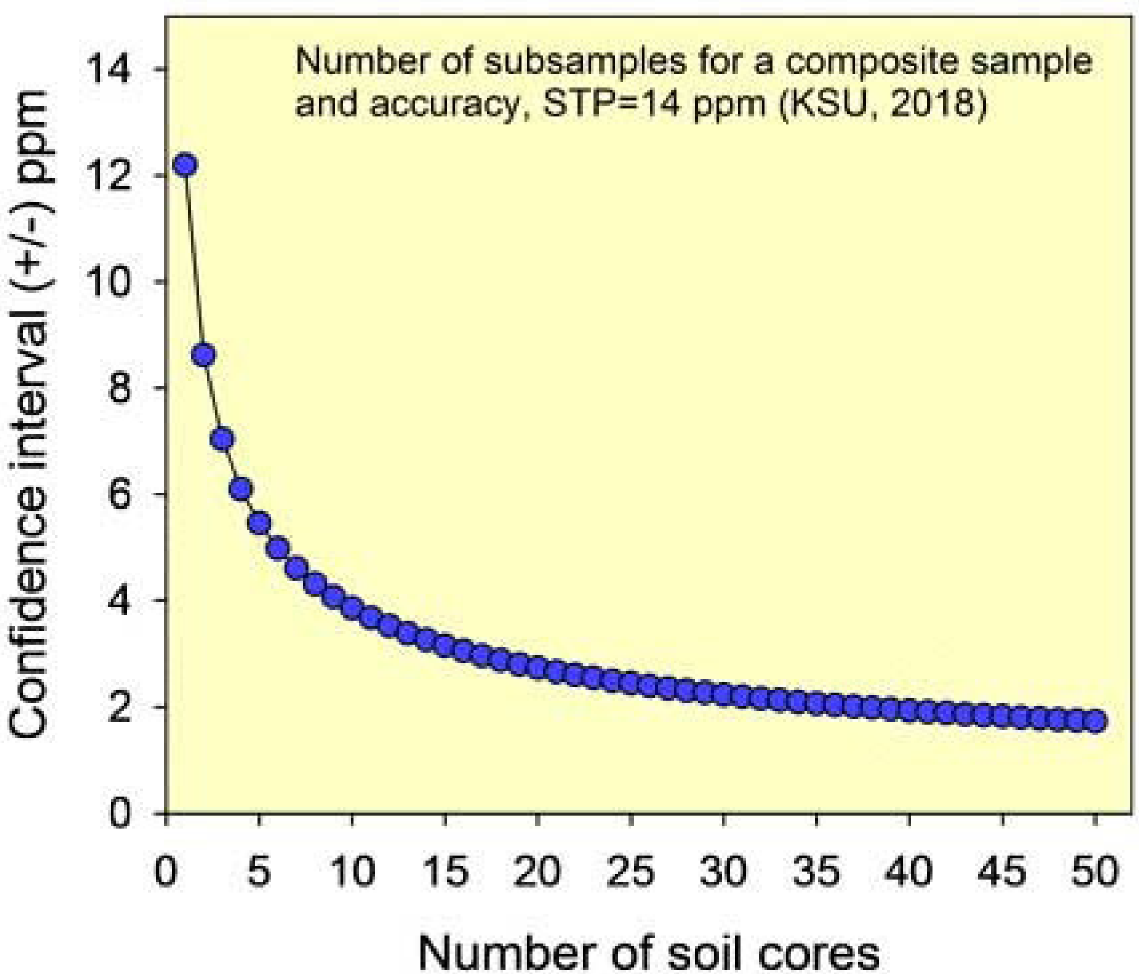

Figure 1. The level of accuracy of the results of a soil test will depend, in part, on how many subsamples were taken to create the composite sample. In general, a composite sample should consist of 15 or more subsamples. For better accuracy, 20-30 cores, or subsamples, should be taken and combined into a representative sample. Graph by Dorivar Ruiz Diaz, K-State Research and Extension.

