# KSU TAPS
## TESTING AG PERFORMANCE SOLUTIONS

# 2025 FARM MANAGEMENT COMPETITION REPORT

USDA United States Department of Agriculture
Natural Resources Conservation Service

Kansas State University

TAPS Testing Ag Performance Solutions

Kansas Water Office

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## Acknowledgment

The success of the KSU-TAPS program is made possible through the contributions of many affiliates and partners. We are deeply grateful to the dedicated individuals across the Kansas State University system, who bring a wealth of knowledge and steadfast support to our efforts. We also extend our gratitude to collaborators from the TAPS Network in Nebraska, Colorado, Oklahoma, Alabama, Maryland, Texas, and Florida for their shared vision and partnership.

A special thank you goes to our talented graduate students, Kabateraine (Maxwell) Tumwesige, Rayhaan Kabenge, and intern Simon Salcido for their hard work and dedication to this program. Their contributions have been essential to our success, and we are proud to have them as part of the TAPS team.


## Mission Statement

To fully engage agriculturalists, scientists, educators, students, and industry in an innovative endeavor, to TAP into the Kansas State University Research and Extension system's potential to facilitate and create an environment for all stakeholders to work together in finding solutions through innovation, entrepreneurialism, technological adoption, new managerial applications, improved techniques and cutting edge methodologies for farms, farm businesses, and farm families to maintain profitability, sustainability, and productivity.


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# **TAPS** Team

**Daran Rudnick**
Director of Sustainable Irrigation & KSU-TAPS

**Renee Tuttle**
Associate Director of KSU-TAPS

**Kelsey Stremel**
Director of Communications & Marketing

**Raenette Martin**
Research Assistant

**Ray Duffey**
Agriculture Tech II

**Josefina Lacasa**
Assistant Professor, Statistics

**Micah Cameron-Harp**
Assistant Professor
Agricultural Economics

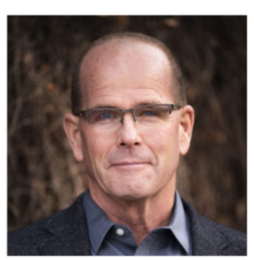
**Jonathan Aguilar**
Professor & Extension Specialist

**Kabateraine 'Maxwell' Tumwesige**
Graduate Student

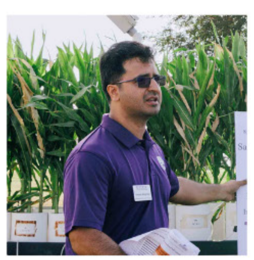
**Rayhaan Kabenge**
Post Doctorate Research Associate

**Susan Metzger**
Director, Kansas Water Institute +

**Brian Olson**
Department Head WKREC



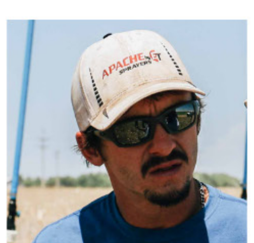
**Dwane Roth**
Front Porch Farms



**Farzam Moghbel**
Post-Doctorate Research Associate

**Simon Salcido**
KSU-TAPS Summer Intern

**Dan Foster**
NWREC Farm Manager



**Colt McElroy**
SWREC Farm Manager

**Brian Jones**
SWREC Farm Crew

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Dear Participants, Partners, and Supporters,

As we reflect on the past year, we are deeply grateful for the progress made through the KSU-TAPS program. Since our October 2023 launch, TAPS has worked to address pressing water challenges and support sustainable agricultural practices in meaningful ways. Through events such as the TAPS Kickoff, Technology Field Days, TAPS Agronomy Twilight Tours, and Awards Banquet, we've fostered opportunities for farmers, researchers, and industry partners to connect, share insights, and collaborate. These gatherings have highlighted the value of working together to address the challenges and opportunities in modern agriculture.

This progress would not have been possible without the steadfast support of our partners, sponsors, and most importantly, our farmers. Your participation and contributions are the foundation of TAPS, enriching the learning experience for everyone involved. We also want to thank our collaborators at K-State and the many organizations, businesses, and agencies that share our vision. To this year's competition participants and winners—congratulations on your hard work and achievements. Your innovative approaches and thoughtful decision-making have been inspiring to witness.

Looking ahead, TAPS remains committed to expanding our reach, strengthening partnerships, and promoting practices that support profitability and sustainability in agriculture. Together, we are building momentum to address the challenges facing our region and industry.

Thank you for being part of this journey. We look forward to continuing this work with all of you in the year ahead.

Sincerely,

The TAPS Team

# TAPS Overview

The 2025 TAPS Corn/Forage Sorghum Water Allocation competition took place at the Kansas State University Northwest Research-Extension Center (NWREC) in Colby, Kansas.

The competition has five awards: 1) Most Economically Profitable; 2) Highest Input Use Efficiency; 3) Greatest Corn Grain Yield, 4) Highest Forage Quality, and 5) Greatest Forage Yield. The competition consisted of 43 participants representing twenty-four farms, referred to as farms, where each farm was allocated four randomized plots per crop (Figure 2 and 3) under a Valley variable rate linear-move irrigation system.

The 2025 TAPS Corn Water Utilization competition took place at the Kansas State University Southwest Research-Extension Center (SWREC) in Garden City, Kansas.

The competition has three awards: 1) Most Economically Profitable; 2) Highest Input Use Efficiency; and 3) Greatest Grain Yield. The competition consisted of 55 participants representing twenty-four farms, referred to as farms, where each farm was allocated four randomized plots (Figure 1) under a Valley variable rate linear-move irrigation system.

Each Farm team was tasked with making key agricultural production and farm business decisions, including technology utilized, hybrid selection (corn only), crop acre allocation (NWREC only), seeding rate, irrigation amount and timing, nitrogen fertilizer amount and timing, insurance coverage (corn only), and corn grain marketing.

Details of each decision are shared in the following pages. Agronomic decisions utilizing data from the contestants' plots were submitted via the password protected TAPS data portal (TAPSNetwork.org). These decisions were compiled by the TAPS team and implemented in the field at the NWREC and SWREC utilizing precision agricultural equipment and machinery. The farm business decisions, insurance and marketing, were simulated. Yields and costs of each farm were scaled (i.e., multiplied) to represent 2,000 acres of production allowing each team to insure and market an amount of grain that is representative of a farm size in Western Kansas.

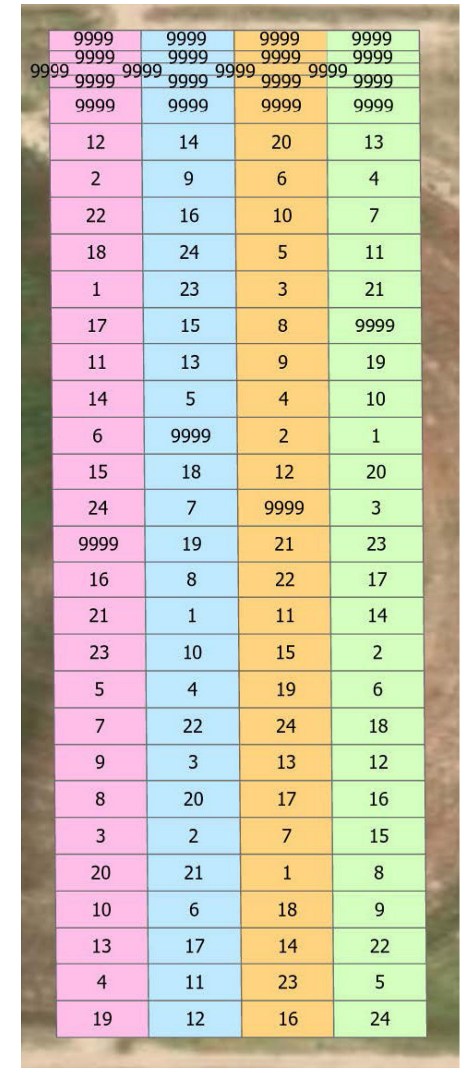


**Figure 1.** Plot map of the TAPS competition field at the Southwest Research-Extension Center in Garden City, KS, showing Farm ID labels.

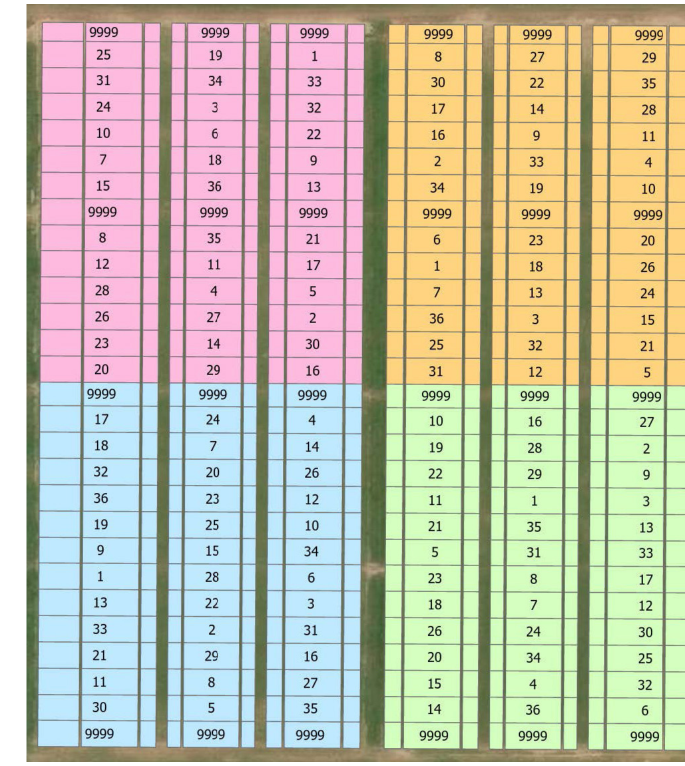


**Figure 2.** Plot map of the TAPS forage sorghum competition field at the Northwest Research-Extension Center in Colby, KS, showing Farm ID labels.

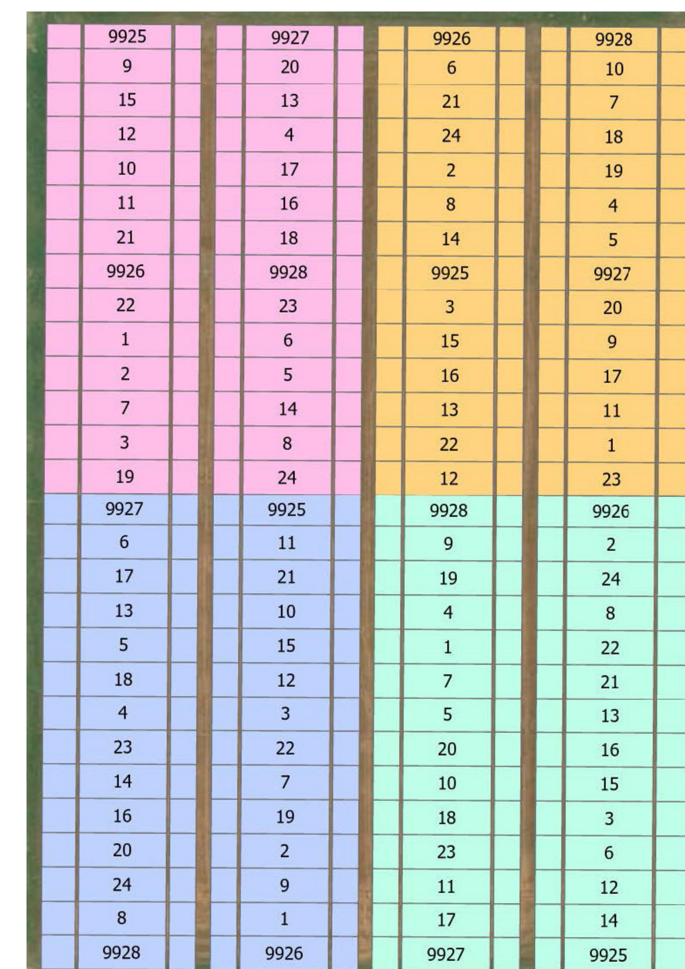


**Figure 3.** Plot map of the TAPS corn competition field at the Northwest Research-Extension Center in Colby, KS.

# **TAPS** Competitors

# Competition Overview
## *Colby*

**24**
**Teams**

**43**
**Participants**

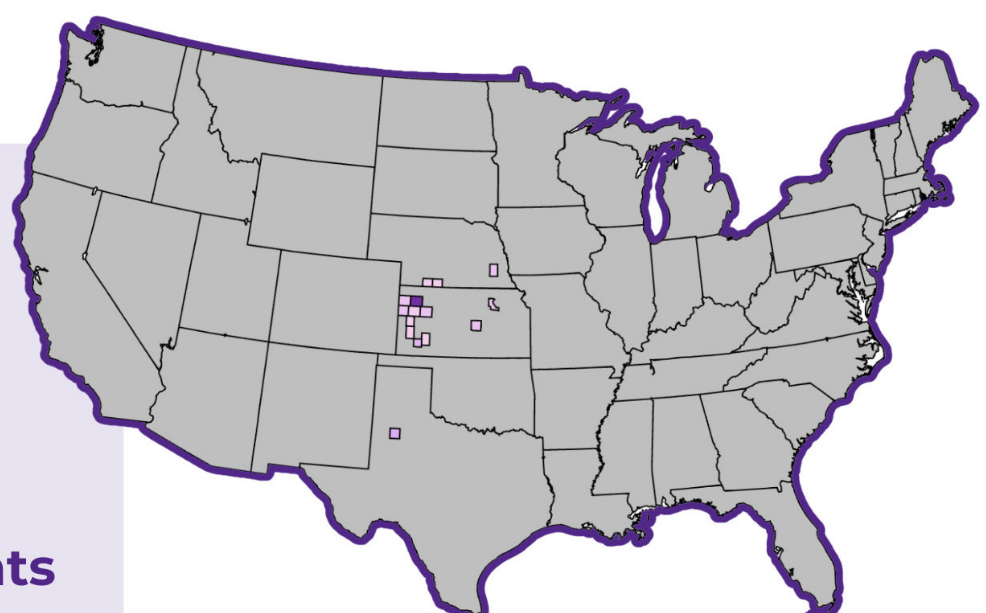

**Figure 4.** Location of participants competing in the 2025 TAPS Farm Management Competition in Colby, Kansas.

# Competition Overview
## *Garden City*

**24**
**Teams**

**55**
**Participants**

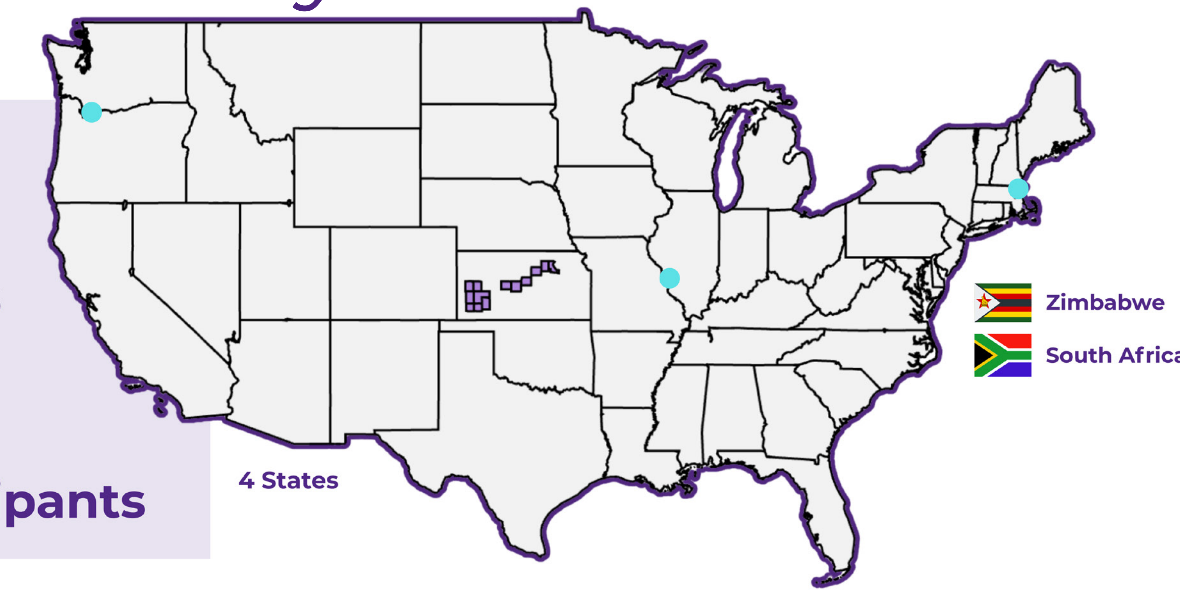


**Figure 5.** Location of participants competing in the 2025 TAPS Farm Management Competition in Garden City, Kansas.

## *TAPS Participants*

Dylan Addington
Jonathan Aguilar^
William Ast
Brent Auvermann
Brian Ballou
Eloy Baquera
Mike Barton
Leah Beaulac
Greg Bellamy
Luke Beyers
Jas Dale
Brandon Depenbusch
Craig Dinkel
Todd Downer
Troy Dumler
Ray Flicker
Ryan Flickner
Brett Forgy
Lynn Goosen
Kel Grafel
Tyler Hands
Aaron Higerd
Kent Higerd
Nick Higgason
Edmund Hilger*
Shannon Hopson
Ryan Inman
Jalen Jagels
Ryan Jagels
Thatcher Jones
Colby Kells*
Nathan Kells*
Shane Knoll
Zach Knoll
Jack Koehn*
Martin Lager
Brian Linin
Lauren Litton
Matt Long*
William Madudike
Elisa Mai
Shane Mann
Russ Martin
Lindy McMillen
Jacob Mettlen
Alex Millershaski
Daryl Millershaski
Keatlegile Mnguni
Farzam Moghbel^
Vanessa Mota
Matt Murrow
Jeremy Myers
Mark Myers
Mark Nelson
Hope Njuki Nakabuye
Dan Northrup
Rachel O'Conner
Jay Ostmeyer
Nathan Peters
Jared Petersile
James Pettz
Jennifer Pettz-Sperry
Dusty Pilger
Russell Plaschka
Jack Polifka
Garret Reiss
Val Reiss
Rocio Reyes Esteves^
Blake Richmeier
Jarrett Richmeier
Randy Richmeier
Riggs Rotenberger
Dwane Roth
Todd Roth
Troy Roth
Zion Roth
Jayson Schoenfeld
Jensen Schoenfeld
Garret Smith
Jackson Stansell*^
Ward Taylor
Jake Thompson
Luis Verla
Creek Williams
Joshua Willis
Jay Wisbey
Trevor Witt

**Denotes participants that competed in both competitions.*
*^ Denotes university and private sector farms ineligible for competitive awards.*

# TAPS Timeline

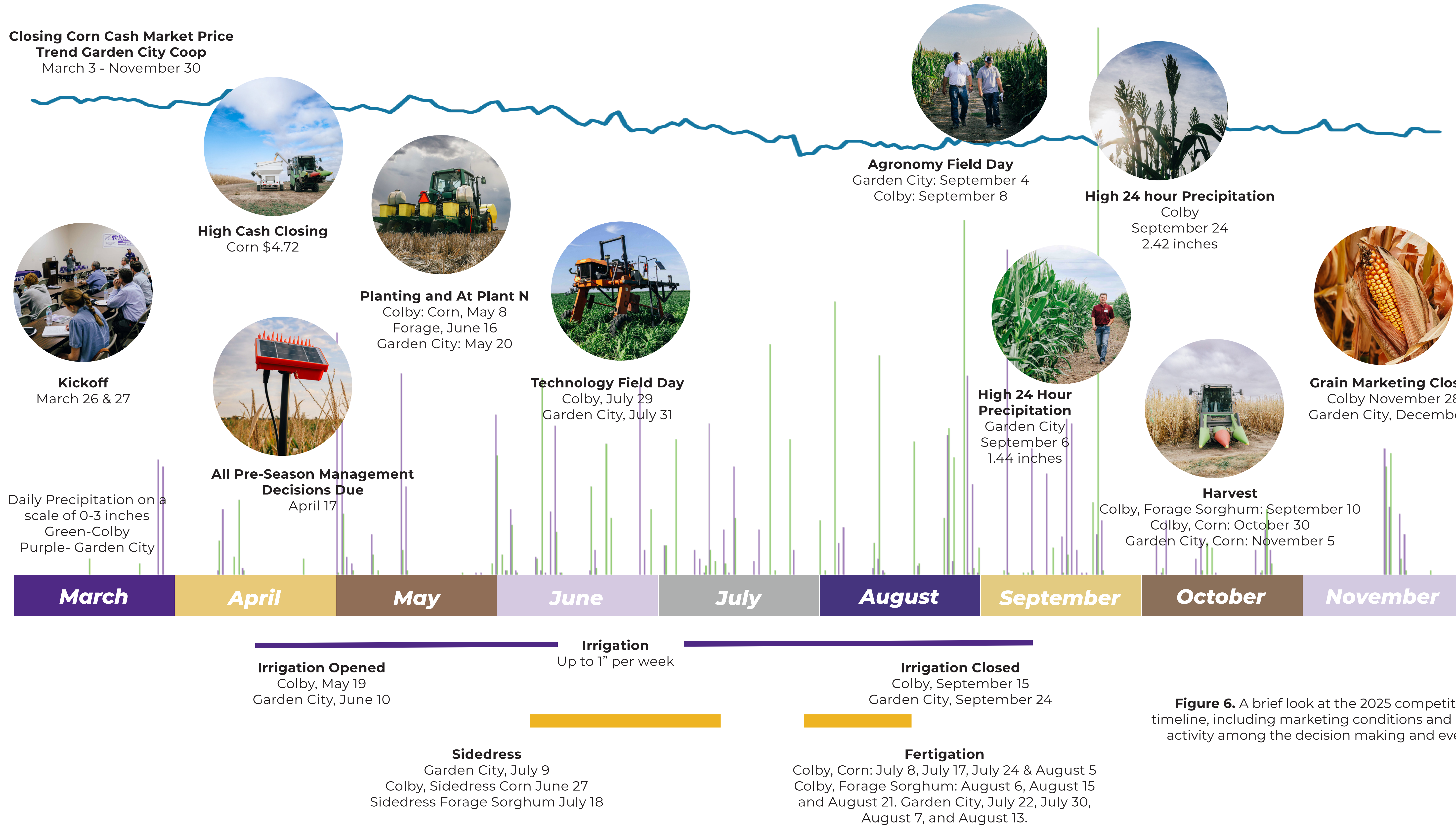


**Figure 6.** A brief look at the 2025 competition timeline, including marketing conditions and rainfall activity among the decision making and events.

# Awards

Participants were competing across four award categories: Most Economically Profitable, Highest Input Use Efficiency, Highest Forage Quality and Greatest Yield. Thanks to our partners and sponsors, winners of each category received a cash prize, and a trophy buckle presented at the awards ceremony.

***Most Economically Profitable: $2,000***

Net income calculated based on the average yield of the competitors' plots and the associated marketing, along with any necessary insurance indemnity payments.

All non-university farms were eligible for the award. Results were rounded to the nearest $0.01.

***Highest Input Use Efficiency: $2,000***

Water-Nitrogen Intensification Performance Index (WNIPI, Lo et al., 2019). Where "control" is a farm managed by K-State that received no irrigation or N fertilizer (except for a 0.5 inch irrigation for herbicide activation and starter fertilizer at the time of planting), "ET" is seasonal evapotranspiration, "I" is seasonal irrigation, "N" is total seasonal applied nitrogen, and "ANU" is aboveground nitrogen uptake. The team, excluding university, with the highest value (Colby: based on acre allocation) was determined the winner. Results were rounded to the thousandth decimal place.

$$WNIPI = \frac{\left(\frac{Y_{Farm}}{Y_{Control}} - 1\right)}{\left(1 + \frac{I_{Farm}}{ET_{Control}}\right) \times \left(1 + \frac{N_{Farm}}{ANU_{Control}}\right)}$$

**Highest Forage Quality (NWREC-Colby only): $500**

Forage Quality was determined as the farm with the lowest Neutral Detergent Fiber (NDF, dry basis). All non-university farms were eligible for the award. Results were rounded to the nearest hundredth decimal place.

***Greatest Yield: $500 maximum***

Greatest Yield (maximum $500) awarded for each crop —corn and forage sorghum in Colby and corn in Garden City. Awards were scaled based on the least and most profitable farms within each competition. All non-university farms were eligible. Results were rounded to the nearest 0.01 bushels/acre for corn and 0.01 tons/acre for forage sorghum.

Dear TAPS Participants and Farm Partners,

Thank you for your involvement in the Testing Ag Performance Solutions (TAPS) program.

Your willingness to share your time, experience and management decisions makes this program possible. TAPS works because producers are directly engaged — not just as audiences, but as collaborators. The information generated through the competition helps researchers ask better questions, helps students understand agriculture more clearly, and helps fellow producers evaluate practices and technologies in a practical way.

Water management, input costs and long-term profitability are real challenges across Kansas and the High Plains. Through TAPS, we are able to work on these issues together, using applied research and real management decisions to produce useful knowledge for farms and rural communities.

On behalf of the Kansas State University College of Agriculture, I appreciate your partnership and your commitment to improving agriculture for the next generation.

Sincerely,

Dan Moser
Interim Eldon Gideon Dean, College of Agriculture
Kansas State University

# TAPS Partners and Sponsors

We are grateful for the partners and sponsors who continue to invest in TAPS and the people who make this program work. Their support helps keep these competitions farmer-driven, data focused, and grounded in real-world decision-making. Because of their commitment, TAPS remains a place to test ideas, evaluate risk, and learn from one another under real conditions. We appreciate the trust, collaboration, and shared commitment to building profitable farming systems for the future.

axis seed — Red Barn Enterprises
Channel
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HOEGEMEYER — THE RIGHT SEED
PIONEER
BREVANT seeds
DEKALB
Golden Harvest
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Precision Planting
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Western Kansas Irrigation, Inc. — Valley
LINDSAY CORPORATION
Vand WATER — Sustainable Solutions
syngenta
AGRI-INJECT
N-TIME
Veris technologies
AIMX Irrigation Solutions, Inc
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SORGHUM CHECKOFF
KANSAS GRAIN SORGHUM — Growers Working Together
Farm Credit of Western Kansas
TAPS
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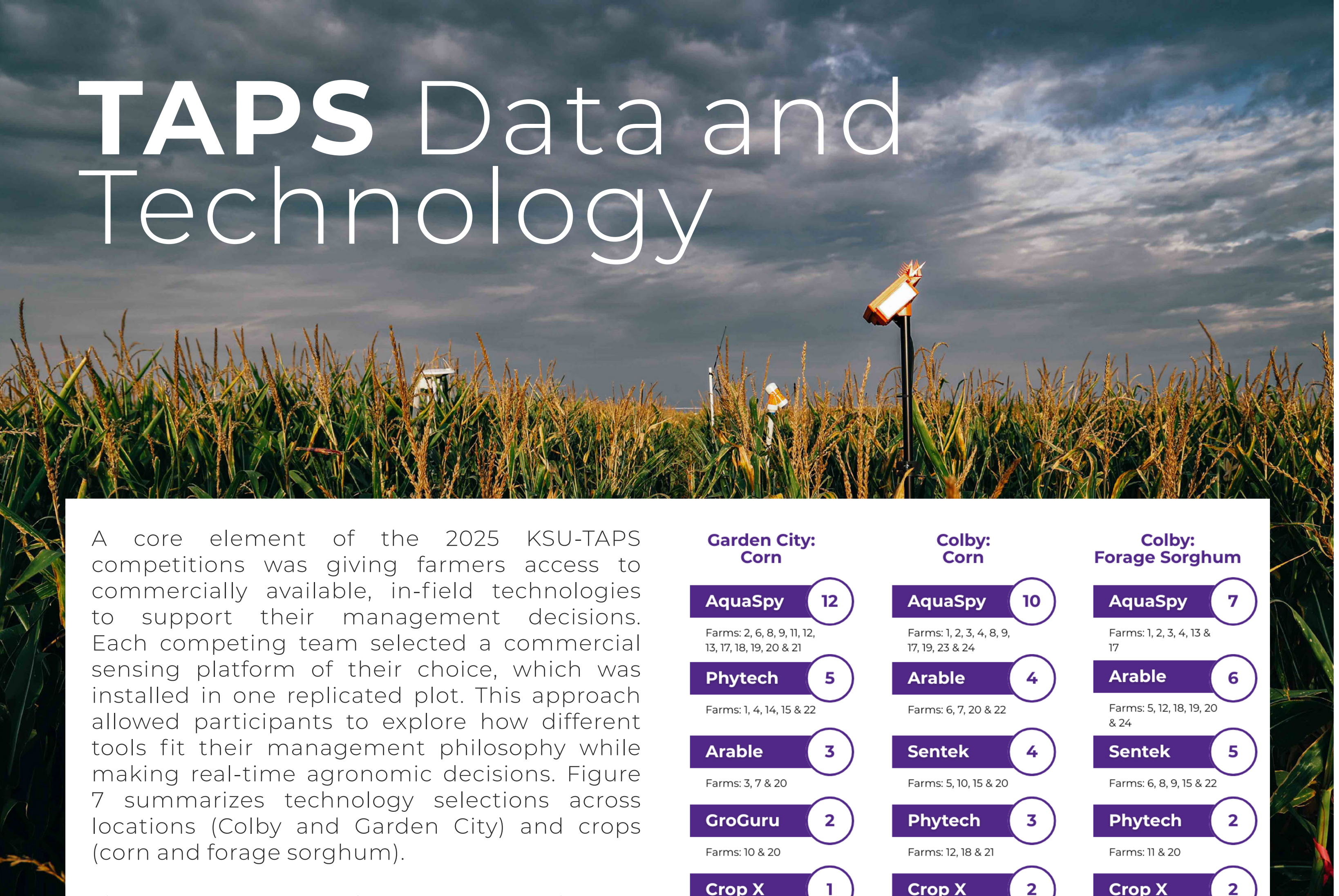
Kansas Water Office — AD ASTRA PER ASPERA
K-STATE Research and Extension — Western Kansas Research-Extension Centers
KCARE — Kansas Center for Agricultural Resources and the Environment

# TAPS Data and Technology



A core element of the 2025 KSU-TAPS competitions was giving farmers access to commercially available, in-field technologies to support their management decisions. Each competing team selected a commercial sensing platform of their choice, which was installed in one replicated plot. This approach allowed participants to explore how different tools fit their management philosophy while making real-time agronomic decisions. Figure 7 summarizes technology selections across locations (Colby and Garden City) and crops (corn and forage sorghum).

| Garden City: Corn | | | Colby: Corn | | | Colby: Forage Sorghum | | |
|---|---|---|---|---|---|---|---|---|
| AquaSpy | 12 | Farms: 2, 6, 8, 9, 11, 12, 13, 17, 18, 19, 20 & 21 | AquaSpy | 10 | Farms: 1, 2, 3, 4, 8, 9, 17, 19, 23 & 24 | AquaSpy | 7 | Farms: 1, 2, 3, 4, 13 & 17 |
| Phytech | 5 | Farms: 1, 4, 14, 15 & 22 | Arable | 4 | Farms: 6, 7, 20 & 22 | Arable | 6 | Farms: 5, 12, 18, 19, 20 & 24 |
| Arable | 3 | Farms: 3, 7 & 20 | Sentek | 4 | Farms: 5, 10, 15 & 20 | Sentek | 5 | Farms: 6, 8, 9, 15 & 22 |
| GroGuru | 2 | Farms: 10 & 20 | Phytech | 3 | Farms: 12, 18 & 21 | Phytech | 2 | Farms: 11 & 20 |
| Crop X | 1 | Farm: 5 | Crop X | 2 | Farms: 13 & 20 | Crop X | 2 | Farms: 14 & 21 |
| Sentek | 1 | Farm: 23 | GroGuru | 2 | Farms: 11 & 14 | GroGuru | 2 | Farms: 7 & 10 |

**Figure 7.** Technology selected by competing farms for Colby and Garden City sites.

The commercial technologies available to participants included both soil-based and plant-based sensing systems. Soil moisture platforms such as AquaSpy, Sentek, CropX, and GroGuru, provided insight into root zone water conditions to support irrigation timing and depth decisions. Plant-focused systems, including Arable Mark III and Phytech, offered additional perspectives on crop condition by integrating weather information and plant response signals. All participant-selected technologies delivered information through manufacturer dashboards, giving farms accessible, field level data to inform in-season decisions.

In addition to commercial sensing tools, participants were provided with baseline field information to support early-season planning. Pre-season soil samples were collected at both locations, aggregated by block, and shared with farms to characterize residual nutrient levels. Participants also had access throughout the season to local weather data from the Kansas Mesonet, which provided regional context for rainfall, temperature, and evaporative demand.

The TAPS program collected additional field data to support post-season evaluation, interpretation of results, and award determination. At the Colby location, soil water content was measured regularly using a field-calibrated CPN Neutron Moisture Meter (Instrotek) to a depth of eight feet. These measurements were used to quantify root-zone water availability and to estimate plot-level crop evapotranspiration (ET) using a soil water balance (SWB) model. End-of-season biomass sampling was conducted at all locations and for all crops to assess nitrogen uptake and, for forage sorghum, key quality parameters.

To document spatial variability and provide visual context, multispectral imagery was collected at both locations using drones at selected times during the season (Figure 8). At Colby, additional sensing was conducted with a high-clearance platform equipped with canopy reflectance and temperature sensors (Figure 9).



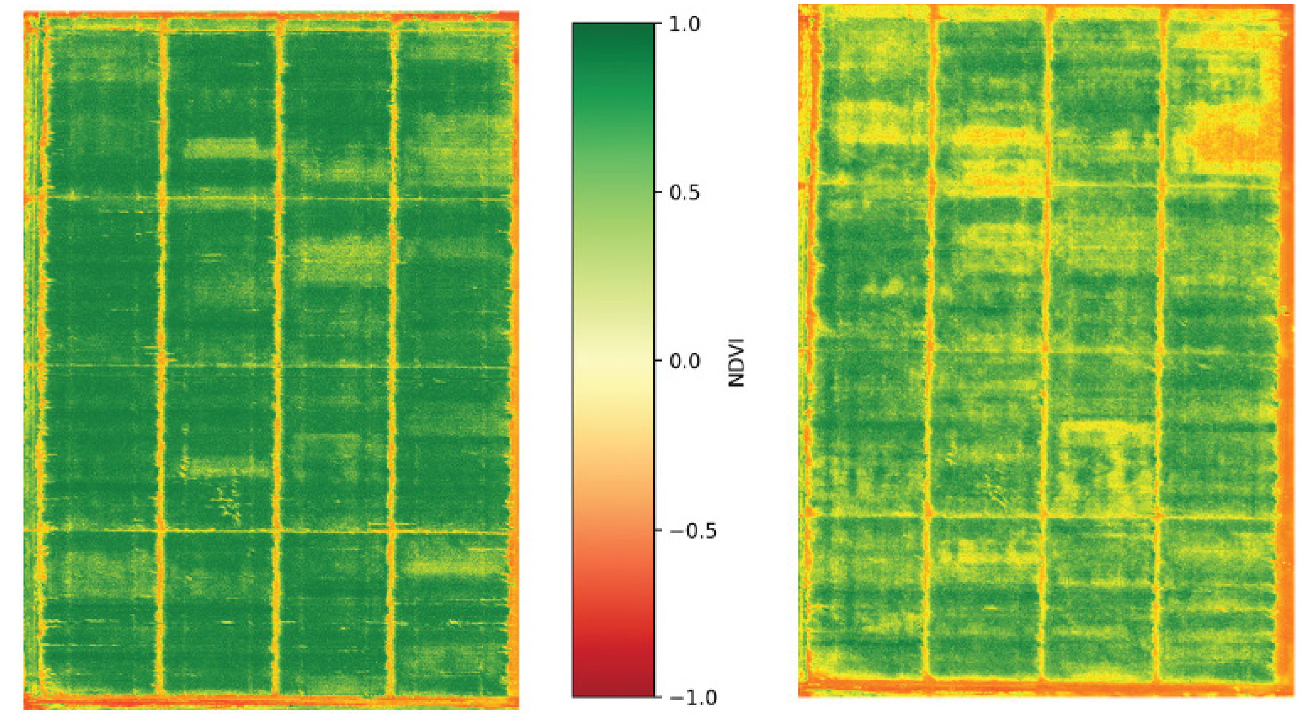



**Figure 8.** Spatial map of the KSU-TAPS Corn field in Colby, KS. The left panel shows conditions on August 20, 2025, and the right panel shows conditions on September 26, 2025.

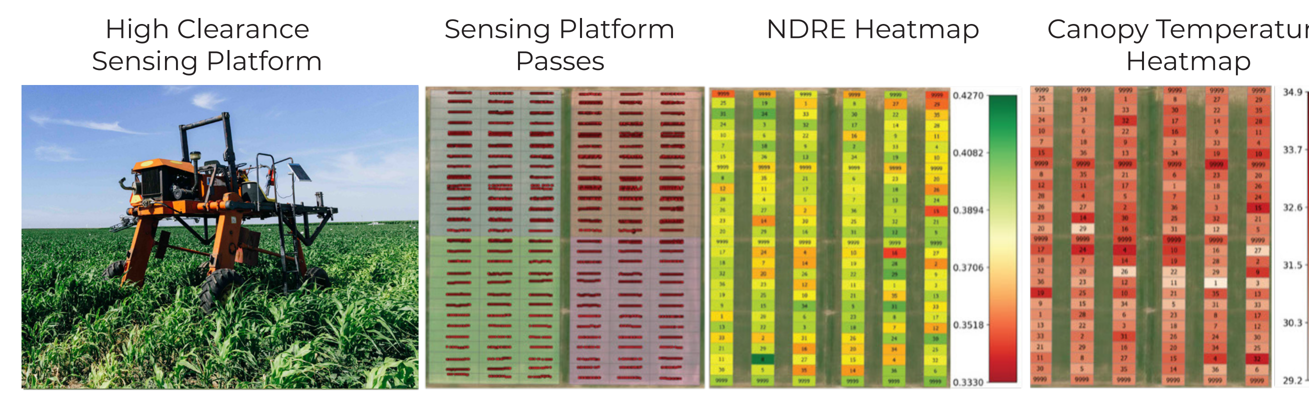



**Figure 9.** Reflectance data (NDRE) and canopy temperature (Tc) collected by a high clearance sensing platform from forage sorghum in Colby on August 18, 2025.

**Figure 10.** Photograph of the TAPS forage competition plots displaying several of the technology options selected by competing farms.

# Growing Conditions and Field History

## Experimental Layout and Initial Soil Water Status

The TAPS Corn and Forage Sorghum Water Allocation Competition was conducted at the Kansas State University Northwest Research-Extension Center in Colby, Kansas, within Kansas Groundwater Management District No. 4. The competition included two separate experimental layouts—one for corn and one for forage sorghum—in which farms were assigned four randomized plots arranged in a randomized complete block design (Figure 11). Both crops were managed under the same irrigation system but were established in areas with differing field histories. Commercial technologies selected by each Farm were placed in Block I. Each plot included buffer rows on the outer edges, reference rows for calibration and comparison, and harvested center rows to ensure yield measurements reflected treatment effects rather than border influence (Figure 12).

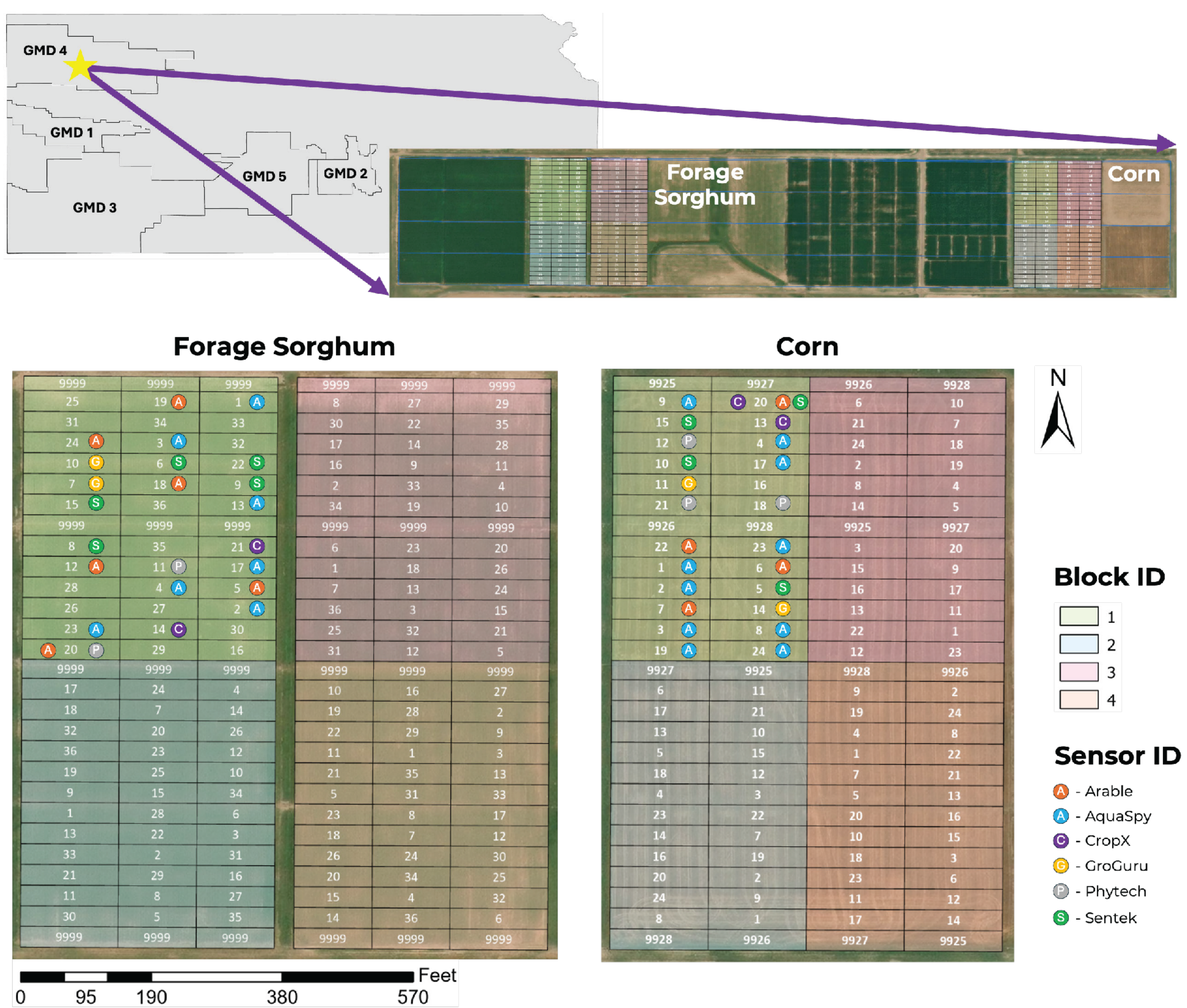



**Figure 11.** Forage sorghum and corn competition plot layout at the Kansas State University Northwest Research-Extension Center in Colby, Kansas, located within Kansas Groundwater Management District 4. Plots were located under a Valley variable-rate linear-move irrigation system. The map also depicts the locations of commercial technologies.



The predominant soil type at the site was Keith silt loam with a slope of 0 to 1%. Table 1 summarizes soil textural and hydraulic properties averaged across nine replications within the eight-foot soil profile. Estimated available water-holding capacity (AWHC), defined as plant-available water, ranged from 2.03 to 2.26 inches per foot. Percent depletion of AWHC measured the day after corn emergence (May 16, 2025) was 13, 36, 52, 67, 70, 70, 69, and 60% from 1 to 8 ft, respectively, in 1-ft increments (Figure 13). A 50% depletion of AWHC, commonly referred to as maximum allowable depletion (MAD), is generally considered yield-limiting.

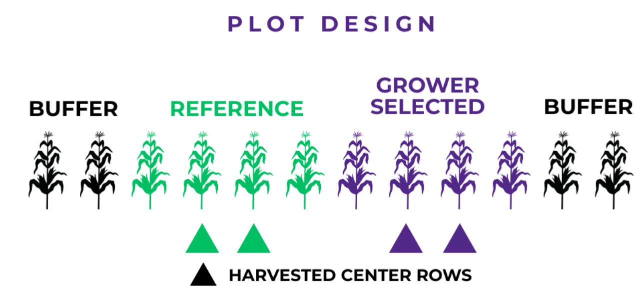



**Figure 12.** Conceptual layout of the TAPS plot design showing buffer rows, reference rows, and grower-selected treatment rows. Buffer rows were used to minimize edge effects, reference rows provided a consistent comparison across plots, and yield data were collected from the harvested center rows to ensure accurate evaluation of treatment performance.

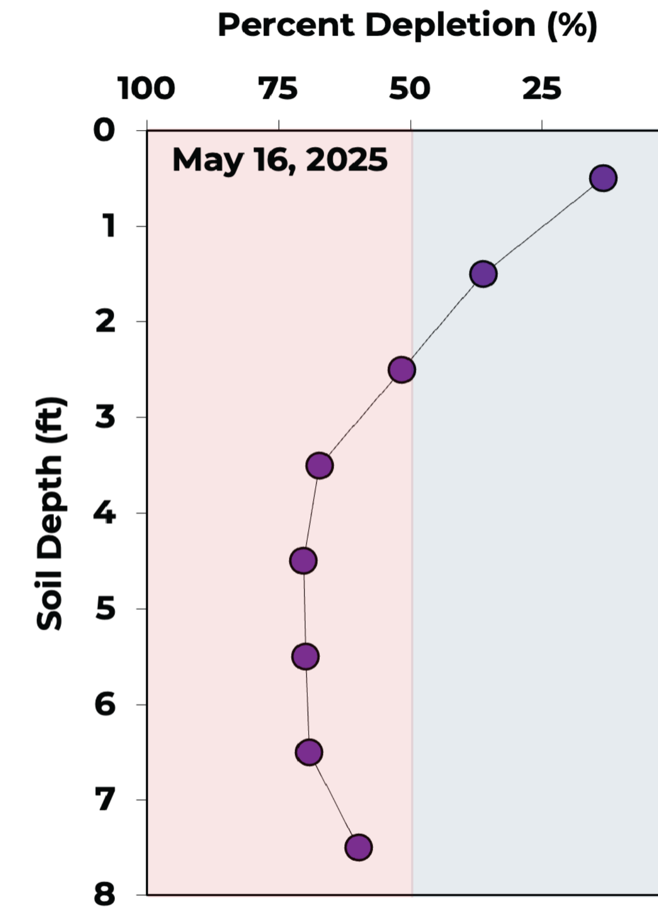



**Figure 13.** Percent depletion of soil available water holding capacity (AWHC) collected on May 16, 2025. Data represents the average of four replications collected across the TAPS corn field.

**Table 1.** Physical and hydraulic soil properties were measured within the competition area. Organic matter content (OMC) and textural composition were analyzed by a commercial laboratory (ServiTech, Inc., Garden City, KS). Field capacity (FC) and permanent wilting point (PWP) were estimated using the algorithm described by Saxton and Rawls (2006).

| Depth (inches) | OMC (%) | Sand, % (%) | Silt, % (%) | Clay, % (%) | FC ($in^3\ in^{-3}$) | PWP ($in^3\ in^{-3}$) | AWHC (in/ft) |
|---|---|---|---|---|---|---|---|
| 0 - 12 | 1.9 | 21.2 | 54.7 | 24.1 | 0.326 | 0.155 | 2.05 |
| 12 - 24 | 1.1 | 18.9 | 55.5 | 25.5 | 0.329 | 0.160 | 2.03 |
| 24 - 36 | 1.0 | 19.7 | 59.0 | 21.3 | 0.312 | 0.136 | 2.10 |
| 36 - 48 | 0.9 | 21.3 | 61.9 | 16.8 | 0.290 | 0.110 | 2.15 |
| 48 - 60 | 0.8 | 21.6 | 63.8 | 14.6 | 0.281 | 0.098 | 2.19 |
| 60 - 72 | 0.8 | 21.6 | 64.6 | 13.8 | 0.278 | 0.093 | 2.21 |
| 72 – 84 | 0.8 | 21.6 | 64.9 | 13.6 | 0.277 | 0.092 | 2.22 |
| 84 - 96 | 0.8 | 21.6 | 66.9 | 11.5 | 0.268 | 0.080 | 2.26 |

## Rainfall Timing, Atmospheric Demand, and ET Response

Daily rainfall for 2025 is shown along with cumulative rainfall from April 1 to October 31 for 2024, 2025, and the long-term average (2010–2025) in Figure 14. The 2025 growing season began dry, with cumulative rainfall remaining below 2024 and the long-term average through August 1 and August 27, respectively. April and May received only 0.89 and 1.08 inches of rainfall, respectively, creating a dry period that coincided with corn and preceded forage sorghum planting. Despite total seasonal rainfall being below normal, rainfall events were relatively consistent from late May through late August. In contrast, very little rainfall was observed from August 27 to September 23, a period corresponding to corn growth stages dough (R4) to physiological maturity (R6) and forage sorghum from heading to harvest (September 10, 2025).

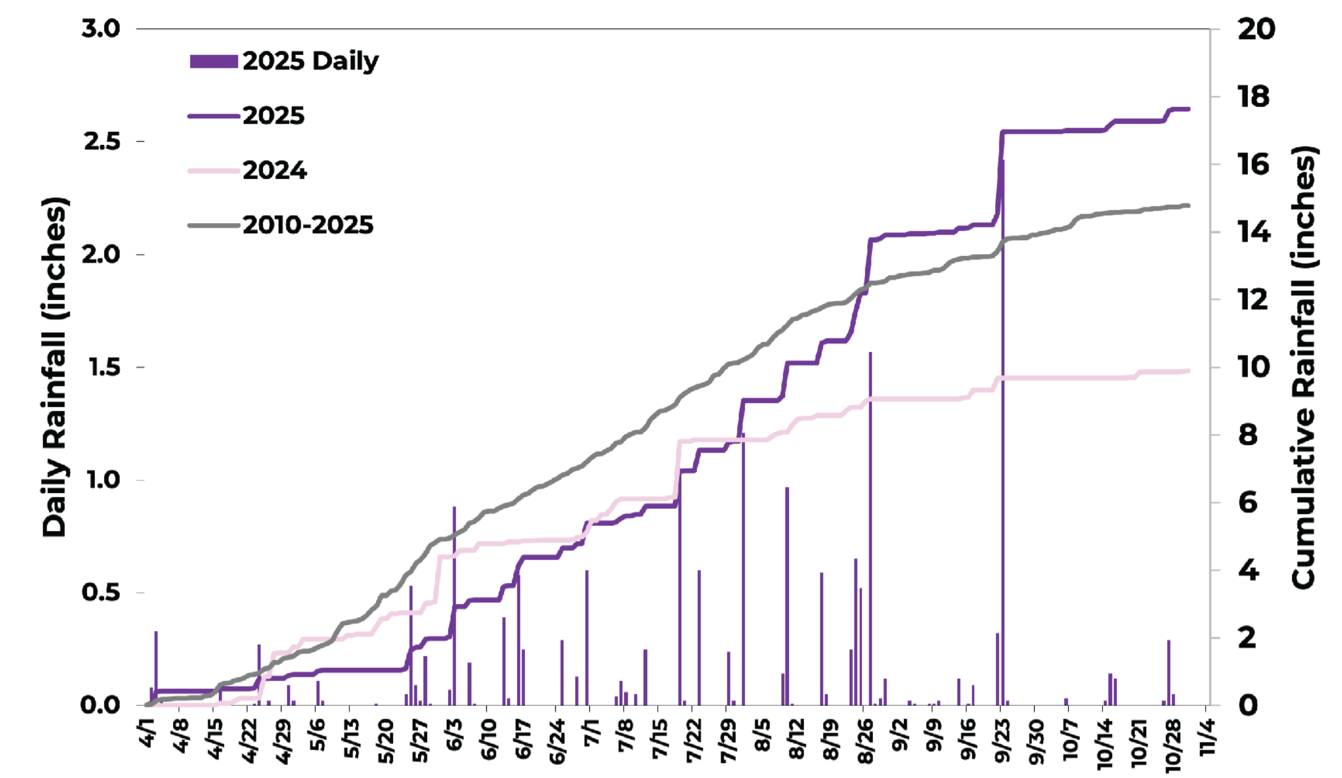



**Figure 14.** Cumulative rainfall (inches) from April 1 to October 31 for 2024, 2025, and the longterm average (2010–2025), with daily rainfall (inches) for 2025 at the Kansas State University Northwest Research-Extension Center, Colby, Kansas.

Weather conditions for the 2025 growing season and the long-term average (2010–2025) are summarized in Table 2. Overall, monthly weather conditions in 2025 were generally consistent with long-term averages for most variables, including maximum and minimum air temperature (Tmax and Tmin), relative humidity (RH), and wind speed at 2 m height (u2). Notable departures from long-term conditions included above-average precipitation during August and September; a higher average Tmin in October (45°F) compared with the long-term average (38°F); slightly elevated RH from July through October; and reduced incoming solar radiation (Rs), which was 6, 4, 5, and 12% lower than the long-term average in June, August, September, and October, respectively.

Atmospheric demand, quantified as alfalfa reference evapotranspiration (ETr) using the Penman-Monteith equation with a fixed canopy resistance (ASCE-EWRI, 2005), was highest in June, averaging 0.38 inches per day. This elevated demand was largely driven by four consecutive days (June 19–22) characterized by extreme conditions, with Tmax of 96, 103, 102, and 98°F and U2 of 12.3, 15.7, 19.2, and 22 mph, respectively. Excluding these four days, July exhibited the highest average ETr at 0.34 inches per day. Thereafter, mean daily ETr declined to 0.26, 0.25, and 0.20 inches per day for August, September, and October, respectively. Notably, a prolonged cool period from August 23 to September 7 resulted in substantially lower atmospheric demand, with ETr averaging 0.17 ± 0.07 inches per day.