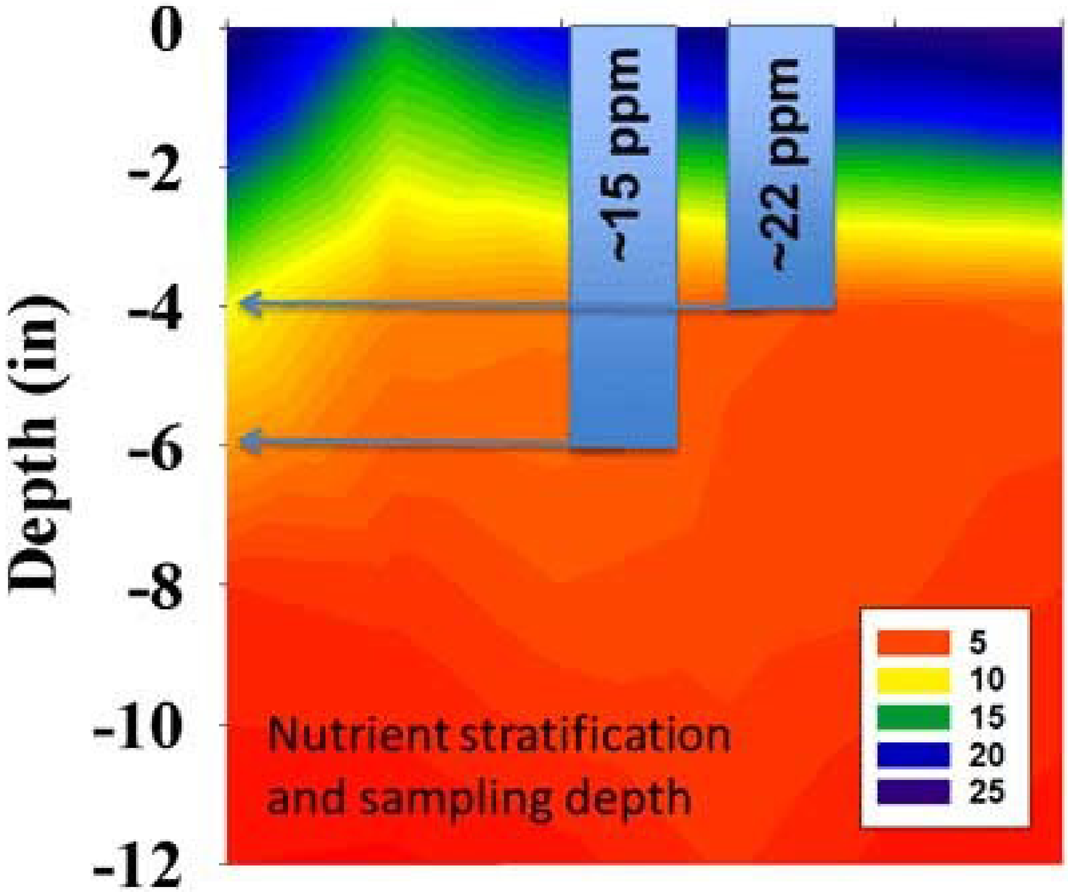

Figure 2. Consistency in sampling depth is particularly important for immobile nutrients like P. Stratification of nutrients and pH can be accentuated under reduced tillage. Image from Dorivar Ruiz Diaz, K-State Research and Extension.

Additional considerations

Soil test results for organic matter, pH, and non-mobile nutrients (P, K, and Zn) change relatively slowly over time, making it possible to monitor changes if soil samples are collected from the same field following the same sampling procedures. However, there can be some seasonal variability and previous crop effects. Therefore, soil samples should be collected at the same time of year and after the same crop.

After harvest in the fall is a good time to collect soil samples for the most limiting crop nutrients in Kansas.

Additional soil sampling resources

Accurate soil tests are dependent on more than proper sampling techniques. Care should be taken regarding the handling/storage of soil samples before submission to a testing facility. Please read this past eUpdate article, "**Soil sample handling practices can affect soil nitrate test accuracy**".

For instructions on submitting soil samples to the K-State Soil Testing Lab, please see the accompanying article "**Fall soil sampling: Sample collection and submission to K-State Soil Testing Lab"** found in this eUpdate issue.

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9. Join us for the 2025 Cotton Field Day - September 30

Producers are invited to attend the 2025 Cotton Field Day on **Tuesday, September 30, from 5:00 to 7:30 p.m.** This evening event will begin at the field location (see flyer QR code and map below) and then move to the farm location.

The program will feature local data, demonstrations, and expert discussions on timely cotton production topics, including:

- Precision fertilizer placement with ExactShot
- Targeted weed control and crop response with See & Spray technology
- Southern Kansas gin report
- Preparing your cotton stripper for harvest

This field day is brought to you by PrairieLand Partners, K-State Department of Agronomy, and supporting partners. Dinner will be provided, and an RSVP is requested.

RSVP online at: PrairieLandPartners.com/RSVP

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JOIN US FOR OUR 2025 COTTON FIELD DAY

PrairieLand Partners

Agronomy, Kansas State University

Starting at the Field location below and moving to the Farm location afterwards. We'll dive into key topics and you'll see real, local data firsthand. Don't miss this chance to gain valuable insights, network with fellow growers, and get your questions answered!

SEPTEMBER 30TH
5:00 PM - 7:30 PM

Please RSVP as Dinner will be provided
PrairieLandPartners.com/RSVP

SCAN FOR COTTON FIELD LOCATION
WE WILL START IN THE FIELD AT 5:00PM

SCAN FOR FARM LOCATION

Topics that will be covered during the field day include:

- Precision Fertilizer placement / ExactShot
- Putting Weeds in the Crosshairs / Weed control & Crop response with See & Spray
- Southern Kansas Gin Report
- Is your Cotton Stripper ready for harvest

RSVP | SAVE YOUR SEAT - RSVP ONLINE AT *PrairieLandPartners.com/RSVP*

FIELD DAY BROUGHT TO YOU BY PRAIRIELAND PARTNERS AND THE FOLLOWING

Pioneer. K-State Research and Extension. Kansas Cotton Association. BASF We create chemistry. SurePoint Ag Systems