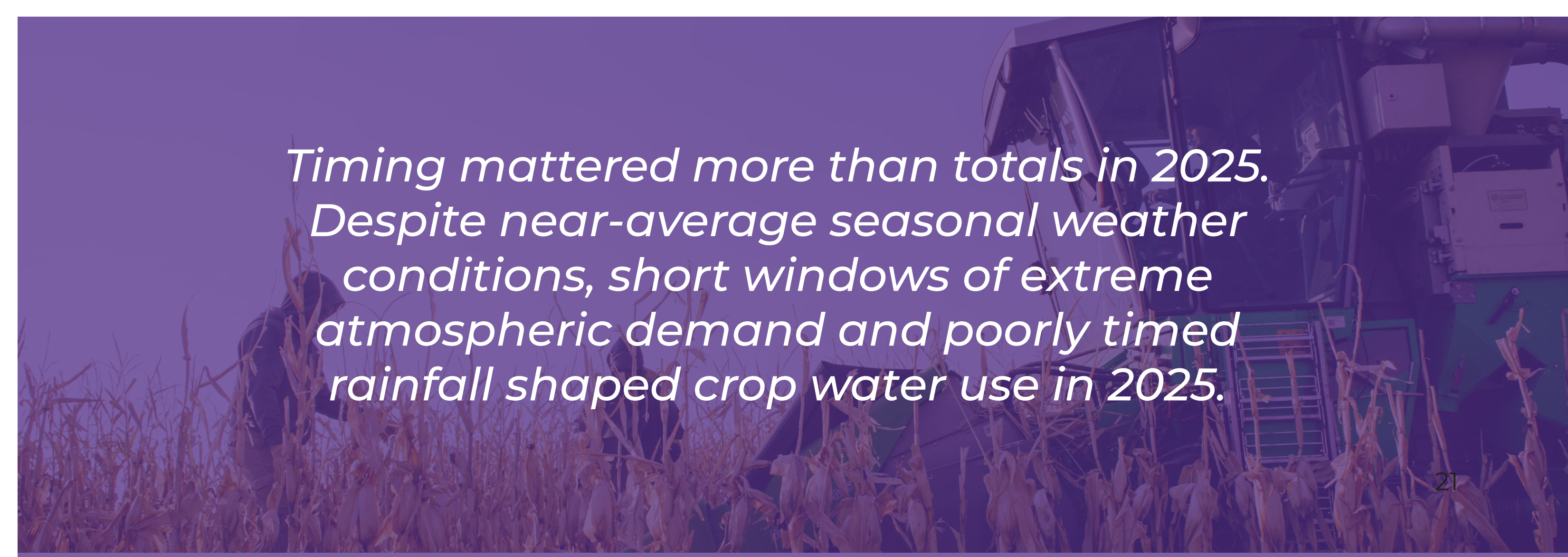


**Table 2.** Monthly average weather conditions for the 2025 growing season and long-term (2010 – 2025) measured near the experimental field at the Northwest Research-Extension Center in Colby, KS. Weather parameters include rainfall, minimum and maximum air temperature (Tmin and Tmax), average relative humidity (RHavg), wind speed at 2 m height (u2), and incoming solar radiation (Rs).

| Year | Month | Rainfall Inches | $T_{max}$ °F | $T_{min}$ °F | $RH_{avg}$ % | $u_2$ mph | $R_s$ W/m² |
|---|---|---|---|---|---|---|---|
| 2025 | April | 0.89 | 68 | 37 | 55 | 9.4 | 231 |
| | May | 1.08 | 73 | 46 | 61 | 9.1 | 249 |
| | June | 3.42 | 86 | 60 | 61 | 9.7 | 270 |
| | July | 2.41 | 90 | 64 | 65 | 7.2 | 279 |
| | August | 6.12 | 87 | 62 | 70 | 6.1 | 238 |
| | September | 3.05 | 82 | 54 | 67 | 6.2 | 198 |
| | October | 0.67 | 69 | 45 | 60 | 7.9 | 141 |
| 2010 to 2025 | April | 1.43 | 65 | 35 | 56 | 10.4 | 234 |
| | May | 3.49 | 73 | 46 | 64 | 9.1 | 251 |
| | June | 2.29 | 88 | 59 | 59 | 9.0 | 288 |
| | July | 2.93 | 90 | 64 | 61 | 7.5 | 280 |
| | August | 2.52 | 88 | 61 | 63 | 6.9 | 249 |
| | September | 1.27 | 83 | 53 | 59 | 7.5 | 208 |
| | October | 0.87 | 68 | 38 | 57 | 8.0 | 159 |

Observed corn evapotranspiration (ETa), estimated using both a soil water balance (SWB) model and the OpenET ensemble model, was evaluated relative to alfalfa reference evapotranspiration (ETr). Resulting alfalfa-based crop coefficients (Kcr) for corn and forage sorghum are presented in Figures 15 and 16, respectively. For both crops, Kcr followed the expected trapezoidal seasonal pattern of crop water use (FAO, 1998), with low values early in the season when ETa was substantially lower than ETr, a rapid increase during canopy development, relatively stable mid-season values under full canopy conditions, and a decline in ETa relative to ETr late in the season.

Mid-season SWB-derived Kcr values for forage sorghum (0.61–0.62) were slightly lower but generally consistent with the 0.70–0.75 range reported by Howell et al. (2008) for the Texas Panhandle. For corn, Kcr values derived from the OpenET and SWB approaches were comparable during the mid-season period; however, OpenET consistently overestimated corn ETa relative to the field-based SWB model during the early and late portions of the growing season. Overall, the observed Kcr values were lower than previously reported values for fully irrigated corn in the Central High Plains (Lo et al., 2019), as the broad range of irrigation applied by TAPS participants led to some plots being deficit irrigated. In addition, OpenET has a spatial resolution of 30 m × 30 m, which can introduce edge (border) effects when evaluating relatively small fields, such as the TAPS competition areas.



# Management Decisions

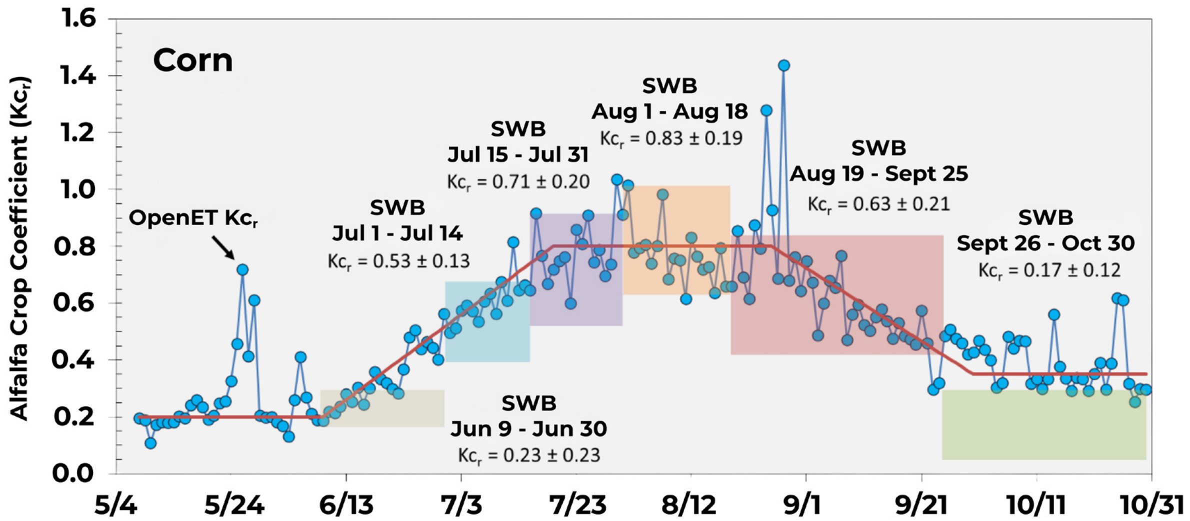



**Figure 15.** Corn crop coefficient (Kcr) relative to alfalfa reference evapotranspiration (ETr), expressed as the daily mean across all competition plots. Daily corn evapotranspiration (ET) was obtained from the OpenET ensemble model, and plot-level average (+/- standard deviation) daily corn ET was estimated using a soil water balance (SWB) model to an eight-foot soil depth.

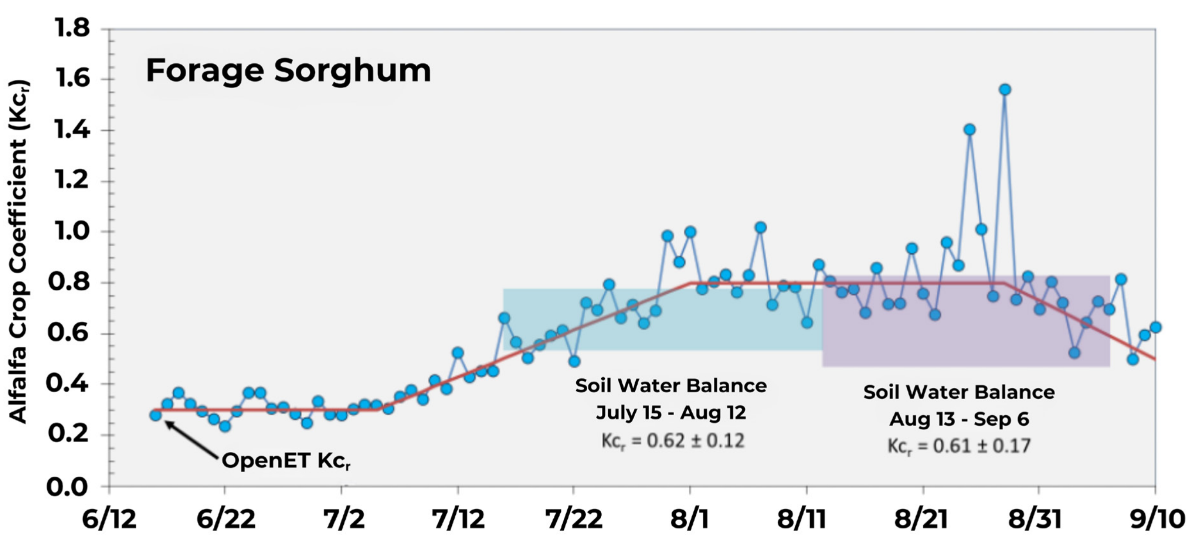



**Figure 16.** Forage Sorghum crop coefficient (Kcr) relative to alfalfa reference evapotranspiration (ETr), expressed as the daily mean across all competition plots. Daily corn evapotranspiration (ET) was obtained from the OpenET ensemble model, and plot-level average (+/- standard deviation) daily corn ET was estimated using a soil water balance (SWB) model to an eight-foot soil depth.



### Acre Allocation

The TAPS Water Allocation Farm Management Competition required each farm to allocate their 2,000 simulated acres between corn and forage sorghum, with a minimum of 250 acres planted to each crop. Corn and forage sorghum were associated with distinct farm budgets, such that acreage allocation influenced both agronomic management decisions and overall profitability. The number of farms planting 250, 500, 750, 1,000, 1,250, 1,500, and 1,750 acres of corn was 0, 0, 2, 6, 3, 6, and 7, respectively (Figure 17). Overall, most farms elected to allocate a larger proportion of their farm acres to corn; for instance, thirteen farms selected either 1,500 or 1,750 acres of corn.

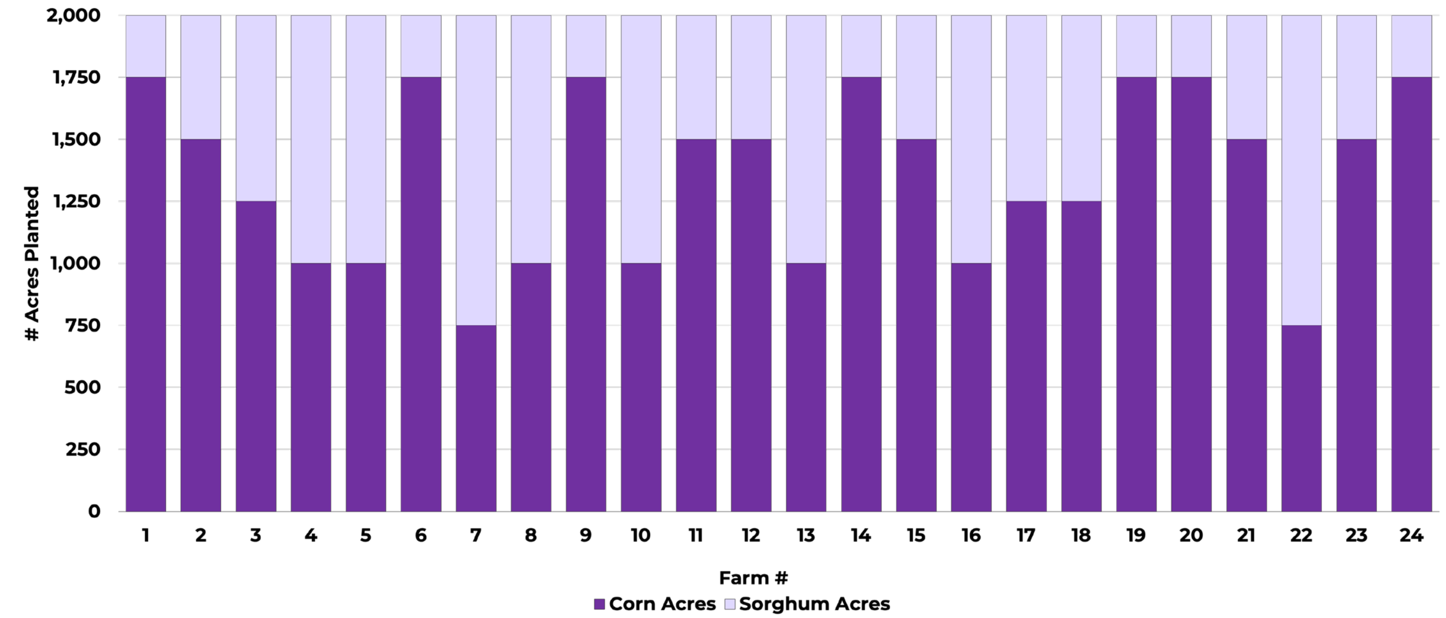



**Figure 17.** Proportion of selected crop acres as selected by participants as their acre allocation decisions. Bars represent entire farm of 2,000 acre; light purple represents sorghum acres; dark purple represents corn acres.

### Acre Allocation & Irrigation Calculations

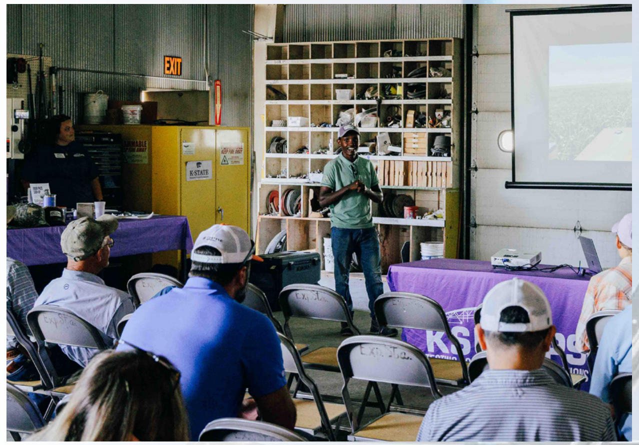
- Q-Stable, Colby, KS: 10 Inches
- Total Farm Acres: 2,000
- Total Acre-Inches: 20,000 ac. in.
- Minimum Acres: 250 acres per crop

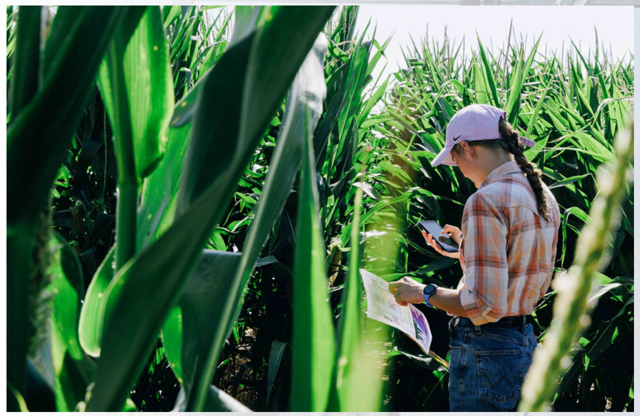
**Example Calculation:**
1,750 acres Corn • 250 acres Forage Sorghum
Desired Corn Irrigation: 11 Inches

11 inches x 1,750 acres = **19,250 ac. in.**
20,000 (total) - 19,520 = **750 ac. in.**
750 ac. in. / 250 ac. FS = **3 inches**

This illustrates allocation of limited irrigation water using an acre-inch framework. In this example, the Q-Stable at Colby, Kansas includes 2,000 total acres with a seasonal allocation of 10 inches, or 20,000 total acre-inches.

The farm plants 1,750 acres of corn and 250 acres of forage sorghum, meeting minimum acreage requirements. Targeting 11 inches of irrigation on corn uses 19,250 acre-inches, leaving 750 acre-inches for forage sorghum. When distributed across 250 acres, this results in 3 inches of irrigation available for forage sorghum. The example demonstrates how crop acreage and irrigation targets for one crop directly affect water availability for others under a fixed allocation.





## Crop Insurance

Excluding the control, each farm was required to select a multi-peril crop insurance (MCPI) policy for all corn acres (Figure 18). Three policy types were offered at coverage levels of 65%, 70%, 75%, 80%, or 85%: Revenue Protection (RP), Revenue Protection with Harvest Price Exclusion (RPHPE), and Yield Protection (YP). Policies were available at both the optional unit (OU) and enterprise unit (EU) levels, based on an Average Production History (APH) of 190 bushels per acre and a February price guarantee of $4.70 per bushel (USDA RMA). Insurance premiums were provided by the USDA Risk Management Agency.

There was a clear preference for RP-EU selected by seventeen farms. RPHPE-EU was selected by two farms. RP-OU, RPHPE-OU, YP-EU, and YP-OU were each selected by one farm. The most common coverage level was 75%, chosen by ten farms, followed by 65% (seven farms), 80% (three farms), 70% (two farms), and 85% (one farm). This resulted in an average cost of $9.73 per acre, ranging from a high of $29.73 per acre (Farm 3) to a low of $2.78/acre (Farm 21).

Due to better-than-average rainfall and generally favorable growing conditions, indemnity payments of $316.88 and $387.60 per acre for Farms 14 and 15, respectively.

These payments were associated with management challenges, including missed irrigation and nitrogen decisions, which affected overall production outcomes rather than weather-related losses.

Due to competition parameters, crop insurance was not considered for forage sorghum.

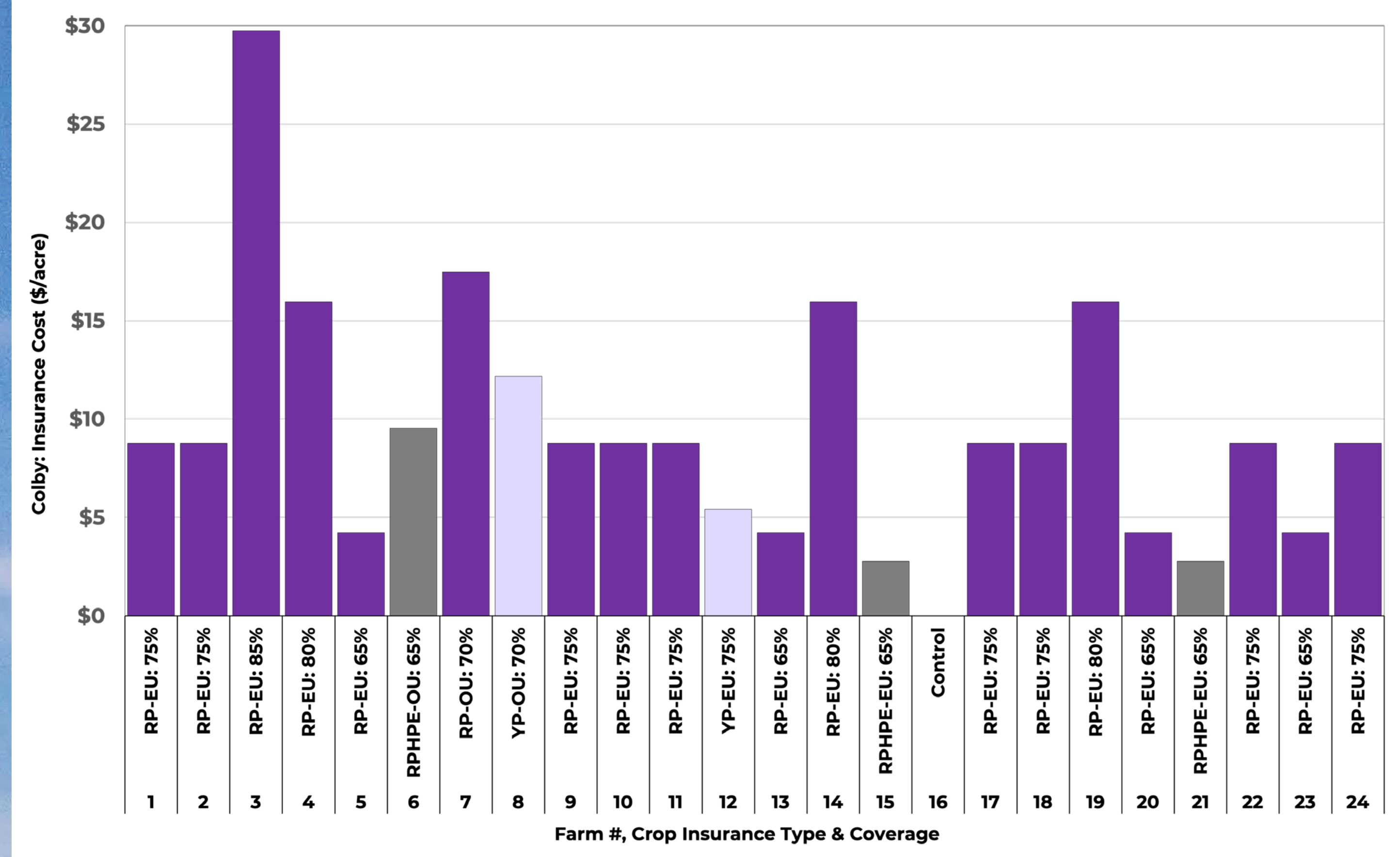



**Figure 18:** Crop insurance type, coverage, and costs ($/acre) for the TAPS Farms in Colby, KS. RP is Revenue Protection, YP is Yield Protection, RPHPE is Revenue Protection Harvest Price Exclusion, EU is Enterprise Units, and OU is Optional Units.

# **Hybrid** and Seeding Rate

Corn was planted into wheat stubble at 30 inch row spacing and a seeding depth of 2.25 inches on May 8, 2025, for all farms using a four-row precision planter (Precision Planting). Seventeen unique corn hybrids were planted in the TAPS competition (Table 3).

Relative maturities (RM) of the selected hybrids ranged from 100 days for Pioneer P00549 to 114 days for Dekalb DKC 114-43, with the majority of most hybrids having a relative maturity of 112 days. The most selected hybrid was Channel 212-02VT2PRIB, which was chosen by four farms (Farms 1, 2, 22, and 24).

Selected seeding rates ranged from 19,000 to 30,000 seeds per acre, with an average of 25,000 seeds per acre. Among competing producer farms, the most common seeding rate was 24,000 followed by 28,000 seeds per acre. In addition, a reference hybrid, Brevant B04Z92AM, was planted adjacent to the grower-selected hybrid within each plot.

The price of an 80,000-seed bag ranged from $250.00 for Dyna-Gro D50VC09 to $357.00 for Pioneer P12517V. Across the seventeen hybrids, the average bag cost was $301.24, with four hybrids exceeding $320 per bag. When accounting for seeding rate, seed cost per acre ranged from $68.75 to $120.00, with an average of $93.32. Seven of the twenty-four farms exceeded a seed cost of $100 per acre. Given that farms allocated between 750 and 1,750 acres to corn, total corn seed costs ranged from $70,444 (Farm 7) to $210,000 (Farm 14).

**Table 3.** Corn acre allocation, seeding rate, and seed cost by farm in the TAPS Water Allocation Farm Management Competition.

| Farm ID | Allocated Acres | Hybrid Company | RM (Days) | Seeding (x1,000/ac) | Cost/ac ($/ac) | Farm Cost ($) |
|---|---|---|---|---|---|---|
| 1 | 1,750 | Channel 212-02VT2PRIB | 112 | 28 | $101.15 | $177,013 |
| 2 | 1,500 | Channel 212-02VT2PRIB | 112 | 24 | $86.70 | $130,050 |
| 3 | 1,250 | Agrigold A643-52 | 113 | 24 | $91.50 | $114,375 |
| 4 | 1,000 | Dekalb DKC 56-26 | 106 | 22 | $80.58 | $80,575 |
| 5 | 1,000 | Axis 62C60 | 112 | 27 | $94.16 | $94,163 |
| 6 | 1,750 | Pioneer P12904AML | 112* | 23 | $92.86 | $162,509 |
| 7 | 750 | Dekalb DKC 62-69 | 112 | 26 | $93.93 | $70,444 |
| 8 | 1,000 | Pioneer P12517V | 112* | 22 | $98.18 | $98,175 |
| 9 | 1,750 | Dekalb DKC 62-69 | 112 | 25 | $90.31 | $158,047 |
| 10 | 1,000 | Dekalb DKC 108-64 | 108 | 24 | $94.20 | $94,200 |
| 11 | 1,500 | Dekalb DKC 108-64 | 108 | 28 | $109.90 | $164,850 |
| 12 | 1,500 | Dyna-Gro D50VC09 | 110 | 22 | $68.75 | $103,125 |
| 13 | 1,000 | Dekalb DKC 114-43 | 114 | 24 | $96.00 | $96,000 |
| 14 | 1,750 | Dekalb DKC 114-43 | 114 | 30 | $120.00 | $210,000 |
| 15 | 1,500 | Dyna-Gro D45SP33 | 105 | 24 | $87.00 | $130,500 |
| 16 | 1,000 | Brevant B04Z92AM | 104 | 28 | $92.75 | $92,750 |
| 17 | 1,250 | Dekalb DKC 61-80 | 111 | 23 | $73.89 | $92,359 |
| 18 | 1,250 | Pioneer P13777PCE | 113* | 26 | $112.45 | $140,563 |
| 19 | 1,750 | Pioneer P00549 | 100* | 19 | $74.81 | $130,922 |
| 20 | 1,750 | Brevant B13Z51 | 113 | 22 | $84.43 | $147,744 |
| 21 | 1,500 | Beck's 6258 V4P | 112 | 25 | $100.63 | $150,938 |
| 22 | 750 | Channel 212-02VT2PRIB | 112 | 28 | $101.15 | $75,863 |
| 23 | 1,500 | Brevant B04Z92AM | 104 | 28 | $92.75 | $139,125 |
| 24 | 1,750 | Channel 212-02VT2PRIB | 112 | 28 | $101.15 | $177,013 |



The forage sorghum hybrid Channel NutriChoice II was planted into corn residue at 30-inch row spacing and a seeding depth of 1.5 inches on June 16, 2025, for all farms using a four-row precision planter (Precision Planting). The Nutri-Choice II hybrid is a medium-full maturity with 80 days to flower. Seeding rates were selected individually by each farm and ranged from 45,000 to 100,000 seeds per acre, with an average of 71,708 seeds per acre (Table 4). The majority of farms (18 of 24) selected seeding rates between 60,000 and 75,000 seeds per acre.

The cost of forage sorghum seed was $80 per bag (1,200,000 seeds per bag), resulting in a seed cost per acre ranging from $3.00 to $6.67, with an average of $4.79. Based on allocated acreage, total forage sorghum seed costs ranged from $1,000 to $7,083, with an average of $3,050. In contrast to corn, total forage sorghum seed costs represented less than 1% to 10.1% of the corresponding corn seed expense across farms.

**Table 4.** Forage Sorghum acre allocation, seeding rate, and seed cost by farm in the TAPS Water Allocation Farm Management Competition.

| Farm ID | Allocated Acres | Seeding (x1,000/ac) | Cost/ac ($/ac) | Farm Cost ($) |
|---|---|---|---|---|
| 1 | 250 | 65 | $4.33 | $1,083 |
| 2 | 500 | 65 | $4.33 | $2,167 |
| 3 | 750 | 80 | $5.33 | $4,000 |
| 4 | 1,000 | 70 | $4.67 | $4,667 |
| 5 | 1,000 | 65 | $4.33 | $4,333 |
| 6 | 250 | 73.25 | $4.88 | $1,221 |
| 7 | 1,250 | 85 | $5.67 | $7,083 |
| 8 | 1,000 | 72.5 | $4.83 | $4,833 |
| 9 | 250 | 60 | $4.00 | $1,000 |
| 10 | 1,000 | 70 | $4.67 | $4,667 |
| 11 | 500 | 90 | $6.00 | $3,000 |
| 12 | 500 | 100 | $6.67 | $3,333 |
| 13 | 1,000 | 75 | $5.00 | $5,000 |
| 14 | 250 | 70 | $4.67 | $1,167 |
| 15 | 500 | 75 | $5.00 | $2,500 |
| 16 | 1,000 | 70 | $4.67 | $4,667 |
| 17 | 750 | 45 | $3.00 | $2,250 |
| 18 | 750 | 80 | $5.33 | $4,000 |
| 19 | 250 | 60 | $4.00 | $1,000 |
| 20 | 250 | 70 | $4.67 | $1,167 |
| 21 | 500 | 70.25 | $4.68 | $2,342 |
| 22 | 1,250 | 70 | $4.67 | $5,833 |
| 23 | 500 | 70 | $4.67 | $2,333 |
| 24 | 250 | 70 | $4.67 | $1,167 |

# Nitrogen Management

Participants were offered multiple nitrogen (N) application options throughout the growing season, including at planting banded directly behind the closing wheels and 3 inches on either side of the planted row; sidedress at V6–V7 growth stage for corn and shortly after the five leaf stage for forage sorghum using 360 Y-Drops (Precision Planting LLC); and in season fertigation using an Agri-Inject Reflex Injection Pump (Agri-Inject, Inc.) tethered to the irrigation system flow meter, with up to four fertigation events for corn and three for forage sorghum. All N fertilizer applications utilized urea ammonium nitrate (UAN 32) priced at $0.63 per lb N. In addition, all farms received a starter fertilizer application at planting consisting of 2 gal per acre of Riser and 2 gal per acre of 10-34-0, providing approximately 7 lb N per acre.

All farms applied N at the time of corn planting, with application rates ranging from 20 to 150 lb N per acre, excluding starter fertilizer (Figure 19). Relative to total seasonal N applied, the proportion applied at planting ranged from 12 to 100%, with an average of 61%. Nitrogen applied at planting had the lowest application cost ($0 per acre), as fuel and labor costs were incorporated into the planting operation. Seven farms elected to apply N fertilizer as a sidedress application on June 26, 2025, which had an application cost of $8.50 per acre. In addition, sixteen farms applied N through the irrigation system (fertigation), with an associated cost of $1.25 per application event. Three farms utilized fertigation on all eligible dates (July 8, July 17, July 22, and August 5). The number of farms electing to apply fertigation declined as the season progressed, with the highest participation occurring at the V12 growth stage (July 8) and the lowest near the dough stage (R2) on August 5.

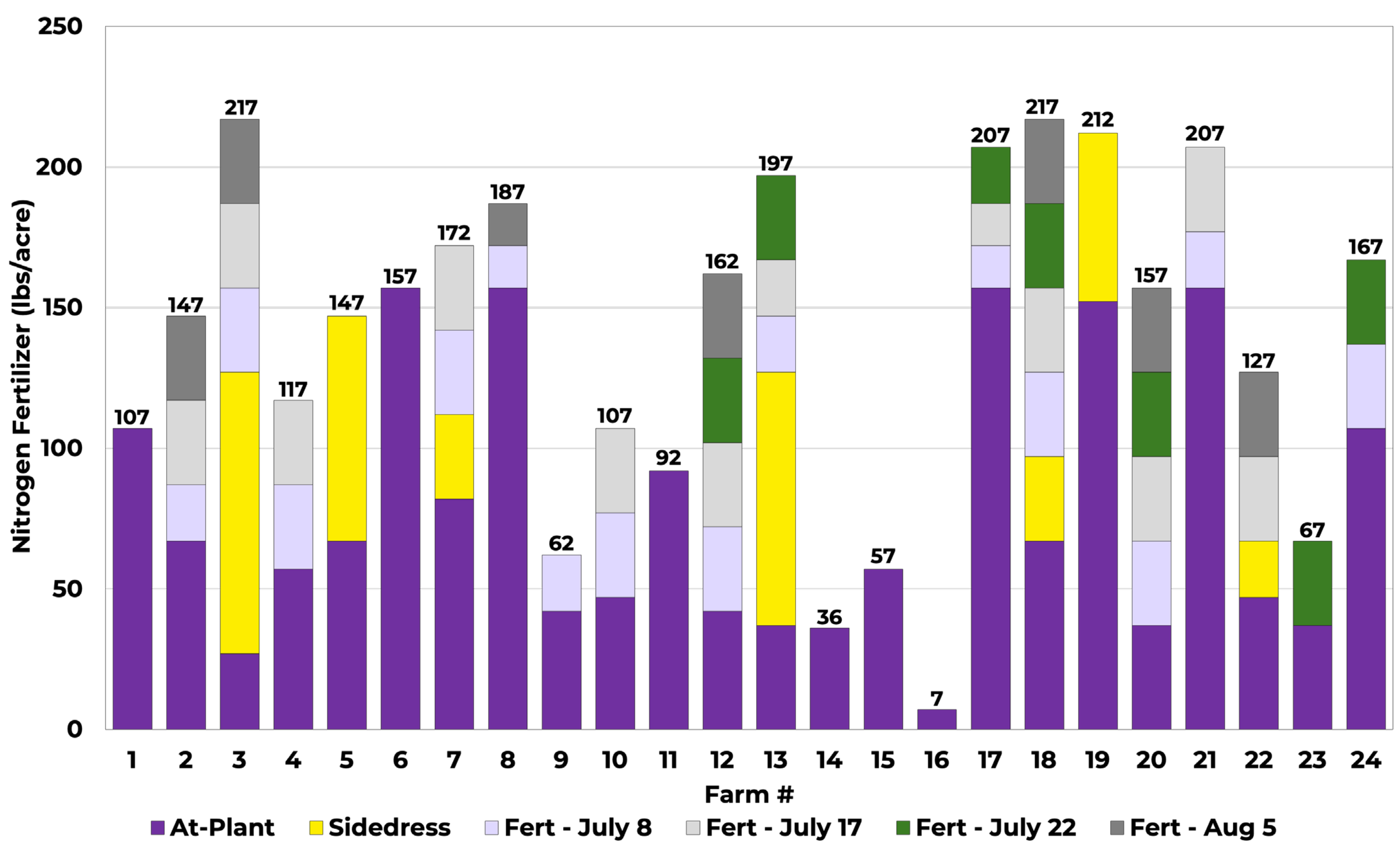



**Figure 19.** *Nitrogen (N) fertilizer applied to corn by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, KS. Application rates are expressed in lb N/acre; at-plant values include 7 lb N/acre of starter N applied in-furrow.*



Nitrogen fertilizer applied to forage sorghum by each farm is presented in Figure 20. Similar to corn, the primary timing of N application occurred at planting, with eighteen farms applying N fertilizer in addition to the starter application.

Five farms (1, 2, 14, 20, and 22), excluding the control (Farm 16), elected not to apply N fertilizer at planting, which carried an application cost of $0 per acre. Average residual nitrate-N prior to planting in the 0–8 inch and 8–24 inch soil profiles was 24 and 31 lb N per acre, respectively.

Across all farms, total N fertilizer applied to forage sorghum ranged from 0 lb N per acre (Farms 1, 2, 14, and 16) to 262 lb N per acre (Farm 18), with an average of 86 lb N per acre. As the season progressed, fewer farms elected to apply additional N fertilizer, with only two farms applying N at the boot stage on August 21, 2025.

Overall, TAPS participants applied less N fertilizer to forage sorghum compared with corn (Table 5). Consequently, a greater proportion of total farm fertilizer expenditures was associated with corn production. Total fertilizer costs, including starter fertilizer and excluding the control, ranged from $66,973 (Farm 14) to $345,988 (Farm 18).

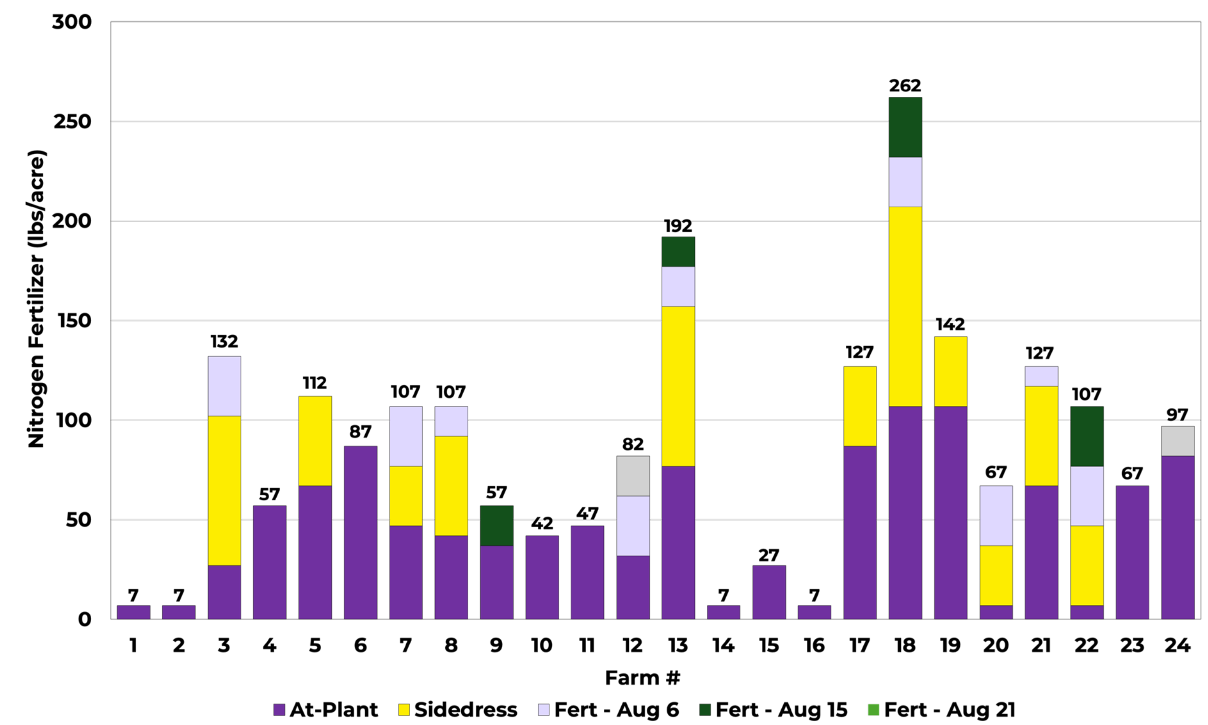



**Figure 20.** Nitrogen (N) fertilizer applied to forage sorghum by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, KS. Application rates are expressed in lb N/acre; at-plant values include 7 lb N/acre of starter N applied in-furrow.

**Table 5.** Nitrogen (N) fertilizer applied by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, KS. Application rates are expressed in lb N/acre; at-plant values include 7 lb N/acre of starter N applied in-furrow.

| | Corn | | | Forage Sorghum | | | |
|---|---|---|---|---|---|---|---|
| Farm ID | Nitrogen (lbs/ac) | Cost ($/ac) | Total Cost ($) | Nitrogen (lbs/ac) | Cost ($/ac) | Total Cost ($) | Farm Cost ($) |
| 1 | 107 | $80.50 | $140,875 | 7 | $17.50 | $4,375 | $145,250 |
| 2 | 147 | $109.45 | $164,175 | 7 | $17.50 | $8,750 | $172,925 |
| 3 | 217 | $162.05 | $202,563 | 132 | $106.00 | $79,500 | $282,063 |
| 4 | 117 | $89.30 | $89,300 | 57 | $49.00 | $49,000 | $138,300 |
| 5 | 147 | $114.20 | $114,200 | 112 | $92.15 | $92,150 | $206,350 |
| 6 | 157 | $112.00 | $196,000 | 87 | $67.90 | $16,975 | $212,975 |
| 7 | 172 | $132.45 | $99,338 | 107 | $90.25 | $112,813 | $212,150 |
| 8 | 187 | $133.40 | $133,400 | 107 | $90.25 | $90,250 | $223,650 |
| 9 | 62 | $53.40 | $93,450 | 57 | $50.25 | $12,563 | $106,013 |
| 10 | 107 | $83.00 | $83,000 | 42 | $39.55 | $39,550 | $122,550 |
| 11 | 92 | $71.05 | $106,575 | 47 | $42.70 | $21,350 | $127,925 |
| 12 | 162 | $120.15 | $180,225 | 82 | $67.25 | $33,625 | $213,850 |
| 13 | 197 | $149.45 | $149,450 | 192 | $145.05 | $145,050 | $294,500 |
| 14 | 36 | $35.77 | $62,598 | 7 | $17.50 | $4,375 | $66,973 |
| 15 | 57 | $49.00 | $73,500 | 27 | $30.10 | $15,050 | $88,550 |
| 16 | 7 | $17.50 | $17,500 | 7 | $17.50 | $17,500 | $35,000 |
| 17 | 207 | $147.25 | $184,063 | 127 | $101.60 | $76,200 | $260,263 |
| 18 | 217 | $163.30 | $204,125 | 262 | $189.15 | $141,863 | $345,988 |
| 19 | 212 | $155.24 | $271,667 | 142 | $111.05 | $27,763 | $299,429 |
| 20 | 157 | $117.00 | $204,750 | 67 | $65.05 | $16,263 | $221,013 |
| 21 | 207 | $146.00 | $219,000 | 127 | $102.85 | $51,425 | $270,425 |
| 22 | 127 | $104.10 | $78,075 | 107 | $91.50 | $114,375 | $192,450 |
| 23 | 67 | $56.55 | $84,825 | 67 | $55.30 | $27,650 | $112,475 |
| 24 | 167 | $120.80 | $211,400 | 97 | $75.45 | $18,863 | $230,263 |



# Irrigation Management

Corn and forage sorghum were irrigated using a Valley variable-rate linear-move irrigation system (Valmont Industries) equipped with Nelson D3030 Sprayhead LEPA sprinklers fitted with 6-psi regulators, spaced at 5-ft intervals and mounted 36 in. above the soil surface. The system had a capacity of 2.7 gpm per acre, allowing a maximum application of 1 inch of irrigation per week for each crop. Irrigation costs included a fixed labor charge of $10.80 per acre and a variable application cost of $7.61 per applied inch to account for energy and system wear. Farms were limited to a combined Q-Stable irrigation allocation of 10 acre-inch per acre, with total irrigation calculated as a weighted average based on each farm's selected crop acreage allocation (Table 3 and 4).

Cumulative irrigation applied to corn is shown in Figure 21). All farms received a uniform 0.5inch irrigation for herbicide activation on May 9, 2025. The first discretionary irrigation for corn occurred on May 21, 2025, with five farms (Farms 1, 2, 7, 18, and 21) electing to irrigate on that date. Seasonal corn irrigation across all farms ranged from 0.5 to 13.0 inches, with a mean of 6.34 inches. Excluding Farms 14, 15, and 16, which applied no irrigation beyond the herbicide activation, the majority of irrigation occurred in July, accounting for an average of 43% of total seasonal irrigation across farms. August was the second most irrigated month, with an average of 29% of seasonal irrigation applied. June received the least amount of irrigation, with an average of 4% of seasonal total being applied.

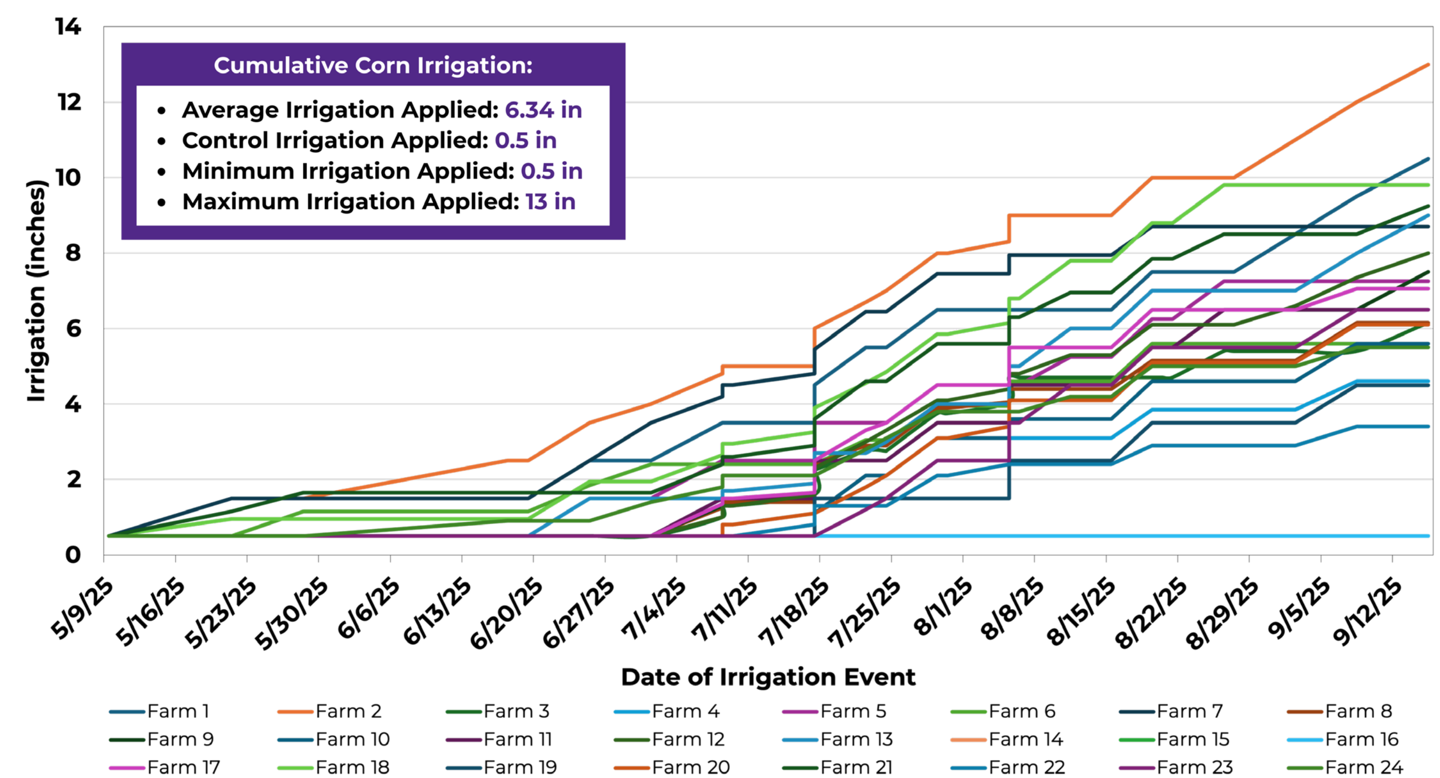



**Figure 21.** Cumulative irrigation (inches) applied to corn by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, Kansas.

### Why Forage Matters Here

Livestock production underpins western Kansas agriculture. In 2023, beef cattle generated more than $13.7 billion in cash receipts — over half of Kansas' total agricultural income. As irrigation capacity declines, feed production must remain viable. Forage sorghum offers a water-efficient, high-biomass option that supports the region's livestock value chain under tighter water constraints.

### Forage Sorghum: Built for Water Limited Systems

- Uses significantly less water than many staple feed crops
- Develops deeper root systems under stress
- Maintains high biomass production in deficit conditions.
- Flexible fit for dairies and feedyards managing water risk.
- Paired with targeted supplements, forage sorghum can meet feed quality needs while maintaining profitability.

### A Practical Trade-Off

While forage sorghum has slightly lower nutritive value than corn, its water efficiency and resilience make it a strategic crop in irrigated and limited-water systems. As pressure on groundwater increases, forage sorghum provides a realistic pathway to sustain feed production without sacrificing system performance.

## Forage Sorghum Irrigation

Cumulative irrigation applied to forage sorghum is presented in Figure 22. Due to the shorter growing season for forage sorghum— planted in June and harvested in September— total irrigation amounts were lower than for corn, ranging from 0.5 to 6.4 inches with an average of 3.02 inches. Excluding the control, two farms (14 and 15) did not apply irrigation to forage sorghum. Most farms concluded irrigation following the final fertigation/irrigation event on August 20–21, 2025, with only four farms (3, 5, 11, and 21) applying irrigation beyond this period. This reduction in late-season irrigation was largely attributed to 3.15 inches of rainfall received between August 22 and 30.

At the farm level, irrigation was capped at a Q-Stable allocation of 10 acre-in per acre across 2,000 total acres. Depending on crop allocation, farms were permitted to exceed the Q-Stable threshold for an individual crop by applying less than Q-Stable to the other crop. Two farms (1 and 2) applied irrigation exceeding 10 inches to corn (10.5 and 13.0 inches, respectively); however, these farms applied only 3.5 and 1.0 inches to forage sorghum, resulting in weighted average irrigation totals of 9.6 and 10.0 inches, respectively. Only one farm (2) applied irrigation at the full Q-Stable allocation. Average irrigation costs were $59/acre for corn and $33.80/acre for forage sorghum. When accounting for crop acreage allocation, average irrigation costs per crop was $80,230 for corn and $22,627 for forage sorghum. Total irrigation costs across farms ranged from $29,210 (Farms 14 and 15) to $173,800 (Farm 2), with an average of $102,857 (Figure 23).

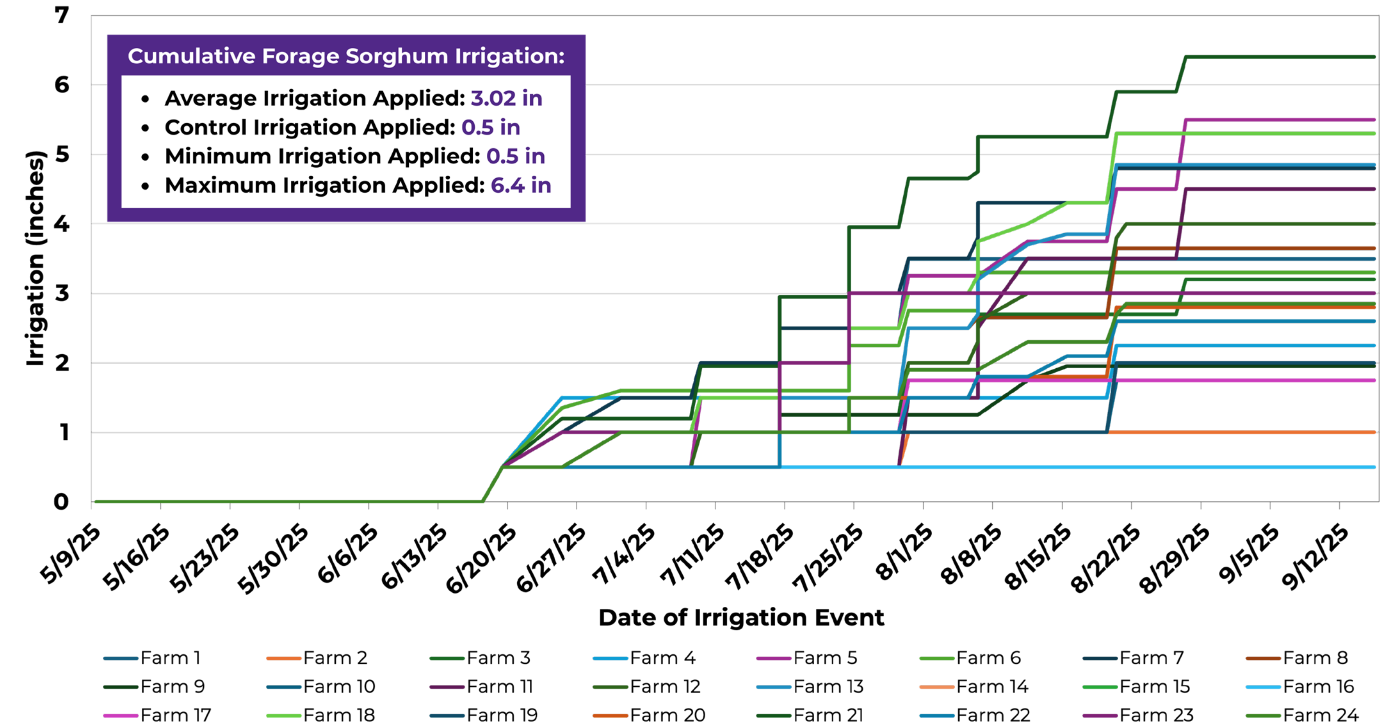



**Figure 22.** Cumulative irrigation (inches) applied to forage sorghum by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, KS.

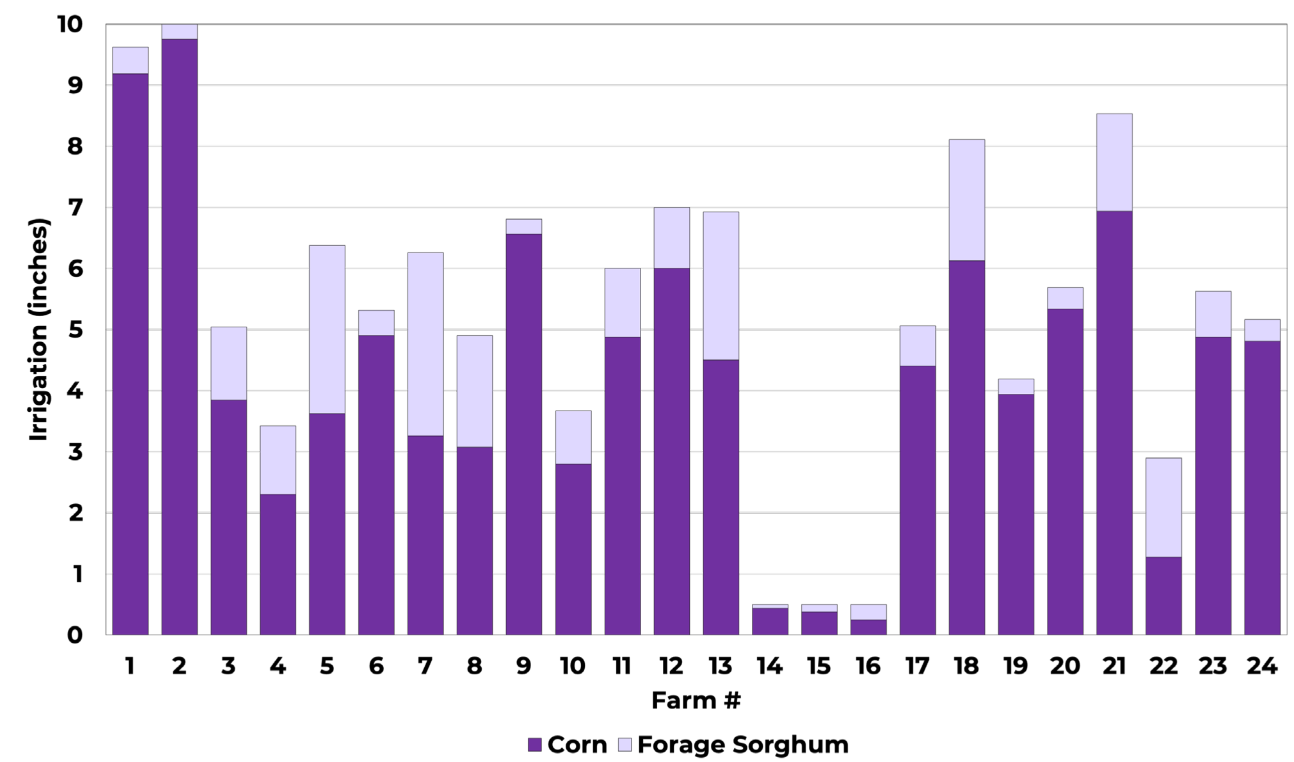



**Figure 23.** Total weighted-average irrigation (inches) applied by TAPS farms during the 2025 growing season at the Kansas State University NWREC in Colby, KS.

# **Grain** Marketing

Participants were encouraged to utilize five marketing methods for corn: Spot (Cash) Sales, Forward Contracts, Basis Contracts with Delivery at Harvest, Simple Hedge-to-Arrive, and Futures Contracts. All marketing decisions were made between April 7 and November 28, 2025.

Final farm production was calculated using the average yield from each farm's plots, managed according to team-defined practices. For marketing purposes, the Average Production History (APH) of 190 bu acre on a 2,000-acre farm was utilized as the benchmark for total marketable bushels. This number was then adjusted post-harvest to account for average farm yield (bu) multiplied by allocated corn acres.

All grain marketing decisions were reviewed and validated, and applicable trucking fees were assessed. All contracts were required to be closed by November 28. Penalties included $0.10 bu for any contracts closed by the TAPS team, $0.05 per bu for unsold grain, and $0.10 bu plus the current market price for oversold grain bought back on November 28.

The 2025 USDA harvest price for corn was $4.22 per bu, which was below the February 2025 price guarantee of $4.70 per bu. While the market showed limited directional movement for much of the season, December 2025 corn futures traded within a relatively narrow range, reflecting ample supplies and mixed demand signals. Modest volatility occurred later in the marketing year, with prices softening into the fall. A brief rally in late November marked the conclusion of the TAPS marketing year.

Grain marketing decisions varied significantly among participants (Figure 24). A total of 12 farms made marketing decisions, resulting in 47 completed contracts: 26 Futures Contracts, 11 Spot (Cash) Contracts, 8 Forward Contracts, 1 Basis Contract, and 1 Simple Hedge-to-Arrive Contract.

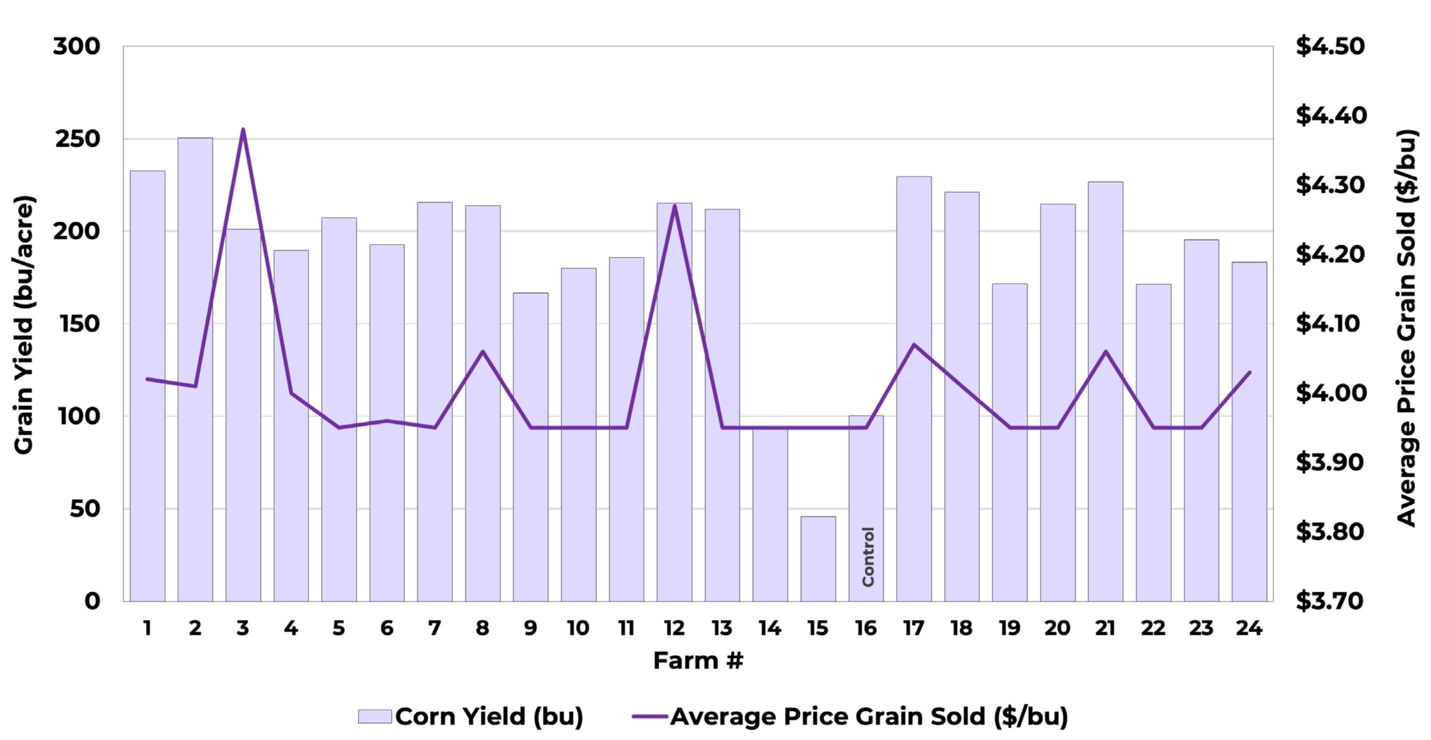



**Figure 24.** *Weighted average grain market price ($/bushels) and average grain yields (bu/ acre) obtained for the TAPS Farms.*

The overall average price per bushel achieved was $4.01, with a maximum of $4.38 by Farm 3 and a minimum of $3.95 by Farms 5, 7, 9, 10, 11, 13, 14, 15, 19, 20, 22, and 23. The 11 farms that did not make marketing decisions had their grain sold at the end of the marketing period for $4.00 per bu, minus a $0.05 bu handling fee. The average corn grain price sold ($/bu) and grain yields for each farm are summarized in Figure 24.

Forage sorghum markets and pricing structures are highly dynamic and continue to evolve, with values largely driven by local supply and demand conditions and the intended end use of the crop. Unlike grain commodities with centralized exchanges, forage sorghum pricing is typically negotiated directly with end-use purchasers such as feedyards or dairies. As a result, pricing can vary considerably based on forage quality, moisture content, transportation distance, harvest logistics, and regional feed demand.

For the purposes of the KSU-TAPS Forage Sorghum Competition, a standardized marketing approach was used to ensure consistency and comparability across all participants. Participants were not permitted to select individual marketing dates or end use purchasers. Instead, a uniform pricing structure was applied to all entries.

The forage sorghum bid price was calculated using the December corn futures price on the day of chopping (September 10, 2025), multiplied by a forage sorghum pricing factor of 6.8. This multiplier reflects forage sorghum value at approximately 80% of the prevailing corn silage price on a per-ton basis. The resulting per-ton price was then multiplied by each participant's final forage yield, standardized to 68% moisture content. On September 10, 2025, the December corn futures price was $4.20 per bushel. Using this standardized approach, the forage sorghum price was calculated as:

**$4.20 × 6.8 = $28.56 per ton (68% moisture)**

This bid price was structured to represent a delivered-to-buyer value and included all harvesting and trucking costs. No additional marketing, harvest, or transportation expenses were charged to participants. This standardized pricing framework allowed forage sorghum marketing outcomes to be evaluated consistently across all competition entries while reflecting realistic regional market practices.

# AWARD WINNERS

# MOST ECONOMICALLY **PROFITABLE**

The Most Economically Profitable award is based on net income, calculated using the average yield from each contestant's plots, grain marketing returns, total cost of production (fixed and variable), and any applicable crop insurance indemnity payments. While many costs were fixed on a per-acre basis, variable costs reflected individual farm management decisions and included crop insurance, seed, nitrogen fertilizer, irrigation, and grain trucking.

A summary of revenue, total expenses, and profit per acre for corn and forage sorghum is presented in Table 6. On average, forage sorghum had a cost of production approximately 54% that of corn. Total expenses averaged $412 per acre for forage sorghum and $759 per acre for corn. Cash rent, a fixed cost, was the largest expense for both crops, accounting for an average of 29.1% and 53.6% of total expenses for corn and forage sorghum, respectively. Fertilizer was the second largest cost component, representing an average of 13.9% of total expenses for corn and 17.5% for forage sorghum. In contrast, average revenue for corn was approximately 57% greater than that of forage sorghum.

**Table 6.** Summary of planted acres, revenue ($/acre), expenses ($/acre), and profit ($/acre) for corn and forage sorghum, along with the weighted average farm profit ($/acre).

| Farm ID | Corn Planted (acres) | Corn Rev. ($/ac) | Corn Exp. ($/ac) | Corn Profit ($/ac) | Forage Sorghum Planted (acres) | Forage Sorghum Rev. ($/ac) | Forage Sorghum Exp. ($/ac) | Forage Sorghum Profit ($/ac) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1,750 | $935 | $777 | $158 | 250 | $469 | $360 | $109 |
| 2 | 1,500 | $1,004 | $814 | $191 | 500 | $364 | $341 | $23 |
| 3 | 1,250 | $880 | $880 | $0 | 750 | $469 | $448 | $21 |
| 4 | 1,000 | $758 | $721 | $37 | 1,000 | $464 | $383 | $81 |
| 5 | 1,000 | $818 | $771 | $47 | 1,000 | $509 | $450 | $58 |
| 6 | 1,750 | $764 | $758 | $6 | 250 | $504 | $410 | $94 |
| 7 | 750 | $852 | $815 | $37 | 1,250 | $493 | $444 | $48 |
| 8 | 1,000 | $868 | $795 | $73 | 1,000 | $454 | $435 | $19 |
| 9 | 1,750 | $658 | $707 | -$48 | 250 | $444 | $381 | $63 |
| 10 | 1,000 | $711 | $728 | -$17 | 1,000 | $359 | $370 | -$10 |
| 11 | 1,500 | $734 | $739 | -$5 | 500 | $390 | $395 | -$5 |
| 12 | 1,500 | $919 | $760 | $160 | 500 | $420 | $416 | $3 |
| 13 | 1,000 | $837 | $822 | $15 | 1,000 | $463 | $499 | -$36 |
| 14 | 1,750 | $644 | $662 | -$18 | 250 | $414 | $338 | $76 |
| 15 | 1,500 | $235 | $622 | -$387 | 500 | $352 | $351 | $1 |
| 16 | 1,000 | $396 | $605 | -$209 | 1,000 | $340 | $338 | $2 |
| 17 | 1,250 | $934 | $790 | $144 | 750 | $428 | $430 | -$2 |
| 18 | 1,250 | $886 | $864 | $21 | 750 | $518 | $547 | -$29 |
| 19 | 1,750 | $677 | $778 | -$101 | 250 | $420 | $442 | -$22 |
| 20 | 1,750 | $848 | $756 | $91 | 250 | $413 | $403 | $10 |
| 21 | 1,500 | $920 | $826 | $94 | 500 | $484 | $468 | $16 |
| 22 | 750 | $677 | $738 | -$61 | 1,250 | $463 | $428 | $35 |
| 23 | 1,500 | $771 | $704 | $67 | 500 | $470 | $395 | $75 |
| 24 | 1,750 | $740 | $772 | -$33 | 250 | $450 | $414 | $36 |

Fourteen farms generated a positive net return for corn, while eighteen farms were profitable for forage sorghum.

Corn exhibited a wider range in profitability, with both higher potential gains and larger losses compared with forage sorghum. Net returns for corn ranged from −$387 to $191 per acre, with an average of $11 per acre, whereas forage sorghum returns ranged from −$36 to $109 per acre, with an average of $28 per acre. Among farms that achieved positive net returns, average profit was $82 per acre for corn and $43 per acre for forage sorghum.

The weighted average profit per acre is shown in Figure 25. Fourteen farms generated positive net returns, ranging from $2 to $152 per acre, while ten farms incurred losses ranging from −$1 to −$290 per acre. Among the fourteen profitable farms, eleven achieved positive net returns for both corn and forage sorghum. Two farms (Farms 17 and 18) were profitable in corn but offset losses in forage sorghum, while one farm (Farm 3) broke even in corn but generated a positive net return in forage sorghum. Farm 1 was the most profitable, with a weighted average profit of $152 per acre, equivalent to $303,842 when scaled to a 2,000 acre operation.

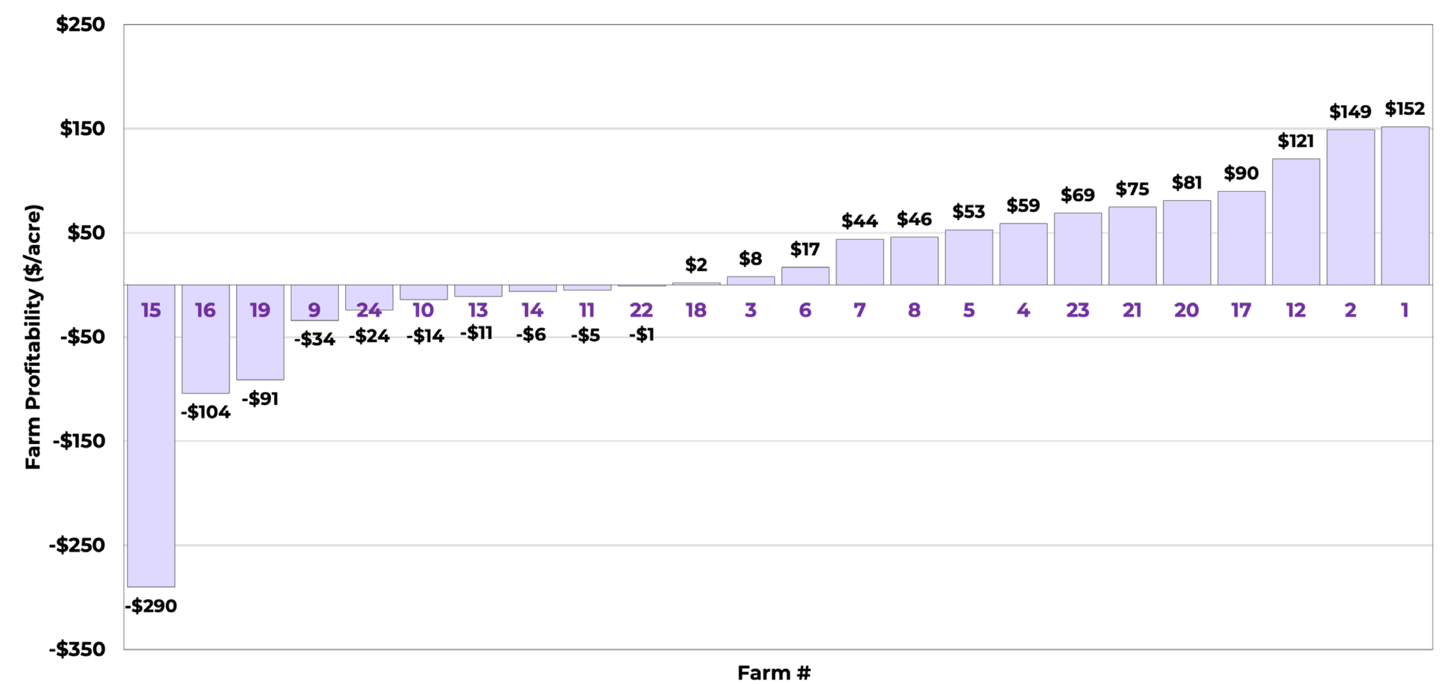



**Figure 25.** *Weighted average profitability ($/acre) based on crop acreage allocation for the TAPS Competition at the Northwest Research-Extension Center in Colby, KS.*

# AWARD WINNER

2025

## MOST ECONOMICALLY PROFITABLE

### FIRST PLACE: FARM 1 — $152/ ACRE

**Kent Higerd** with a weighted average profitability of $151.92/acre. Farm 1 planted 1,750 acres of corn and 250 acres of forage sorghum and utilized marketing contracts for an average corn price sold of $4.02/bu.

### SECOND PLACE: FARM 2 — $149/ ACRE

**Aaron Higerd** with a weighted average profitability of $148.60/acre. Farm 2 planted 1,500 acres of corn and 500 acres of forage sorghum and utilized marketing contracts for an average corn price sold of $4.01/bu.

### THIRD PLACE: FARM 12 — $121/ ACRE

**Martin Lager** with a weighted average profitability of $120.61/acre. Farm 12 planted 1,500 acres of corn and 500 acres of forage sorghum and utilized a marketing contract for an average corn price sold of $4.27/bu.

# **Highest** Input Use Efficiency

Water and nitrogen fertilizer are two primary inputs influencing agronomic, economic, and environmental outcomes for most cropping systems (Rudnick et al., 2016). Because these inputs can interact to affect crop performance, evaluating management efficiency requires their joint consideration. The Water–Nitrogen Intensification Performance Index (WNIPI; Lo et al., 2019) is non-dimensional (unitless) and quantifies the increase in grain yield relative to a control as a function of applied nitrogen fertilizer and irrigation above the control's aboveground nitrogen uptake and evapotranspiration (ET), respectively.

$$WNIPI = \frac{\left(\frac{Y_{Farm}}{Y_{Control}} - 1\right)}{\left(1 + \frac{I_{Farm}}{ET_{Control}}\right) \times \left(1 + \frac{N_{Farm}}{ANU_{Control}}\right)}$$

The control treatment (Farm 16) received no nitrogen fertilizer beyond starter nitrogen (7 lb N per acre) and no irrigation beyond a single 0.5-inch application for herbicide activation. For corn, Farm 16 produced an average yield of 100.3 bu per acre at 15.5% moisture content, with a seasonal ET of 15.6 inches and aboveground nitrogen uptake of 163 lb N per acre. For forage sorghum, the control yielded 11.9 tons per acre at 68% moisture content, with a seasonal ET of 11.4 inches and aboveground nitrogen uptake of 94 lb N per acre.

The WNIPI values for corn, forage sorghum, and weighted average based on acre allocation are presented in Figure 26. Except for two farms (14 and 15), corn had higher WNIPI values than forage sorghum. The negative corn WNIPI values were associated with farms 14 and 15 obtaining lower yields than the control farm. The maximum WNIPI value for both corn and forage sorghum was obtained by Farm 1.

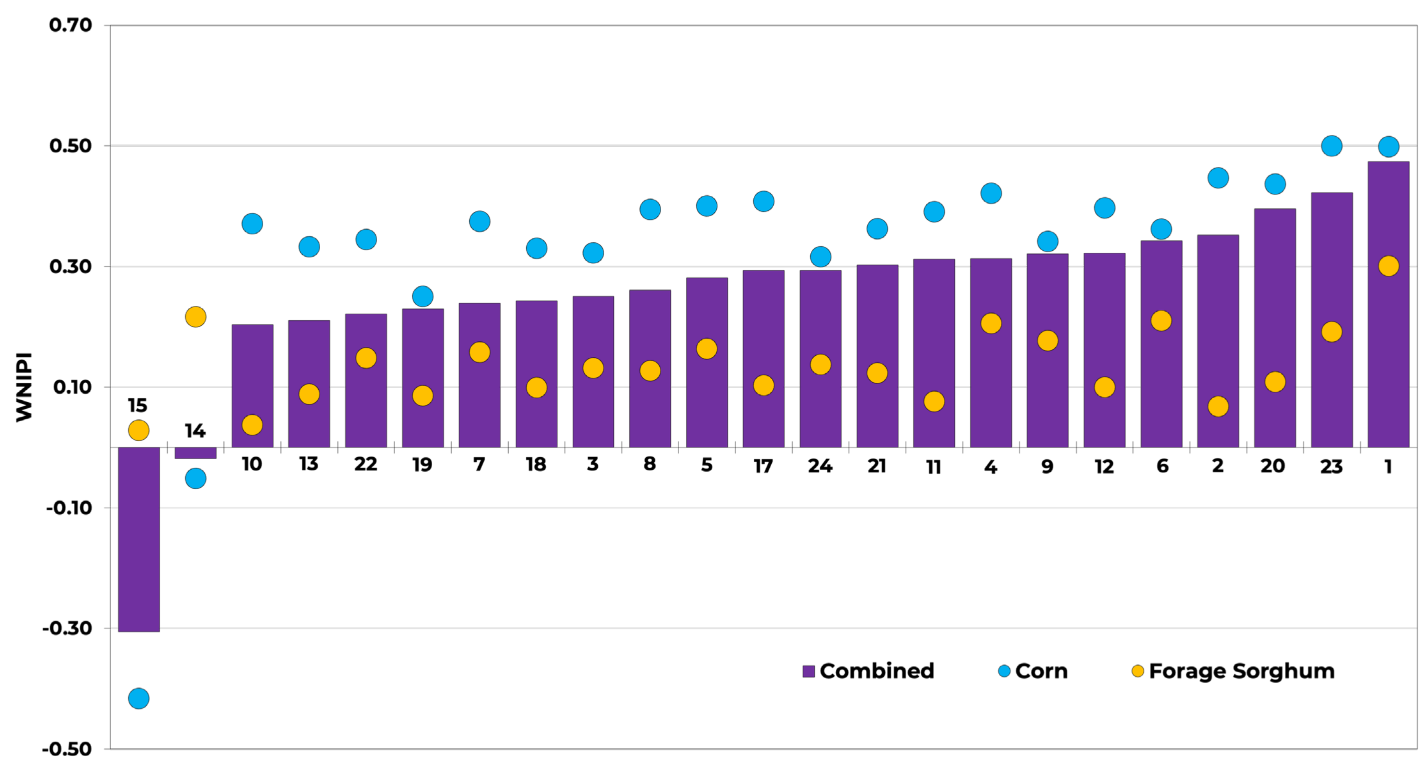



**Figure 26.** Water and Nitrogen Intensification Performance Index (WNIPI) for corn, forage sorghum, and weighted-average by crop acre allocation (purple bars) for the TAPS Competition at the Northwest Research-Extension Center in Colby, KS.



## TAPS on TAP: How Farmers Are Leading the Way on Nitrogen-Water Efficiency

Managing nitrogen and irrigation together is a continual challenge in western Kansas, where moisture varies widely and fertilizer decisions hinge on how much water a crop can realistically use. Farmers see this interaction every season, and their choices through TAPS give researchers a clearer view of how these inputs work together under High Plains conditions.

*Lacasa presents KSU-TAPS data at the 2025 CANVAS Science Societies conference in Salt Lake City, Utah.*

At the 2025 CANVAS Science Societies meeting, Josephina Lacasa, an assistant professor of statistics at Kansas State University and TAPS team member, highlighted what producers in this region already experience in their own fields. TAPS brings those decisions into a shared setting, allowing producers and researchers to compare how different approaches perform when weather, soils and timing are held constant.

As Josephina explained, the way farms decide on fertilizer is closely linked to their irrigation strategy.

"The team selects an amount of nitrogen fertilizer that has something to do with how much they plan to irrigate and their goals for the TAPS competition," she said. "If you have more water available, you'll put more nitrogen on the field because you won't be limited by the other factor. But if your goals are to be more cost efficient or you are in a limited water environment, it may be best to reduce nitrogen inputs."

From a research perspective, that's valuable information. For farmers, it's the reality of working with what the year gives them — trying to make nitrogen and water line up, even when conditions don't cooperate.

Using data from the 2024 Colby competition, Josephina mapped how yield and profit respond when nitrogen and irrigation are adjusted together. Her models identified a consistent pattern: profitability improved when decisions stayed within what the year's moisture could support, rather than pushing either input beyond the crop's capacity to use it.

TAPS producers help refine that understanding. Their management choices across different weather years and soil conditions show how nitrogen and irrigation interact in real-world situations, sharpening where productive combinations tend to fall and how they shift from season to season.

Those decisions matter. They clarify questions such as:

- How does nitrogen efficiency change in dry years?
- How much irrigation justifies higher N rates?
- Where is the "sweet spot" between over watering and underfeeding?
- Which strategies consistently return profit, even in tough years?

Each team contributes to the answer, and every season adds clarity.

This work aligns with long-standing Kansas research. Decades of K-State studies show that nitrogen improves water-use efficiency when moisture is adequate, but excess nitrogen under limited water can decrease efficiency and returns. Likewise, irrigation without enough nitrogen leaves yield potential on the table.

As Josephina noted, "These results can help us communicate to our farmers," but more importantly, they come from farmers. TAPS works because producers bring curiosity, competition and practical know-how, building a dataset that supports their neighbors and communities.

TAPS on TAP is a regular Kansas Farmer column by K-State college of agriculture director of communication and TAPS partner Kelsey Stremel, that shares real-world lessons, data, and decision insights from the TAPS competitions. To learn more and view past TAPS on TAP columns visit www.farmprogress.com/kansas-farmer.


# AWARD WINNER

## HIGHEST INPUT-USE EFFICIENCY

### FIRST PLACE: FARM 1 — 0.474

**Kent Higerd** had a WNIPI of 0.474. He planted Channel® hybrid 212-02VT2PRIB, at a seeding rate of 28,000/acre, with irrigation of 10.50 inches and 107 lb N/acre fertilizer. He planted forage sorghum at a seeding rate of 65,000/acre, with irrigation of 3.5 inches and 7 lb N/acre of fertilizer.

### SECOND PLACE: FARM 20 — 0.396

The **Crowd Source (Social Media) Team** had a WNIPI of 0.396. They planted Brevant® hybrid B13Z51 at a seeding rate of 22,000/acre, with irrigation of 6.1 inches and 157 lb N/acre fertilizer. They planted forage sorghum at a seeding rate of 70,000/acre, with irrigation of 2.8 inches and 67 lb N/acre fertilizer.

### THIRD PLACE: FARM 2 — 0.352

**Aaron Higerd** had a WNIPI of 0.352. He planted Channel® hybrid 212-02VT2PRIB at a seeding rate of 24,000/acre, with irrigation of 13 inches and 147 lb N/acre fertilizer. He planted forage sorghum at a seeding rate of 65,000/acre, with irrigation of 1 inch and 7 lb N/acre fertilizer.

# **Greatest** Yield

While TAPS focuses on profitability and efficiency, yield is a key measurement of crop success. Corn was harvested for all farms on October 30 using a Wintersteiger Delta Combine equipped with a Harvest Master Grain Gauge. Whereas forage sorghum was harvested using a single row John Deere silage chopper and yield was determined using a load cell equipped weigh wagon. Corn grain yields were adjusted to 15.5% moisture content and forage sorghum was adjusted to 68% moisture content.

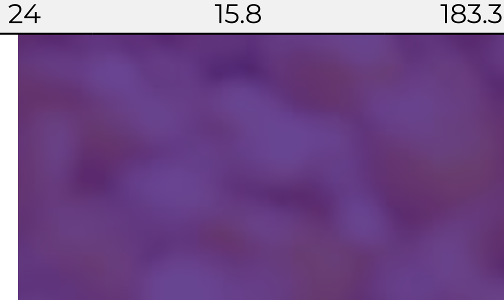
Corn yields ranged from 45.7 (Farm 15) to 250.4 (Farm 2) with an average of 188.1 bu per acre (Table 7). Fourteen farms exceeded the APH of 190 bu per acre. Corn yield was primarily limited by water rather than N fertilizer. Corn yield exhibited a linear response to irrigation, increasing by approximately 1 bushel per acre for each additional inch of irrigation applied. In contrast, the yield response to N fertilizer was relatively modest, averaging about 0.2 bushels per acre for every additional 10 lb N per acre.

Corn yield maximized (i.e., plateaued) at approximately 150 lb N per acre (Figure 27). However, the probable range of N fertilizer required to reach the yield plateau was between 131 and 169 lb N per acre. Applying N beyond this level did not result in additional yield gains.

Forage sorghum yields ranged from 11.9 tons per acre (Farm 16—control) to 18.1 tons per acre (Farm 18), with an average yield of 15.4 tons per acre (Table 7). Forage yield generally increased with higher fertilizer and irrigation inputs, with the greatest yields observed at the highest application rates (Figure 28). Notably, the forage yield–nitrogen–irrigation relationship differed somewhat from the corn grain yield response discussed above. Because forage yield primarily reflects total aboveground biomass production, growth-limiting factors such as water and nutrient availability tend to exert a more direct influence on yield.

**Table 7.** Forage sorghum yield (tons/acre) at 68% moisture content and corn grain yield (bu/acre) at 15.5% moisture content for the TAPS Competition at the Northwest Research-Extension Center in Colby, KS. Greatest yield for each crop is bolded.

| Farm ID | Forage Sorghum (tons/acre) | Corn (bu/acre) |
|---|---|---|
| 1 | 16.4 | 232.7 |
| 2 | 12.8 | **250.4** |
| 3 | 16.4 | 201.0 |
| 4 | 16.2 | 189.6 |
| 5 | 17.8 | 207.2 |
| 6 | 17.7 | 192.7 |
| 7 | 17.2 | 215.7 |
| 8 | 15.9 | 213.7 |
| 9 | 15.5 | 166.7 |
| 10 | 12.6 | 179.9 |
| 11 | 13.7 | 182.8 |
| 12 | 14.7 | 215.3 |
| 13 | 16.2 | 212.0 |
| 14 | 14.5 | 94.2 |
| 15 | 12.3 | 45.7 |
| 16 | 11.9 | 100.3 |
| 17 | 15.0 | 229.6 |
| 18 | **18.1** | 221.1 |
| 19 | 14.7 | 171.5 |
| 20 | 14.5 | 214.6 |
| 21 | 17.0 | 226.7 |
| 22 | 16.2 | 171.4 |
| 23 | 16.5 | 195.3 |
| 24 | 15.8 | 183.3 |



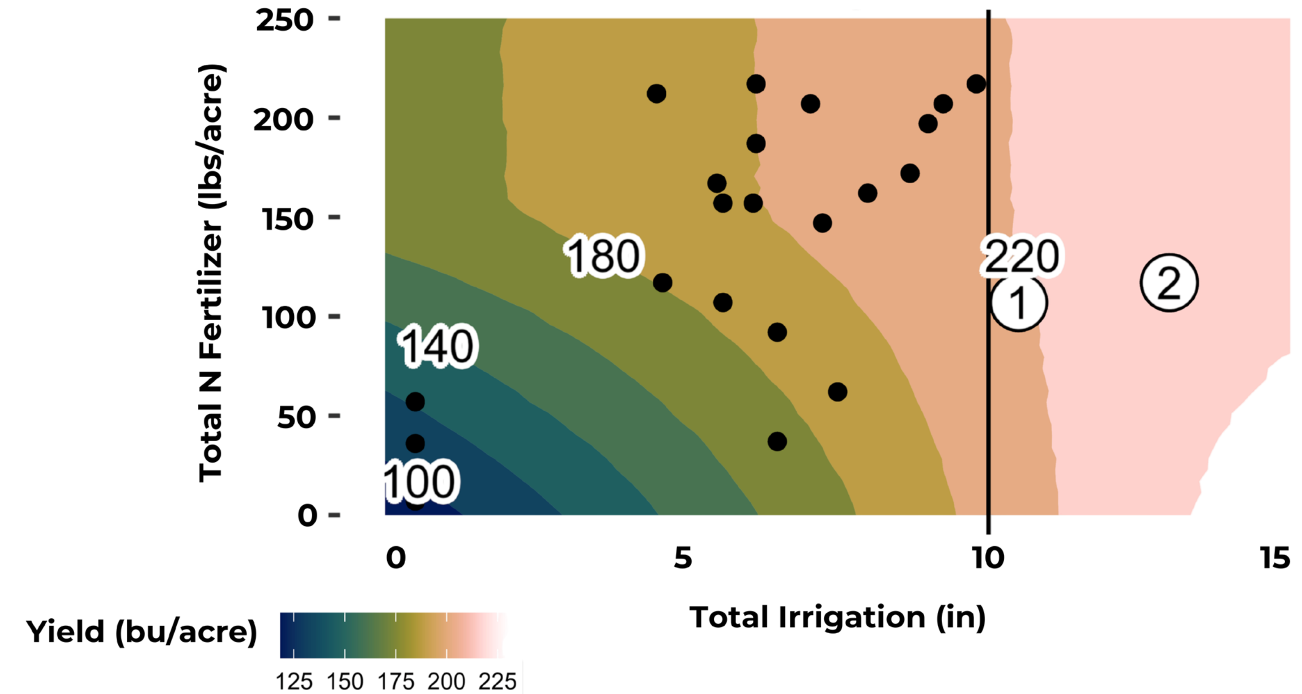



**Figure 27.** Corn yield (bu/acre) as a function of applied irrigation (inches) and nitrogen fertilizer rate (bu/acre), with yield represented by the background color. The Q-stable irrigation limit of 10 inches and the two highest-yielding farms (Farms 1 and 2) are indicated.

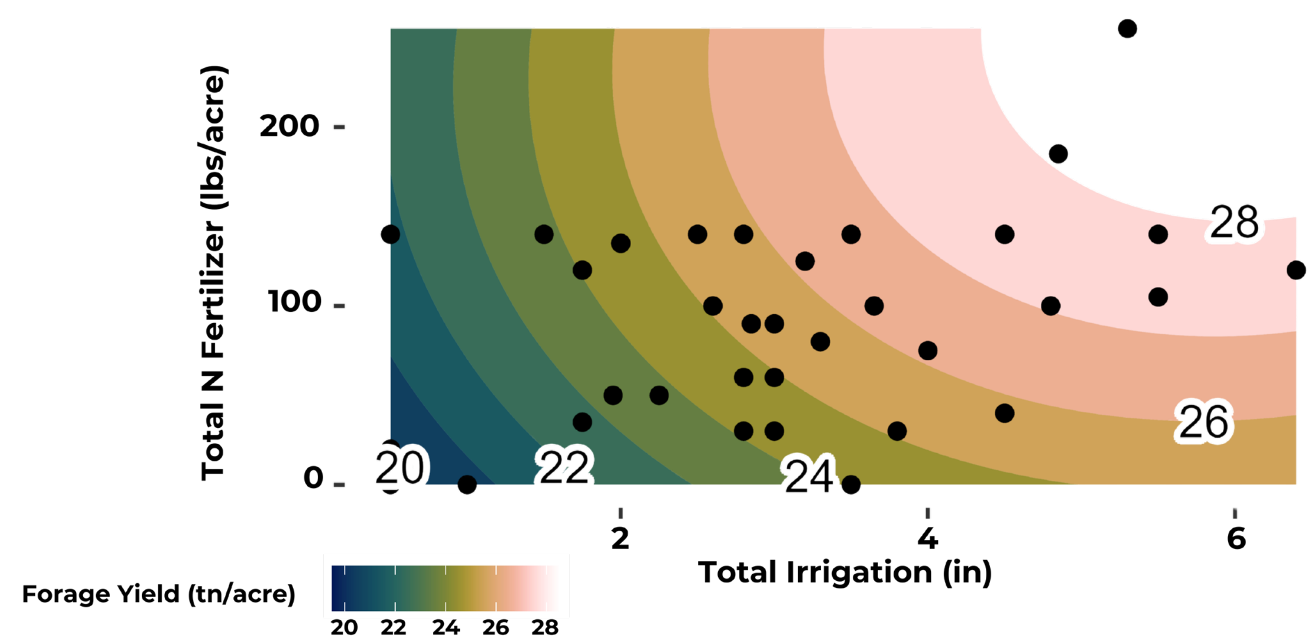



**Figure 28**. Forage Sorghum yield (tons per acre) at 68% moisture content as a function of applied irrigation (inches) and nitrogen fertilizer rate (lb per acre), with yield represented by the background color.


# AWARD WINNER

## GREATEST GRAIN YIELD

### FIRST PLACE: FARM 2 — 250 BU/ACRE

**Aaron Higerd** achieved a yield of 250.4 bu/acre using Channel® hybrid 212-02VT2PRIB, planted at a seeding rate of 24,000 per acre, with irrigation of 13 inches and 147 lb N/acre fertilizer.

### SECOND PLACE: FARM 1 — 233 BU/ACRE

**Kent Higerd** achieved a yield of 232.7 bu/acre using Channel® hybrid 212-02VT2PRIB, planted at a seeding rate of 28,000 per acre, with irrigation of 10.50 inches and 107 lb N/acre fertilizer.

### THIRD PLACE: FARM 17 — 230 BU/ACRE

**Nathan Kells**, **Colby Kells** & **Jack Koehn** achieved a yield of 229.6 bu/acre using Dekalb® hybrid DKC 61-80, planted at a seeding rate of 23,000 per acre, with irrigation of 7.05 inches and 207 lb N/acre fertilizer.




# AWARD WINNER

## GREATEST SORGHUM YIELD

### FIRST PLACE: FARM 18 — 18.1 TN/ACRE

**Val Reiss** & **Garret Reiss** achieved a yield of 18.1 tn/acre with a seeding rate of 80,000 per acre, with irrigation of 5.3 inches and 262 lb N/acre fertilizer.

### SECOND PLACE: FARM 5 — 17.8 TN/ACRE

**Matt Long** achieved a yield of 17.8 tn/acre with a seeding rate of 65,000 per acre, with irrigation of 5.5 inches and 112 lb N/acre fertilizer.

### THIRD PLACE: FARM 6 — 17.7 TN/ACRE

**Brian Linin** achieved a yield of 17.7 tn/acre with a seeding rate of 73,250 per acre, with irrigation of 3.3 inches and 87 lb N/acre fertilizer.

# **Greatest** Forage Sorghum Quality

**Table 8.** Average forage sorghum quality parameters, including percent dry matter (DM) at time of harvest, neutral detergent fiber (NDF, dry basis), acid detergent fiber (ADF, dry basis), total digestible nutrients (TDN, dry basis), crude protein (CP, dry basis), in vitro dry matter digestibility at 48 hrs (IVDMD48, dry basis), lignin (dry basis), and starch (dry basis), for the TAPS Competition at the Kansas State University NWREC in Colby, KS.

| Farm ID | DM% | NDF | ADF | TDN | CP | IVTDMD48 | Lignin | Starch |
|---|---|---|---|---|---|---|---|---|
| 1 | 19.80 | 52.35 | 31.00 | 58.73 | 5.13 | 80.80 | 1.82 | 3.53 |
| 2 | 19.69 | 50.70 | 29.38 | 60.45 | 5.70 | 83.15 | 1.68 | 3.40 |
| 3 | 19.49 | 48.95 | 29.63 | 62.73 | 5.50 | 84.08 | 1.78 | 3.98 |
| 4 | 20.91 | 49.98 | 29.15 | 61.98 | 5.93 | 84.05 | 1.73 | 3.78 |
| 5 | 19.00 | 50.75 | 29.50 | 61.13 | 6.18 | 83.05 | 1.91 | 3.28 |
| 6 | 19.78 | 51.20 | 31.18 | 60.63 | 5.98 | 82.50 | 1.95 | 2.83 |
| 7 | 19.88 | 50.28 | 31.75 | 58.40 | 5.50 | 81.73 | 2.01 | 3.45 |
| 8 | 19.39 | 48.75 | 29.58 | 63.03 | 6.08 | 84.85 | 1.69 | 3.28 |
| 9 | 20.97 | 51.53 | 30.75 | 60.55 | 6.30 | 82.23 | 1.92 | 2.95 |
| 10 | 20.36 | 50.73 | 30.03 | 61.23 | 5.65 | 83.08 | 1.65 | 3.53 |
| 11 | 20.90 | 49.33 | 29.15 | 60.68 | 6.45 | 83.38 | 1.62 | 3.38 |
| 12 | 21.64 | 49.98 | 29.28 | 60.50 | 6.60 | 82.93 | 1.76 | 3.20 |
| 13 | 19.35 | 48.43 | 28.55 | 62.43 | 6.38 | 84.18 | 1.75 | 4.08 |
| 14 | 21.11 | 52.45 | 30.05 | 59.90 | 6.03 | 82.18 | 1.65 | 2.50 |
| 15 | 21.46 | 50.75 | 29.60 | 61.43 | 7.15 | 83.30 | 1.80 | 2.90 |
| 16 | 20.59 | 52.38 | 30.08 | 59.35 | 6.78 | 81.70 | 1.78 | 2.55 |
| 17 | 17.84 | 49.20 | 28.43 | 62.23 | 5.28 | 84.30 | 1.72 | 4.08 |
| 18 | 20.12 | 50.20 | 29.28 | 62.08 | 7.10 | 83.83 | 2.00 | 3.20 |
| 19 | 20.38 | 51.93 | 30.03 | 60.18 | 7.80 | 81.65 | 1.97 | 2.63 |
| 20 | 20.31 | 50.80 | 29.65 | 61.00 | 5.68 | 82.80 | 1.71 | 3.18 |
| 21 | 18.59 | 51.65 | 31.43 | 60.70 | 5.10 | 82.40 | 2.08 | 3.33 |
| 22 | 18.91 | 50.45 | 29.83 | 59.95 | 5.95 | 82.13 | 1.78 | 3.25 |
| 23 | 20.04 | 49.85 | 29.38 | 61.03 | 6.38 | 83.13 | 1.83 | 3.75 |
| 24 | 21.74 | 49.78 | 28.50 | 61.38 | 5.90 | 83.65 | 1.58 | 3.70 |



Forage quality is a critical determinant of animal performance, as it directly influences intake, digestibility, and protein supply. At harvest, forage sorghum samples were collected and analyzed by Ward Laboratories for moisture content, nutrient composition, and forage quality using near-infrared reflectance (NIR) spectroscopy.

While numerous forage quality attributes are important, the TAPS forage quality award was based on neutral detergent fiber (NDF), recognizing management strategies that resulted in lower fiber concentrations and, consequently, greater intake potential. There was a tight range in observed NDF (dry basis) values with a low of 48.4 (Farm 13 – winning farm) and a high of 52.5 (Farm 14) with an average of 50.5.

A correlation (r) matrix for forage sorghum is presented in Figure 29, illustrating relationships among management practices, yield, selected forage quality parameters, and remote sensing metrics. Irrigation and nitrogen fertilization exhibited weak negative associations with fiber-related quality traits, including neutral detergent fiber (NDF) and lignin. In contrast, remote sensing indicators such as the normalized difference vegetation index (NDVI), normalized difference red-edge (NDRE), and canopy temperature (Tc) were more strongly associated with yield than with forage quality metrics.

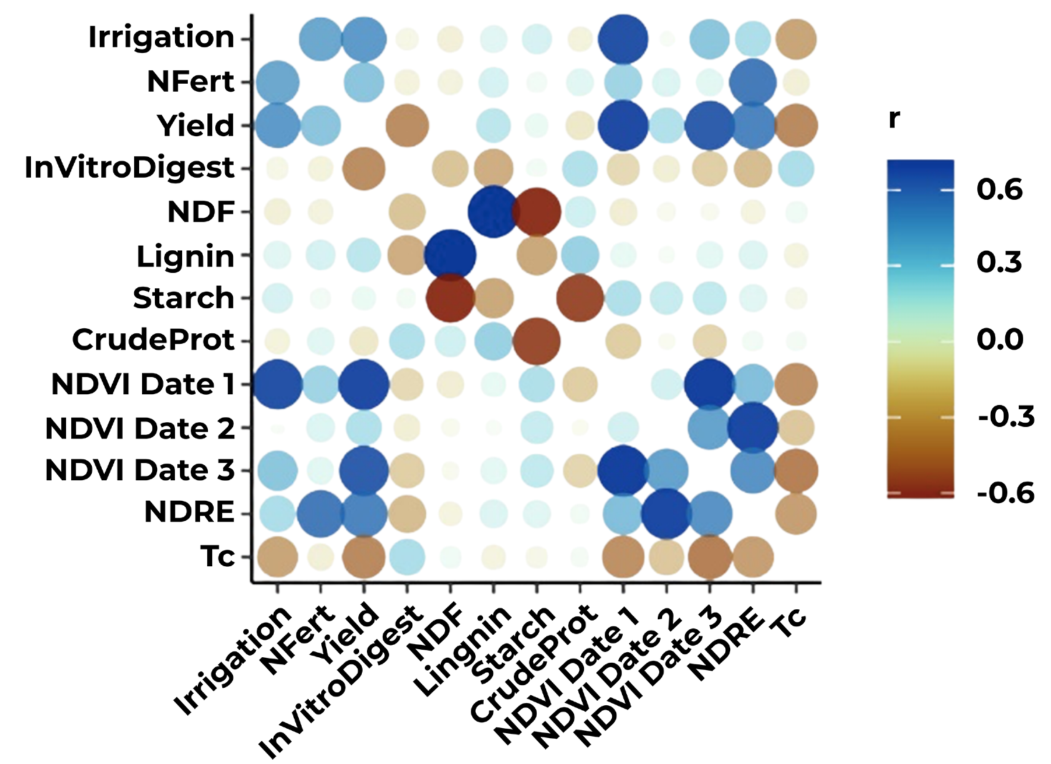



**Figure 29.** Correlation (r) matrix for various forage sorghum management practices, yield and quality parameters, and remote sensing metrics such as NDVI, NDRE, and canopy temperature (Tc). NDVI dates were August 7, 18, and 21, respectively, and NDRE and Tc were collected on August 18.


# AWARD WINNER

## HIGHEST FORAGE SORGHUM QUALITY

### FIRST PLACE: FARM 13 — 48.4

**Brandon Depenbusch** & **Russell Plaschka** recorded the lowest Neutral Detergent Fiber NDF of 48.4, while producing 16.2 tons/acre of forage. The team seeded 75,000 seeds/acre, applied 192 lb N/acre and irrigated 4.85 inches.

### SECOND PLACE: FARM 8 — 48.8

**Greg Bellamy** & **Dusty Pilger** had the second lowest NDF at 48.8, while producing 15.9 tons/acre forage. The team seeded 72,500 seeds/acre, applied 107 lb N/acre, and irrigated 3.65 inches.

### THIRD PLACE: FARM 3 — 49.0

**Shane Mann** had the third lowest NDF at 49.0, while producing 16.4 tons/acre of forage. The team seeded 80,000 seeds/acre, applied 132 lb N/acre, and irrigated 3.20 inches.

# Southwest Research-Extension Center Corn Water Utilization Competition

# Growing Conditions

## Growing Conditions and Field History

The TAPS Corn Water Utilization Competition was conducted at the Kansas State University Southwest Research– Extension Center Finnup site located a few miles north of Garden City, Kansas, within Kansas Groundwater Management District No. 3. Twenty-four farms were part of the competition. Each farm was randomly assigned four plots arranged in a randomized complete block design (Figure 30). The competition area encompassed approximately 10 acres, with individual plots measuring 90 ft in length by 45 ft (16 rows) in width.

Corn was planted in an east–west orientation into a field that has been managed under no-till practices for ~10 years, with corn as the previous crop in 2024 and cotton in 2023. Irrigation was applied using a Valley variable-rate linear move irrigation system. The dominant soil at the site is Ulysses silt loam with a 0 to 1% slope and an approximate plant available water-holding capacity of 2.5 inches per foot of soil.

Pre-season soil samples were collected by randomly subsampling within each block and aggregating into a single composite sample per block. Average surface soil properties included a pH of 6.75, organic matter content of 2.0%, and 28 lb per acre of nitrate-nitrogen. Commercial technologies selected by participating farms were installed in Block 3 (Figure 30).

Monthly average weather conditions for the 2025 growing season and the long-term average (2010–2025) are summarized in Table 9. Weather data were obtained from the Kansas Mesonet station at the Southwest Research–Extension Center in Garden City, Kansas, located approximately 1.8 miles southeast of the TAPS field.

Overall, 2025 weather conditions were generally consistent with the 16-year long-term average with respect to air temperature, incoming solar radiation, wind speed, and relative humidity during much of the growing season. Notable deviations from long-term conditions were primarily associated with precipitation and late-season humidity. Rainfall was above the long-term average in April, August, and September, while July experienced a pronounced rainfall deficit of 42% (1.92 inches in 2025 compared with a long-term average of 3.29 inches). September rainfall totaled 4.53 inches, more than three times the long-term average, and coincided with higher average relative humidity (70%) compared with the long-term mean of 60%.



**Figure 30.** Corn Water Utilization competition plot layout at the Kansas State University Southwest Research-Extension Center in Garden City, Kansas, located within Kansas Groundwater Management District No. 3. Plots were located under a Valley variable rate linear-move irrigation system. The map also depicts the locations of commercial technologies.

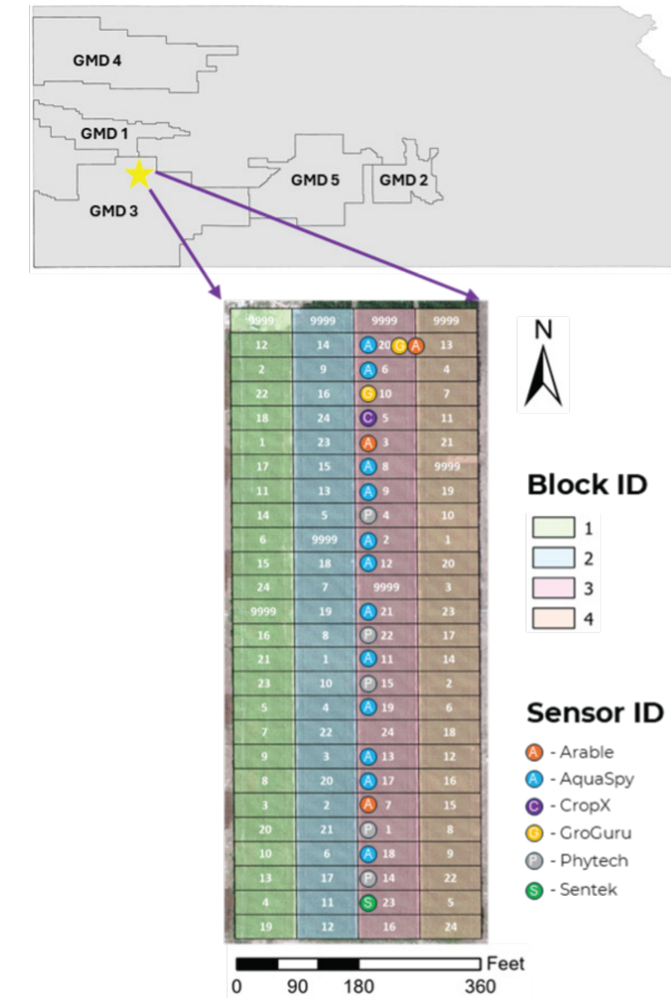



**Table 9.** Monthly average weather conditions for the 2025 growing season and long-term (2010 – 2025) obtained from the Kansas Mesonet located at the Southwest Research-Extension Center in Garden City, KS. Weather parameters include rainfall, minimum and maximum air temperature (Tmin and Tmax), average relative humidity (RHavg), wind speed at 2 m height (u2), and incoming solar radiation (Rs).

| Year | Month | Rainfall Inches | $T_{max}$ °F | $T_{min}$ °F | $RH_{avg}$ % | $u_2$ mph | $R_s$ W/m² |
|---|---|---|---|---|---|---|---|
| 2025 | April | 2.17 | 71 | 40 | 55 | 9.3 | 245 |
| | May | 2.36 | 74 | 49 | 64 | 7.4 | 260 |
| | June | 2.27 | 88 | 62 | 64 | 8.3 | 285 |
| | July | 1.92 | 93 | 66 | 63 | 7.4 | 304 |
| | August | 2.48 | 90 | 64 | 64 | 6.7 | 252 |
| | September | 4.53 | 84 | 58 | 70 | 6.3 | 215 |
| | October | 1.05 | 73 | 47 | 63 | 8.1 | 159 |
| 2010 to 2025 | April | 1.37 | 69 | 38 | 56 | 9.7 | 235 |
| | May | 2.52 | 77 | 49 | 63 | 8.6 | 263 |
| | June | 2.56 | 90 | 61 | 60 | 8.8 | 296 |
| | July | 3.29 | 93 | 65 | 61 | 7.0 | 283 |
| | August | 1.97 | 91 | 63 | 63 | 6.8 | 254 |
| | September | 1.47 | 86 | 56 | 60 | 7.6 | 215 |
| | October | 0.98 | 72 | 41 | 58 | 7.3 | 166 |

# **Management** Decisions

## Crop Insurance

Excluding the control group, each farm was required to select a multi-peril crop insurance (MCPI) policy for all corn acres (Figure 31). Three policy types were offered at coverage levels of 65%, 70%, 75%, 80%, or 85%: Revenue Protection (RP), Revenue Protection with Harvest Price Exclusion (RPHPE), and Yield Protection (YP). Policies were available at both the optional unit (OU) and enterprise unit (EU) levels, based on an Average Production History (APH) of 200 bushels per acre and a February price guarantee of $4.70 per bushel (USDA RMA). Insurance premiums were provided by the USDA Risk Management Agency.

There was a clear preference for RP-EU selected by seventeen farms. RPHPE-EU was selected by three farms. RP-OU, RPHPE-OU, and YP-EU were each selected by one farm. The most common coverage level was 65%, chosen by ten farms, followed by 75% (six farms), 70% (four farms), 80% (two farms) and 85% (one farm). This resulted in an average cost of $10.10 per acre, ranging from a high of $33.10 per acre (Farm 9) to a low of $3.87 per acre (Farm 12).

Due to better than average rainfall and favorable growing conditions, only two farms received indemnity payments of $54.05 and $129.81 per acre for farms 1 and 10, respectively. These payments were associated with management challenges, including missed irrigation and nitrogen fertilizer decisions, which affected overall production outcomes rather than weather related losses.

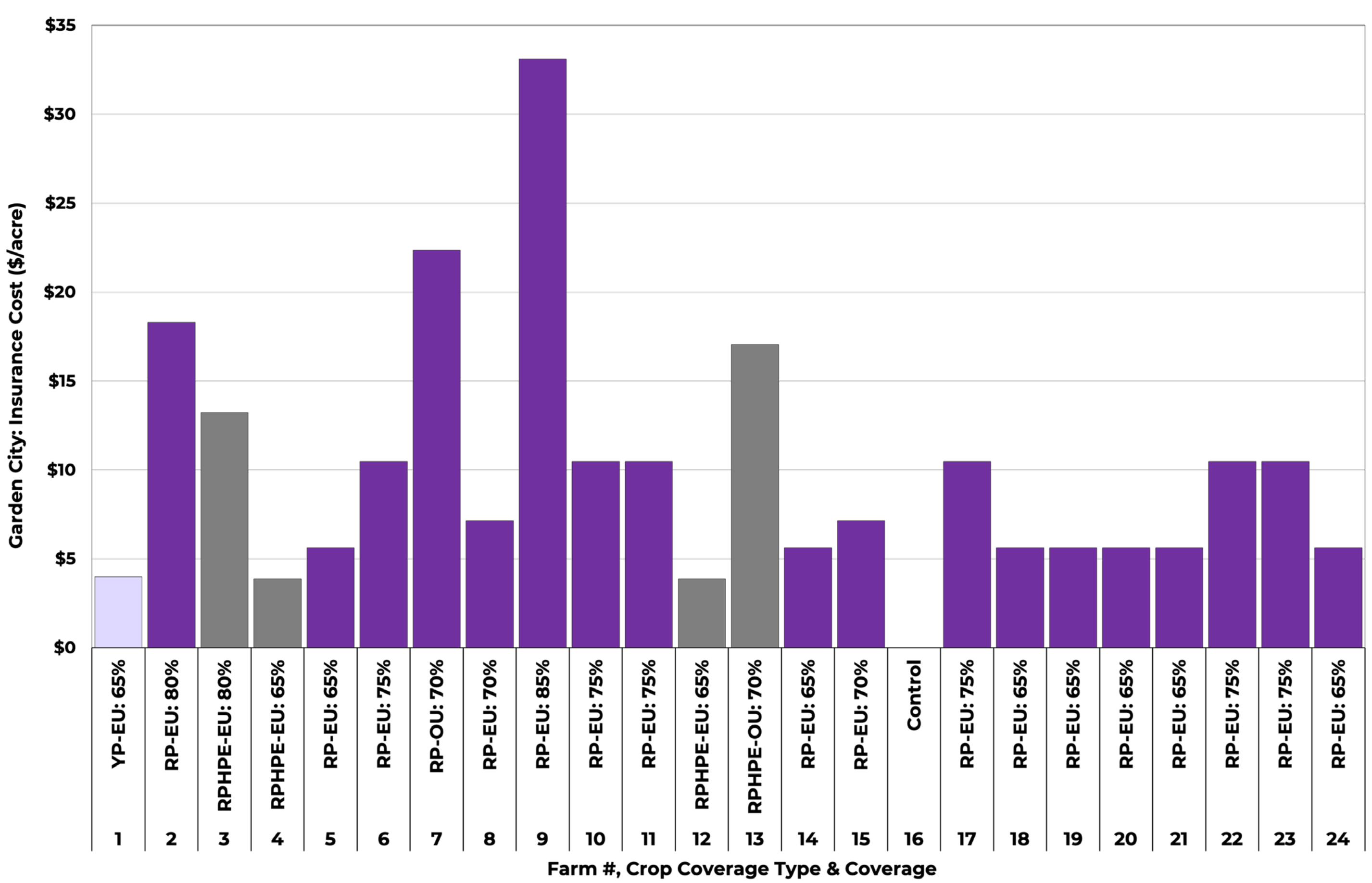



**Figure 31:** Crop insurance type, coverage, and costs ($/acre) for the TAPS Farms. RP is Revenue Protection, YP is Yield Protection, RPHPE is Revenue Protection Harvest Price Exclusion, EU is Enterprise Units, and OU is Optional Units.



## Hybrid Selection and Seeding Rate

Corn was planted into corn residue on May 20, 2025, at 30-inch row spacing and a seeding depth of 2.25 inches using a four row precision planter (Precision Planting) for all participating farms. A total of thirteen unique corn hybrids were selected by participants for the TAPS competition (Table 10). Hybrid relative maturities ranged from 108 days (Dekalb DKC 108-64) to 115 days (Pioneer P1548AM), with the majority of farms selecting hybrids between 112 and 114 days.

Golden Harvest G15L32-DV was the most frequently selected hybrid, planted by four farms (7, 18, 19, and 21). Four additional hybrids—Channel 212-02VT2PRIB, Hoegemeyer 8351V, Pioneer P12904AML, and Pioneer P1548AM—were each selected by three farms. Seeding rates varied from 20,000 to 32,000 seeds per acre, averaging 25,792 seeds per acre, with 26,000 seeds per acre representing the most common rate among producer farms. A reference hybrid, Hoegemeyer 8351V, was planted adjacent to each grower-selected hybrid within plots for comparison purposes; reference data are not reported here.

Seed costs were obtained from regional sales representatives and reflected the hybrid and trait packages assumed for a simulated 2,000-acre TAPS farm. Prices for an 80,000-seed bag ranged from $255.00 (Taylor 8824) to $422.00 (Brevant B13Z51V), with an average cost of $317 across the thirteen hybrids. When adjusted for seeding rate, seed costs ranged from $77.70 to $126.60 per acre, averaging $100.36 per acre.

**Table 10.** Corn hybrid, seeding rate, and seed cost by farm in the TAPS Water Allocation Farm Management Competition. CRM: Comparative Relative Maturity

| Farm ID | Hybrid Company | RM (Days) | Seeding (x1,000/ac) | Cost ($/ac) | Farm Cost ($) |
|---|---|---|---|---|---|
| 1 | Pioneer P1548AM | 115* | 32 | $126.00 | $252,000 |
| 2 | Channel 21202VT2PRIB | 112 | 26 | $93.93 | $187,850 |
| 3 | Pioneer P1548AM | 115* | 26 | $102.38 | $204,750 |
| 4 | Pioneer P12904AML | 112* | 25 | $96.88 | $193,750 |
| 5 | Axis 59V44 VT4PRO | 109 | 21 | $77.70 | $155,400 |
| 6 | Dekalb DKC 10864 | 108 | 20 | $90.00 | $180,000 |
| 7 | Golden Harvest G15L32DV | 114 | 25 | $95.94 | $191,875 |
| 8 | Pioneer P12904AML | 112* | 28 | $108.50 | $217,000 |
| 9 | Hoegemeyer 8351V | 113 | 26 | $100.43 | $200,850 |
| 10 | Dekalb DKC 6269 | 112 | 24 | $102.00 | $204,000 |
| 11 | Pioneer P1122AML | 111* | 24 | $84.00 | $168,000 |
| 12 | Channel 21202VT2PRIB | 112 | 25 | $90.31 | $180,625 |
| 13 | Taylor 8824 | 112 | 26 | $82.88 | $165,750 |
| 14 | LG 61C34STX | 111 | 26 | $99.13 | $198,250 |
| 15 | Pioneer P14364PCUE | 114* | 23 | $96.74 | $193,488 |
| 16 | Hoegemeyer 8351V | 113 | 24 | $92.70 | $185,400 |
| 17 | Pioneer P12904AML | 112* | 23 | $89.13 | $178,250 |
| 18 | Golden Harvest G15L32DV | 114 | 30 | $115.13 | $230,250 |
| 19 | Golden Harvest G15L32DV | 114 | 30 | $115.13 | $230,250 |
| 20 | Brevant B13Z51V | 113 | 24 | $126.60 | $253,200 |
| 21 | Golden Harvest G15L32DV | 114 | 30 | $115.13 | $230,250 |
| 22 | Pioneer P1548AM | 115* | 29 | $114.19 | $228,375 |
| 23 | Channel 21202VT2PRIB | 112 | 28 | $101.15 | $202,300 |
| 24 | Hoegemeyer 8351V | 113 | 24 | $92.70 | $185,400 |

# Nitrogen Management

Nitrogen (N) fertilizer management decisions were determined by participants and could be implemented at multiple points throughout the growing season. Farms were provided flexibility to allocate N across early, mid-, and late-season application windows in alignment with their individual management strategies. Available application timings included at-planting, early season as sidedress, and late vegetative to early reproductive via fertigation. All N fertilizer sources were urea ammonium nitrate (UAN 32), priced at $0.63 per lb N. In addition to participant-selected N applications, all farms received a uniform starter fertilizer at planting consisting of 2 gal per acre of Riser and 2 gal per acre of 10-34-0, supplying approximately 7 lb N per acre.

## At-Plant Nitrogen Application

At-plant nitrogen was applied on May 20, 2025, with fertilizer banded directly behind the closing wheels and placed approximately 3 inches on either side of the planted row. Because this operation occurred concurrently with planting, no separate application cost was assessed. Excluding the control, all farms elected to apply N at planting, with rates ranging from 30 to 180 with an average of 95 lbs of N per acre. Corresponding fertilizer material costs ranged from $36.40 to $130.90 per acre, with a mean cost of $76.53 per acre.

To incorporate the at-plant N fertilizer and activate the pre-emergence herbicide, a uniform 0.5-inch irrigation was applied across the field on May 22, 2025.

## Sidedress Nitrogen Application

Sidedress N fertilizer was applied on June 26, 2025, coinciding with the V6 growth stage. Fertilizer was applied using 360 Y-Drops (Precision Planting LLC), allowing placement near the crop row during active vegetative growth. A fixed application cost of $8.50 per acre was associated with this operation. Nine farms opted to apply sidedress N, reflecting more selective use of this practice relative to at-plant fertilization.

## Fertigation Nitrogen Application

Fertigation offered farms an opportunity to supplement N later in the season using an Agri-Inject Reflex Injection Pump (AgriInject, Inc.) tethered to the irrigation system flow meter. Up to four fertigation events were available and occurred on July 24, July 30, August 7, and August 13, 2025. An application cost of $1.25 per acre per event was assessed.

Adoption varied by timing, with six farms applying N during the first fertigation event, nine farms during the second, three farms during the third, and six farms during the final event. For fertigation applications, 0.10 inches of irrigation water was applied as a carrier for each 10 lb N per acre, proportional to the amount of N delivered rather than as a stand-alone irrigation decision.

## Seasonal Total

When summed across all application timings, total seasonal N fertilizer rates (excluding the control) ranged from 37 to 247 lb N per acre, with an average of 162 lb N per acre. Including the starter fertilizer, total seasonal N fertilizer costs ranged from $36.40 to $179.70 per acre, with an average per acre cost of $114.85.



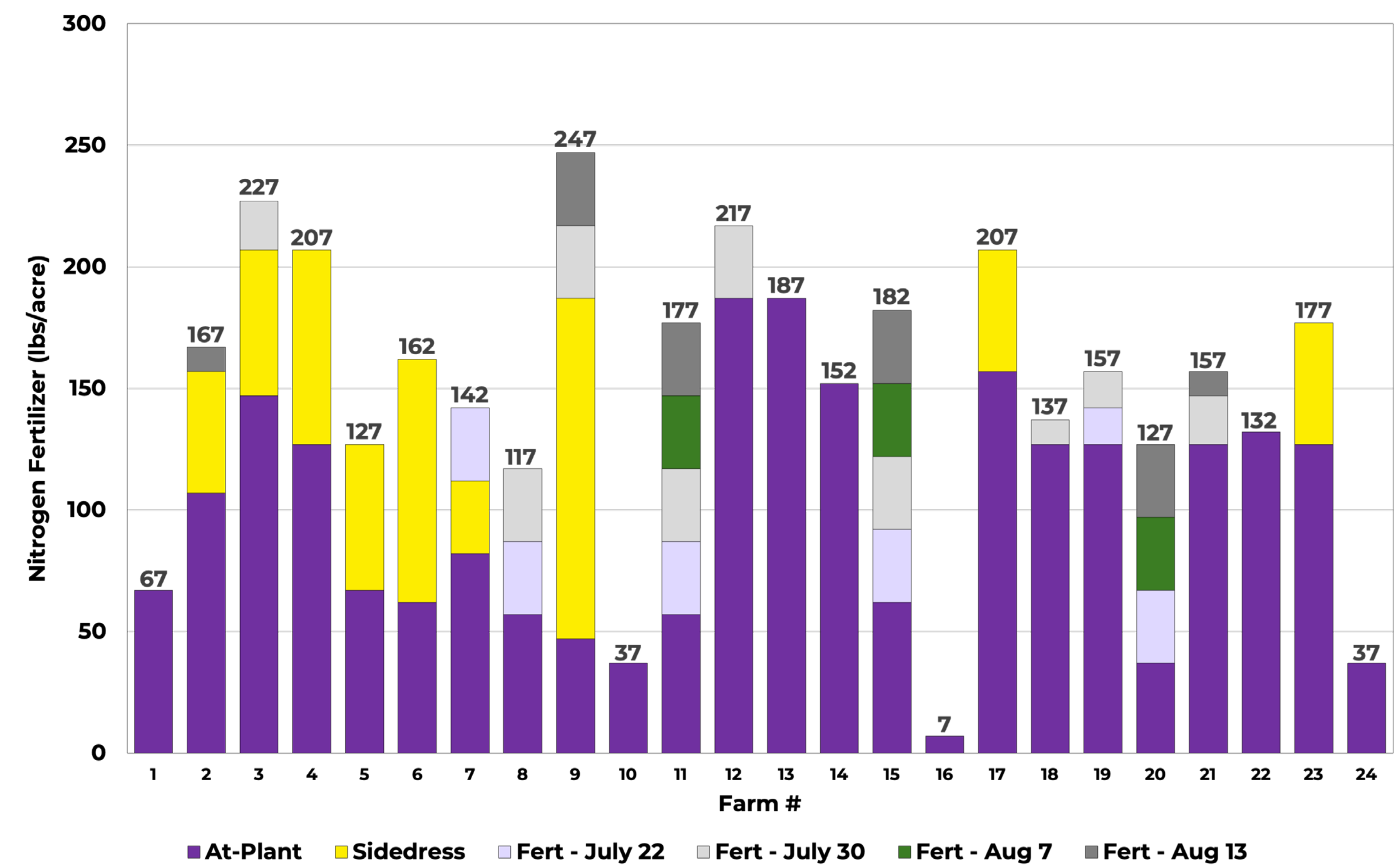



**Figure 32.** Nitrogen (N) fertilizer applied to corn by TAPS farms during the 2025 growing season at the Kansas State University SWREC in Garden City, KS. Application rates are expressed in lb N per acre; at-plant values include 7 lb N per acre of starter N applied in-furrow.

## You May Already Have the Nitrogen

Across western Kansas, many fields already contain plant-available nitrogen before a single pound of fertilizer is applied. Residual nitrate in the soil, releases from organic matter, previous crops, manure history, and even irrigation water all contribute plant-available N during the season. If you don't count those sources, you end up paying for nitrogen twice — once in the soil and again in the tank.

The updated Kansas fertilizer recommendations were built to account for those sources and help manage input cost. Instead of a fixed rate, the recommendation estimates how much N the crop needs and subtracts what the field will supply.

The recommendations account for:

- Residual soil nitrate (0–24" profile test)
- Soil organic matter mineralization
- Previous crop credits (like soybeans or alfalfa)
- Nitrogen in irrigation water
- Manure history

Research across Kansas shows nitrogen efficiency improves when applications are based on soil test information and field history, not a flat rate. Applying extra nitrogen does not guarantee higher yield, but it does increase cost and the chance nitrate moves below the root zone.

Start with a profile soil nitrate test

A 0–24 inch soil sample tells you how much nitrogen the crop already has access to so fertilizer fills the gap instead of creating excess.

To learn more visit K-State Soil Test Interpretations & Fertility Recommendations: agronomy.k-state.edu

**Scan here to learn more.**

# Irrigation Management

Irrigation was applied using a Valley variable rate linear-move irrigation system (Valmont Industries) equipped with Nelson D3030 Sprayhead LEPA sprinklers fitted with 6-psi regulators, spaced at 5-ft intervals and mounted approximately 2 ft above the soil surface. The TAPS competition simulated an irrigation system capacity of 2.7 gpm per acre, allowing a maximum application of 1 inch of irrigation per week.

Cumulative irrigation applied to corn is shown in Figure 33. All farms received a uniform 0.5inch irrigation on May 22, 2025, to incorporate nitrogen fertilizer and activate herbicides. The first producer-scheduled irrigation occurred on June 20, 2025, by Farms 6, 7, and 13, coinciding with the V5 growth stage. Most irrigation was applied from mid-July through mid-August during a prolonged dry period, with minimal irrigation applied in September following late-August rainfall.

Seasonal irrigation ranged from 0.5 inches (Farms 1, 10, and 16 -control) to 9.4 inches (Farm 15). Excluding the control and two farms that did not schedule irrigation, the average was 6.58 inches. Total irrigation cost, which includes a fixed labor charge of $10.80 per acre and a variable application cost of $7.61 per applied inch, ranged from $14.61 to $82.33 per acre. The percentage of Q-Stable utilized by the competing farms ranged from 5 to 86%.

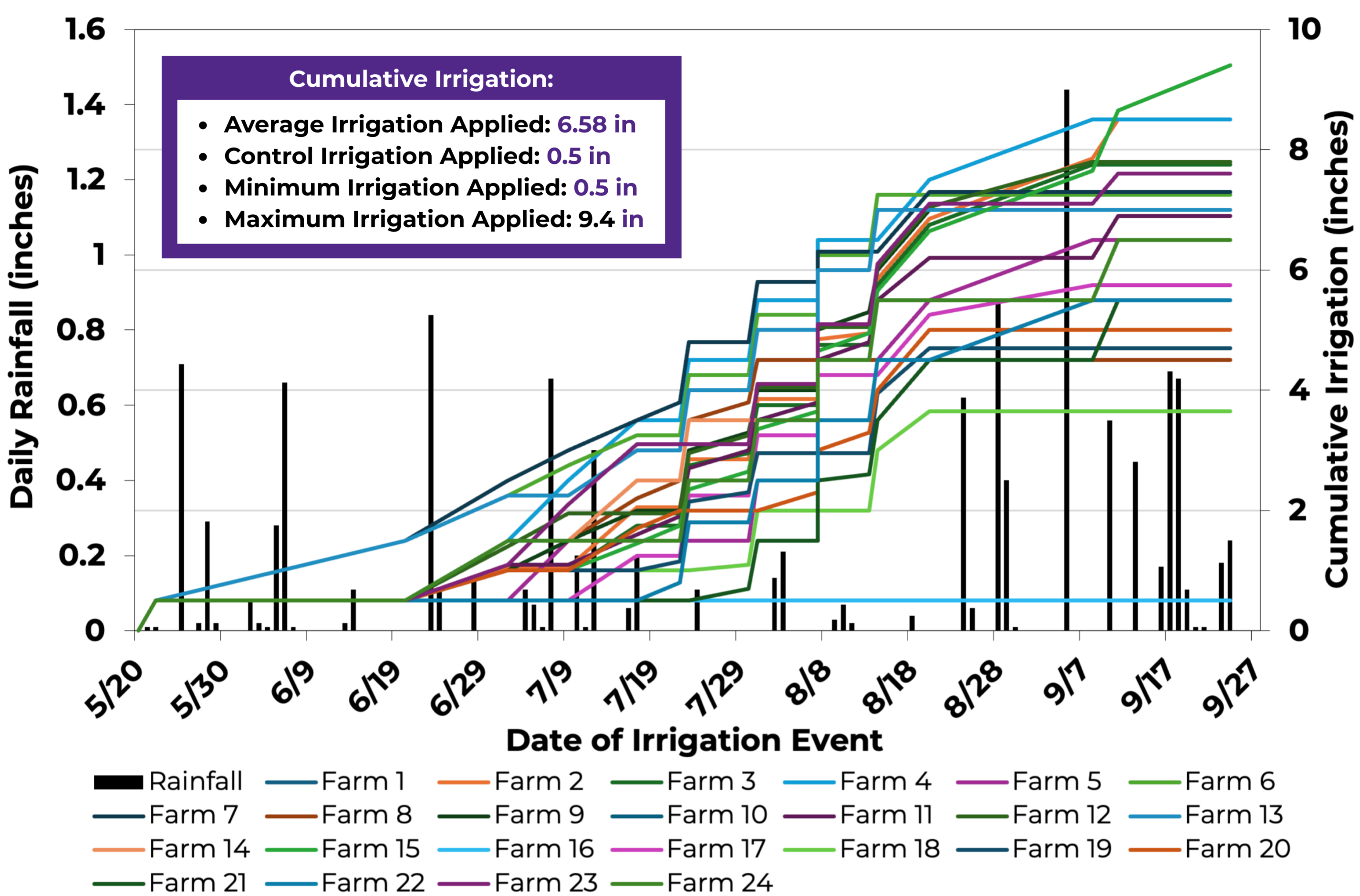



**Figure 33.** Cumulative irrigation (inches) applied by TAPS farms during the 2025 growing season at the Kansas State University Southwest Research-Extension Center in Garden City, Kansas.

**Table 11.** Total seasonal irrigation (inches), percentage of Q-Stable utilized, and cost ($/acre) by the 2025 TAPS Farms at the Kansas State University Southwest Research-Extension Center in Garden City, Kansas.

| Farm ID | Irrigation (inches) | Q-Stable Utilization (%) | Cost ($/ac) |
|---|---|---|---|
| 1 | 0.50 | 5 | $14.61 |
| 2 | 8.50 | 78 | $75.49 |
| 3 | 7.75 | 71 | $69.78 |
| 4 | 8.50 | 78 | $75.49 |
| 5 | 6.50 | 59 | $60.27 |
| 6 | 7.25 | 66 | $65.97 |
| 7 | 7.30 | 67 | $66.35 |
| 8 | 4.50 | 41 | $45.05 |
| 9 | 7.00 | 64 | $64.07 |
| 10 | 0.50 | 5 | $14.61 |
| 11 | 6.90 | 63 | $63.31 |
| 12 | 7.80 | 71 | $70.16 |
| 13 | 7.00 | 64 | $64.07 |
| 14 | 5.50 | 50 | $52.66 |
| 15 | 9.40 | 86 | $82.33 |
| 16 | 0.50 | 5 | $14.61 |
| 17 | 5.75 | 53 | $54.56 |
| 18 | 3.65 | 33 | $38.58 |
| 19 | 4.70 | 43 | $46.49 |
| 20 | 5.00 | 46 | $48.85 |
| 21 | 5.50 | 50 | $52.66 |
| 22 | 5.50 | 50 | $52.66 |
| 23 | 7.60 | 69 | $68.64 |
| 24 | 6.50 | 59 | $60.27 |

# **Grain** Marketing

Participants were encouraged to utilize five marketing methods: Spot (Cash) Sales, Forward Contracts, Basis Contracts with Delivery at Harvest, Simple Hedge-to-Arrive, and Futures Contracts. All marketing decisions were made between April 7 and December 5, 2025, due to delays in harvest data calculations.

Final farm production was calculated using the average yield from each farm's plots, managed according to team-defined practices. For marketing purposes, the Average Production History (APH) of 200 bu per acre on a 2,000-acre farm was utilized as the benchmark for total marketable bushels. This number was then adjusted post-harvest to account for average farm yield (bu).

All grain marketing decisions were reviewed and validated, and applicable trucking fees were assessed. All contracts were required to be closed by December 5. Penalties included $0.10 per bu for any contracts closed by the TAPS team, $0.05 per bu for unsold grain, and $0.10 per bu plus the current market price for oversold grain bought back on December 5.

The 2025 USDA harvest price for corn was $4.22 per bu, which was below the February 2025 price guarantee of $4.70 per bu. While the market showed limited directional movement for much of the season, December 2025 corn futures traded within a relatively narrow range, reflecting ample supplies and mixed demand signals. Modest volatility occurred later in the marketing year, with prices softening into the fall. A brief rally in late November marked the conclusion of the TAPS marketing year.

Grain marketing decisions varied significantly among participants (Figure 34). A total of 10 farms made marketing decisions, resulting in 31 completed contracts: 15 Forward Contracts, 12 Spot (Cash) Contracts, 3 Basis Contracts, and 1 Futures Contract.

The overall average price per bushel achieved was $4.24 per bu, with a maximum of $4.80 per bu by Farm 11 and a minimum of $4.10 per bu by Farms 1, 3, 4, 5, 7, 8, 10, 18, 19, 20, 21, 22, and 24. The 13 farms that did not make marketing decisions had their grain sold at the end of the marketing period for $4.15 per bu, minus a $0.05 per bu handling fee. The average corn grain price sold ($/bu) and grain yields for each farm are summarized in Figure 34.


**Figure 34.** Weighted average grain market price ($/Bushels) and average grain yields (bu/acre) obtained for the TAPS Farms at the Kansas State University SWREC in Garden City, KS.



## Sell Smart in Flat Markets

**TAPS results show timing — not just yield — drives profitability**

For Kansas farmers, grain marketing does not begin at harvest. It begins the day the seed goes into the ground.

That lesson emerged clearly from the 2024 Kansas State University Testing Ag Performance Solutions (TAPS) competition. The most successful farms were not simply those with the highest yields — they were the farms that marketed grain early, often, and intentionally.

In Colby, TAPS participants navigated a marketing year defined by sluggish corn prices and brief, unpredictable rallies. USDA's harvest price of $4.16 per bushel was 11% lower than the spring projected price of $4.66. December futures offered a roughly 50-cent rally in late August before dropping about 35 cents in October, followed by only a short-lived rebound.

Teams that captured those windows posted the strongest financial outcomes. One team secured $5.01 per bushel through a forward contract, while teams that remained unpriced until the deadline settled closer to $4.24.

**A Familiar Market Environment**

The following year presented a similar picture.

December corn futures peaked near $4.75 in February before slipping to roughly $4.11 later in the season. Forward cash bids across six Kansas locations averaged $3.79 in late July — enough to cover direct costs and cash rent, but leaving little margin for family living expenses. Basis levels also weakened, averaging approximately 32 cents below the five-year average, making storage a risk rather than a guaranteed opportunity.

K-State agricultural economist Dan O'Brien noted that markets remained primarily driven by supply, with moderate carryout projections and limited demand strength.

"Producers need to decide whether they can afford to wait or whether they need to move now to cover costs," O'Brien said.

**What TAPS Data Shows**

TAPS results reinforced the same conclusion: successful farms did not wait for a perfect price. They managed price risk throughout the season.

In 2024, participants completed 86 marketing transactions across forward contracts, futures, basis contracts, hedge-to-arrive agreements and spot sales. The difference between the top and bottom marketing performers was about 80 cents per bushel — a margin that influenced net farm income more than any single input decision.

**Managing Risk, Not Predicting Markets**

Opportunities may also come from diversification. In some Kansas markets, forward sorghum bids were 30–40 cents higher than spot cash prices, offering a margin-protection option for producers willing to act early.

Kansas Farm Bureau commodities director Mark Nelson emphasizes a practical starting point.

"The first question to answer is always, 'Can I cover my cost of production?'" Nelson said. "From there, it's about matching the tools — forward contracts, options or crop mix — to your own risk and opportunities."

Whether in a competition or on individual farms, the takeaway remains consistent: marketing decisions do not start when the combine enters the field. They begin months earlier, with a plan.

In flat or declining markets, farms that market steadily and manage risk are more likely to remain financially resilient when the books close.

TAPS on TAP is a regular Kansas Farmer column by K-State college of agriculture director of communication and TAPS partner Kelsey Stremel, that shares real-world lessons, data, and decision insights from the TAPS competitions. To learn more and view past TAPS on TAP columns visit www.farmprogress.com/kansas-farmer.


# AWARD WINNERS

# MOST ECONOMICALLY **PROFITABLE**

Profitability was calculated as the difference between total revenue and total expenses (Table 12). Revenue, driven primarily by grain yield and marketing decisions—and supplemented by indemnity payments for two farms (Farms 1 and 18)—ranged from $540 to $1,074 per acre, with the highest revenue observed for Farm 15.

Total expenses ranged from $562 per acre (Farm 16) to $820 per acre (Farm 9), with an average of $716 per acre. Cash rent represented the largest share of total expenses, averaging 24% across farms, followed by fertilizer costs (including starter fertilizer), which accounted for an average of 15% of total expenses.

Two farms (Farms 1 and 18) experienced net losses, while the remaining farms were profitable (Figure 35). The highest profit ($318 per acre) was achieved by Farm 11. Although Farm 11 ranked fourth in yield (218.5 bu per acre), it received the highest average grain price ($4.80 per bu), resulting in the second-highest revenue ($1,049 per acre). Combined with relatively moderate total expenses ($731 per acre; 14th highest), Farm 11 narrowly exceeded Farm 15 by $7.55 per acre in net profit.

To examine the relationships and key drivers of profitability, a surface analysis is presented in Figure 36. Profit is shown as the background color, with total irrigation on the x-axis and total nitrogen fertilizer on the y-axis. Estimated yield is overlaid as black isolines to provide context for the profitability patterns.

**Table 12.** Total profitability calculated on net-income basis with any farms that received crop insurance indemnity payments noted.

| Team ID | Revenue ($/ac) | Expenses ($/ac) | Profit ($/ac) |
|---|---|---|---|
| 1 | $539.90 | $628.29 | -$88.39 |
| 2 | $923.15 | $758.97 | $164.18 |
| 3 | $856.90 | $793.19 | $63.71 |
| 4 | $860.59 | $770.34 | $90.25 |
| 5 | $730.21 | $682.52 | $47.69 |
| 6 | $844.05 | $730.62 | $113.43 |
| 7 | $773.67 | $735.88 | $37.79 |
| 8 | $731.44 | $687.38 | $44.06 |
| 9 | $1,002.08 | $820.24 | $181.84 |
| 10 | $623.22 | $594.55 | $28.67 |
| 11 | $1,048.80 | $730.78 | $318.02 |
| 12 | $1,017.01 | $759.18 | $257.83 |
| 13 | $1,023.74 | $738.91 | $284.83 |
| 14 | $847.07 | $707.79 | $139.29 |
| 15 | $1,073.98 | $763.51 | $310.46 |
| 16 | $578.51 | $562.21 | $16.30 |
| 17 | $785.40 | $744.83 | $40.57 |
| 18 | $676.09 | $695.33 | -$19.24 |
| 19 | $849.52 | $723.44 | $126.08 |
| 20 | $808.93 | $718.14 | $90.79 |
| 21 | $730.21 | $725.24 | $4.98 |
| 22 | $784.74 | $712.90 | $71.84 |
| 23 | $895.78 | $755.58 | $140.21 |
| 24 | $815.08 | $635.43 | $179.66 |



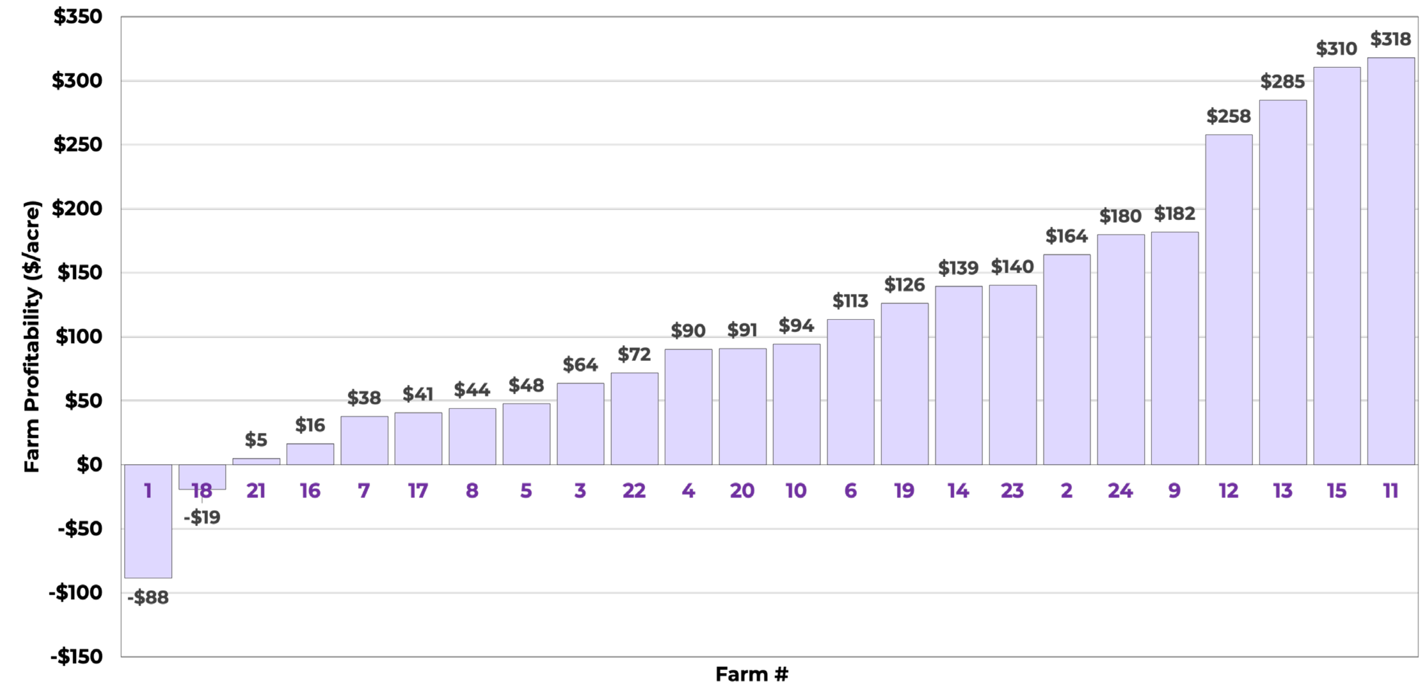



**Figure 35.** Profitability ($/acre) of the TAPS Farms competing at the Southwest Research-Extension Center in Garden City, Kansas.

Overall, profitability increased with greater irrigation and declined with excessive nitrogen fertilization. Management strategies applying more than approximately 150 lb N per acre generally exhibited lower profitability compared with strategies that allocated proportionally more resources to irrigation and achieved a more balanced water– nitrogen combination.

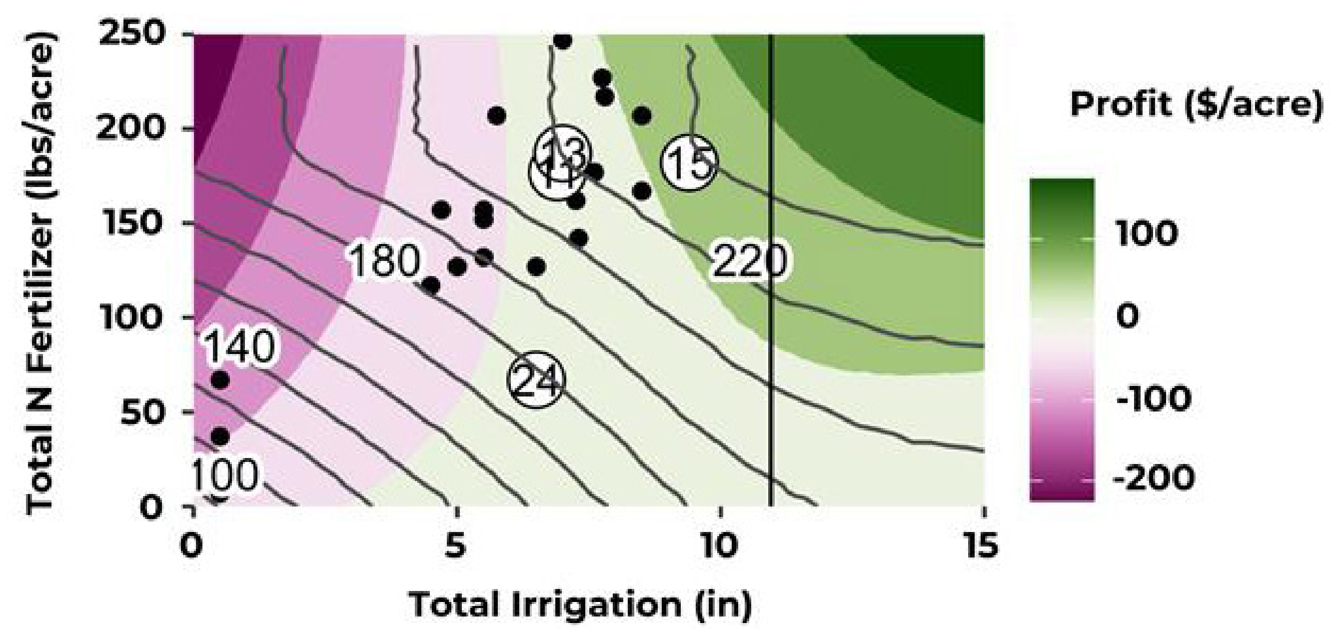



**Figure 36.** Farm profitability ($/acre) as a function of applied irrigation (inches) and nitrogen fertilizer rate (lb/acre), with profit represented by the background color and estimated yield by the black contour lines. The Q-stable irrigation limit of 10.95 inches and award-winning farms for profit (Farm 11), yield (Farm 15), efficiency (13 and 24) are indicated.

# AWARD WINNER

2025

## MOST ECONOMICALLY PROFITABLE

### FIRST PLACE: FARM 11 — $318/ACRE

**Tyler Hands**, **Jacob Mettlen** & **Lindy McMillen** with a profitability of $318.02/acre. Farm 11 utilized a local spot cash contract for an average corn price sold of $4.80/bu.

### SECOND PLACE: FARM 15 — $310/ACRE

**Ryan Jagels** & **Jalen Jagels** with a profitability of $310.46/acre. Farm 15 utilized a local spot cash contract for an average corn price sold of $4.75/bu.

### THIRD PLACE: FARM 12 — $285/ACRE

**Todd Roth**, **Troy Roth**, **Dwane Roth**, **Leah Beaulac**, **Rachel O'Conner**, **William Madudike** & **Keatlegile Mnguni** with a profitability of $284.83/acre. Farm 13 utilized a local spot cash contract and a basis contact for an average corn price sold of $4.60/bu.

# **Highest** Input Use Efficiency

The Water–Nitrogen Intensification Performance Index (WNIPI; Lo et al., 2019) is non-dimensional (unitless) and quantifies the increase in grain yield relative to a control as a function of applied nitrogen fertilizer and irrigation above the control's aboveground nitrogen uptake and evapotranspiration (ET), respectively.

The control (Farm 16) received no nitrogen fertilizer, except for starter (7 lb N per ac) and no irrigation beyond a single 0.5-inch application for herbicide activation. Farm 16 produced an average yield of 141.1 bu per acre at 15.5% moisture content, with an estimated seasonal ETa of 17.46 inches and aboveground nitrogen uptake of 159 lb N per acre.

The WNIPI values along with total nitrogen fertilizer and irrigation are presented in Figure 37. Two farms, 1 and 10, had negative WNIPI values due to lower yields than the control. Although, farm 1 and 10 applied 60 and 30 lbs per acre of N fertilizer, respectively, the absence of irrigation, along with differences in hybrid performance, resulted in the lower yield and consequently negative WNIPI values. For the farms that applied both irrigation and nitrogen, WNIPI ranged from 0.079 (Farm 18) to 0.221 (Farm 24). Farm 24, university managed, was not eligible for the award.

$$\mathrm{WNIPI} = \frac{\left(\frac{Y_{\mathrm{Farm}}}{Y_{\mathrm{Control}}} - 1\right)}{\left(1 + \frac{I_{\mathrm{Farm}}}{ET_{\mathrm{Control}}}\right) \times \left(1 + \frac{N_{\mathrm{Farm}}}{ANU_{\mathrm{Control}}}\right)}$$

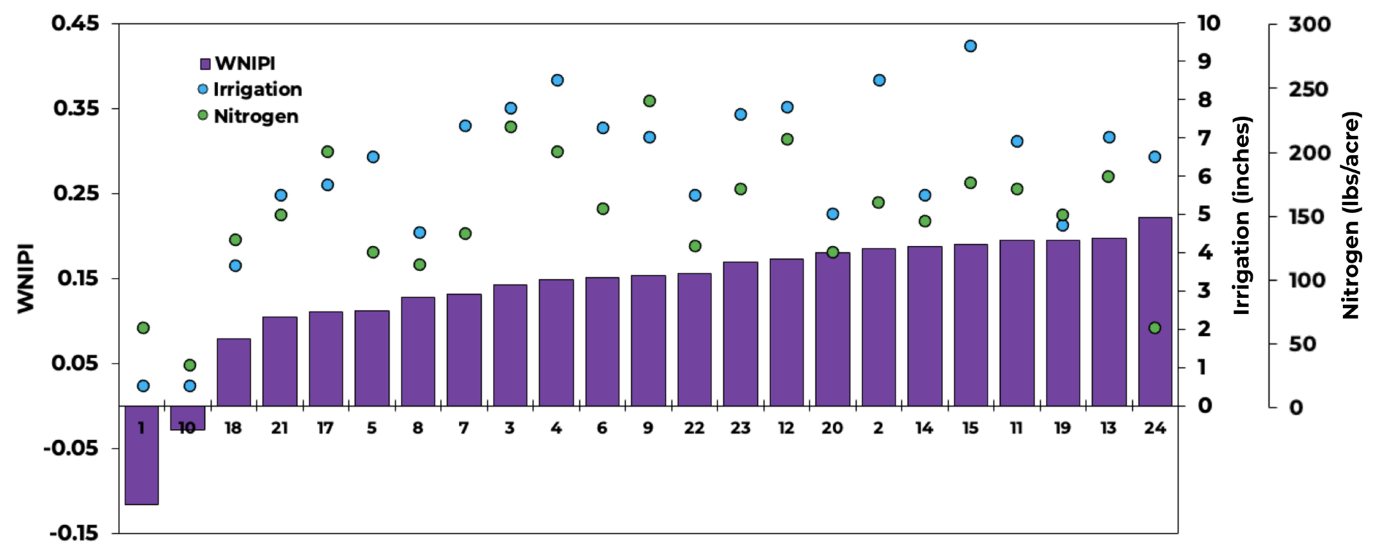



**Figure 37.** Water and Nitrogen Intensification Performance Index (WNIPI) and seasonal total irrigation (inches) and nitrogen fertilizer (lbs/acre) for the TAPS Farms competing at the Southwest Research-Extension Center in Garden City, Kansas.



Like profitability, a surface analysis was developed for WNIPI (Figure 38). WNIPI increased with irrigation up to approximately 8 inches of irrigation and then declined at a given nitrogen rate. In contrast, increasing nitrogen fertilizer resulted in only marginal gains in WNIPI, as indicated by the predominantly vertical isolines.

The overlaid estimated yield isolines (black contours) slope diagonally, indicating that yield increased with concurrent increases in irrigation and nitrogen fertilizer up to approximately 150 lb N per acre. In contrast, similar WNIPI values occurred across abroad range of yields, highlighting inherent trade offs between production and efficiency. Notably, WNIPI peaked at moderate irrigation levels, whereas profitability peaked at moderate to high irrigation levels (Figure 36). Together, these patterns underscore the importance of jointly evaluating WNIPI and profitability when assessing management strategies. Finally, caution should be exercised when interpreting regions of the response surface outside the range of observed data, as these areas reflect extrapolated relationships rather than measured outcomes.

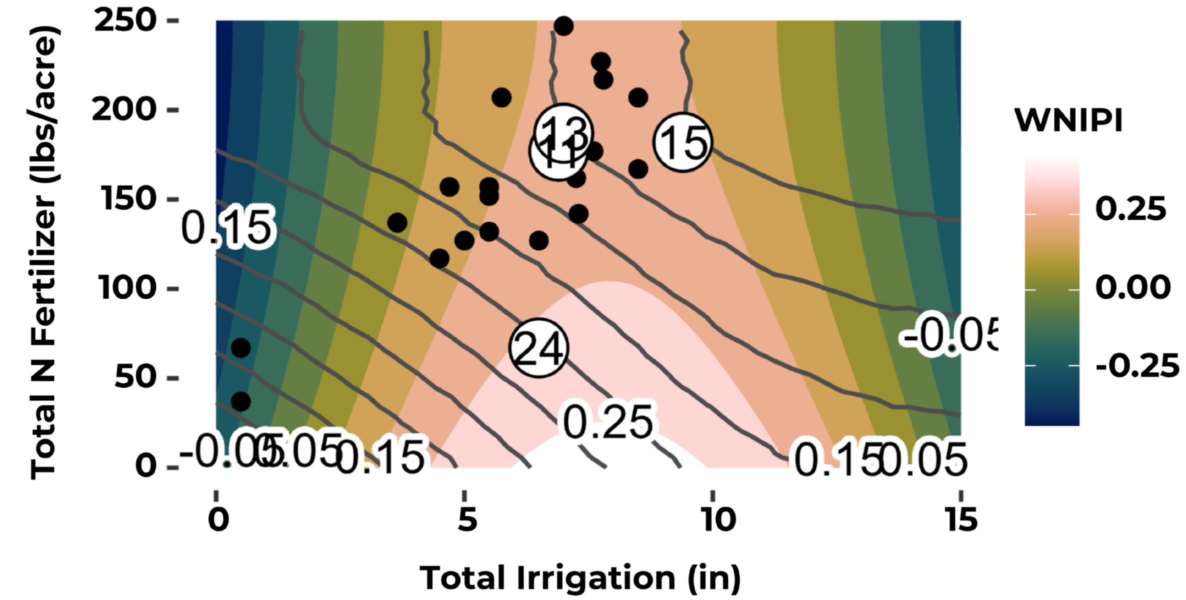
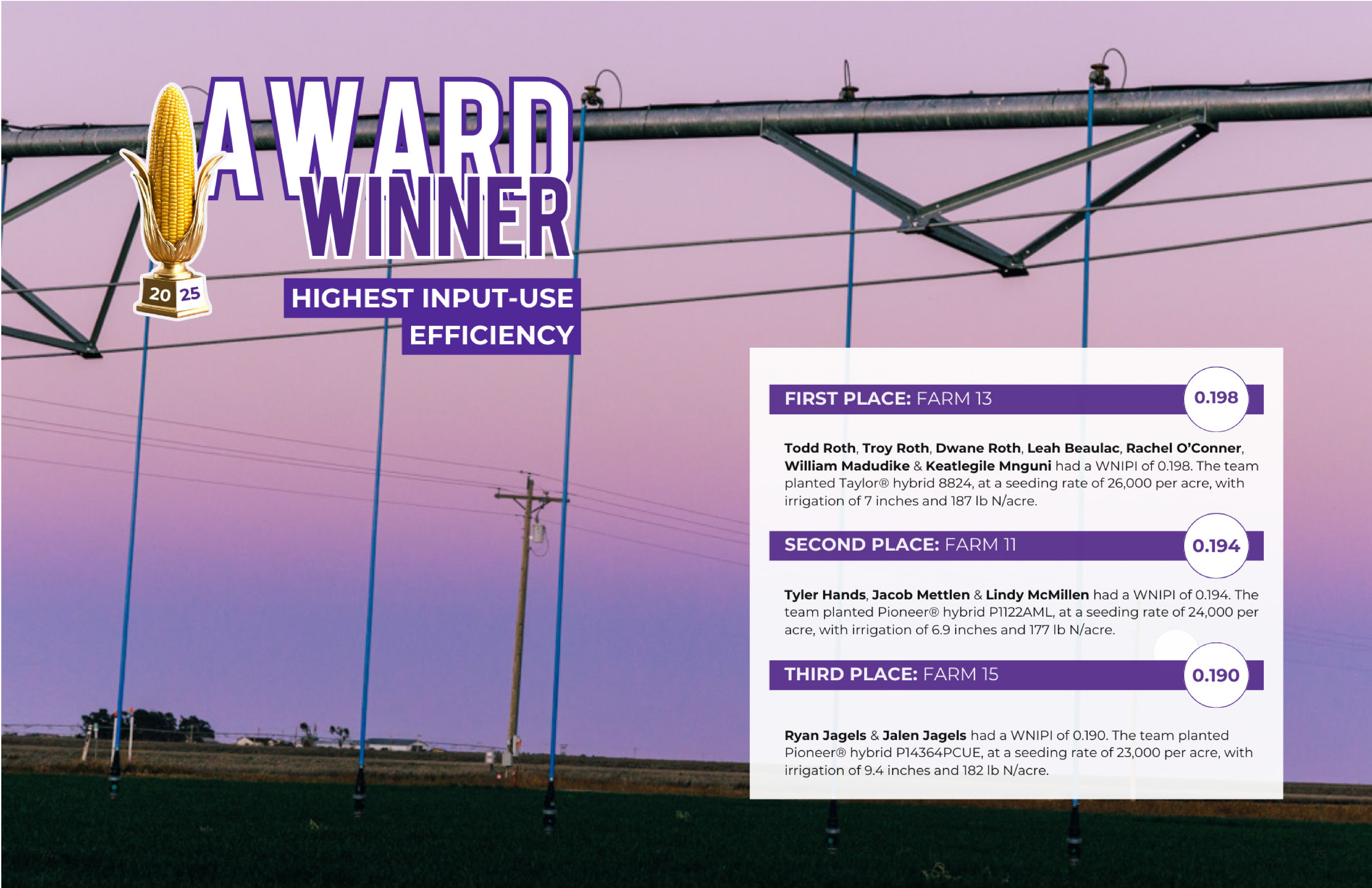



**Figure 38.** Water and Nitrogen Intensification Performance Index (WNIPI) as a function of applied irrigation (inches) and nitrogen fertilizer rate (lb/acre), with WNIPI represented by the background color. Estimated grain yield is represented by black isolines. Award-winning farms for profit (Farm 11), yield (Farm 15), efficiency (13 and 24) are indicated.



# AWARD WINNER

## HIGHEST INPUT-USE EFFICIENCY

### FIRST PLACE: FARM 13 — 0.198

**Todd Roth**, **Troy Roth**, **Dwane Roth**, **Leah Beaulac**, **Rachel O'Conner**, **William Madudike** & **Keatlegile Mnguni** had a WNIPI of 0.198. The team planted Taylor® hybrid 8824, at a seeding rate of 26,000 per acre, with irrigation of 7 inches and 187 lb N/acre.

### SECOND PLACE: FARM 11 — 0.194

**Tyler Hands**, **Jacob Mettlen** & **Lindy McMillen** had a WNIPI of 0.194. The team planted Pioneer® hybrid P1122AML, at a seeding rate of 24,000 per acre, with irrigation of 6.9 inches and 177 lb N/acre.

### THIRD PLACE: FARM 15 — 0.190

**Ryan Jagels** & **Jalen Jagels** had a WNIPI of 0.190. The team planted Pioneer® hybrid P14364PCUE, at a seeding rate of 23,000 per acre, with irrigation of 9.4 inches and 182 lb N/acre.

# **Greatest**
# Grain Yield

Corn was harvested on November 6 using a Wintersteiger Delta combine equipped with a HarvestMaster Grain Gauge. Grain yields, adjusted to 15.5% moisture, ranged from 118.5 bu per acre (Farm 1) to 226.1 bu per acre (Farm 15). The highest-yielding team, Farm 15, planted Pioneer P14364PCUE (CRM 114) at 23,000 seeds per acre, applied the greatest irrigation depth (9.4 inches) and the seventh highest nitrogen rate (182 lb N per acre) in the competition. These results further support that water availability was more strongly associated with yield increases than nitrogen fertilizer, as yield response to N plateaued within the approximate range of 111 to 173 lb N per acre, as higher N rates did not consistently translate to higher yields (Figure 39).

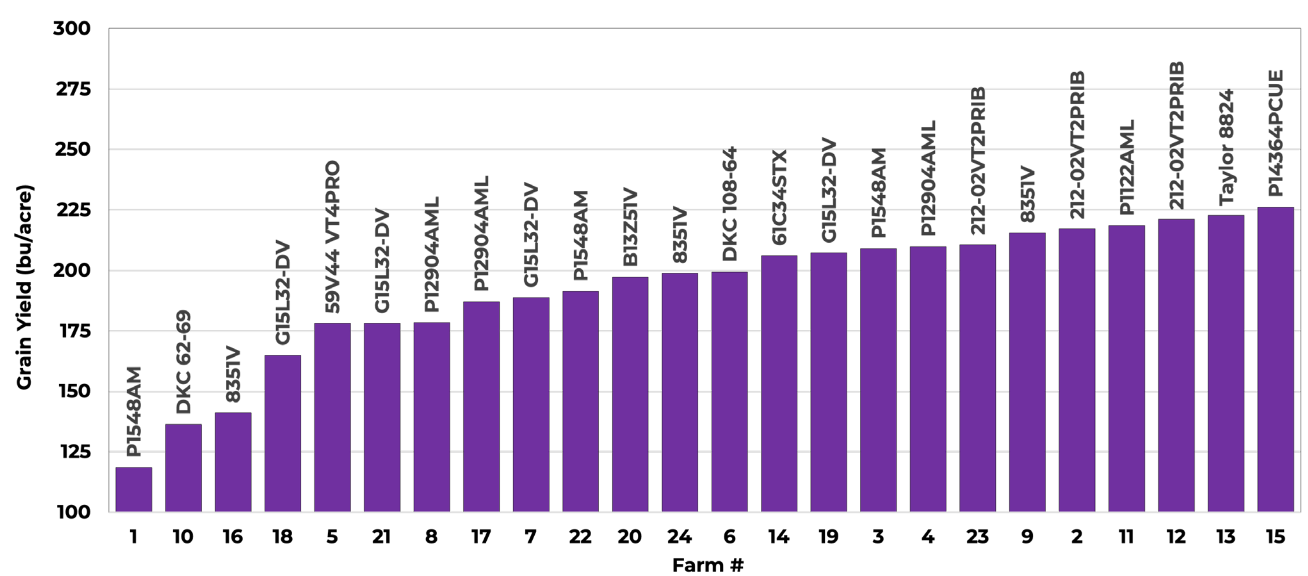
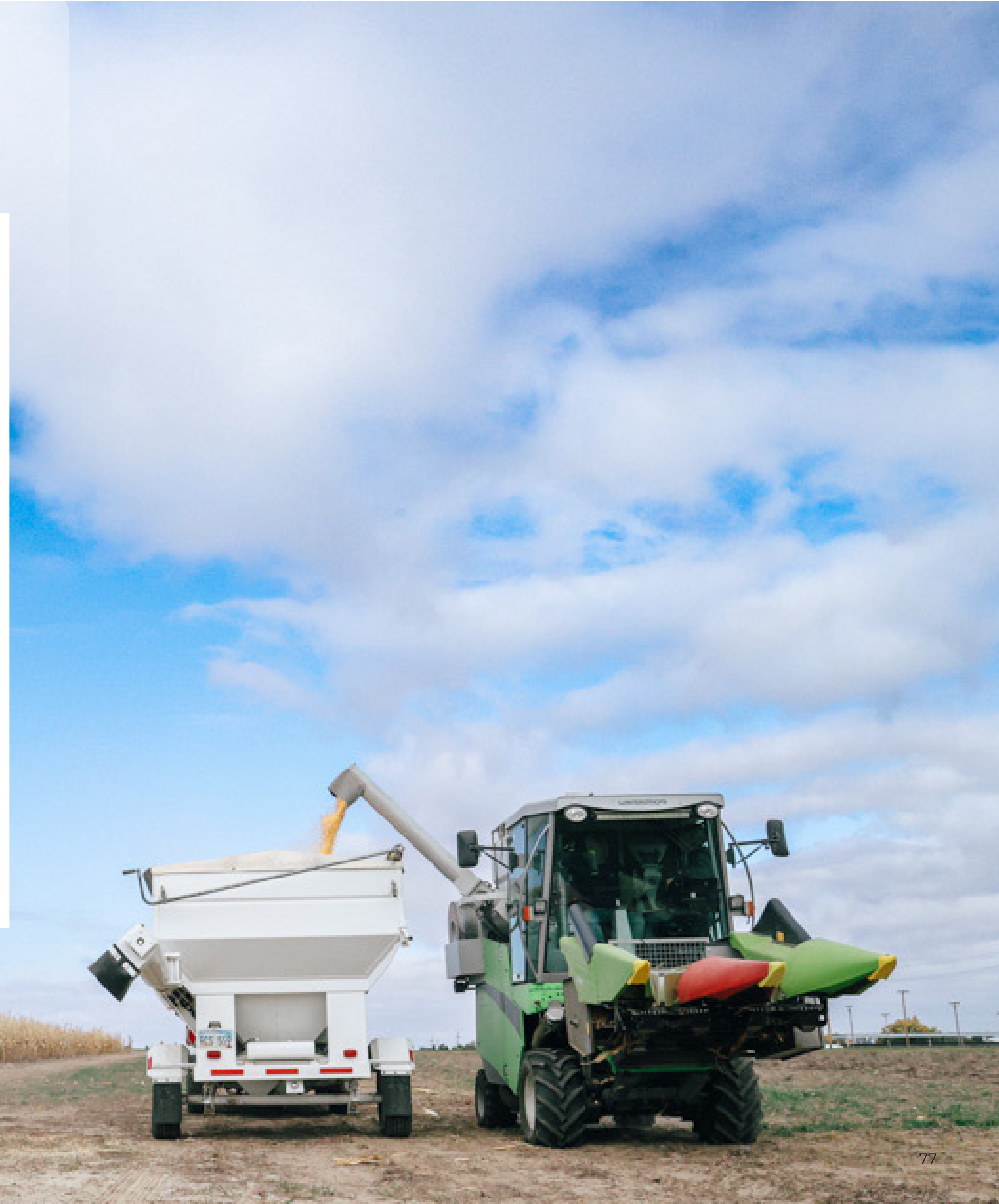



**Figure 39.** Planted hybrid and resulting grain yield (bu/acre) at 15.5% moisture content for the TAPS Farms TAPS Farms at the Kansas State University SWREC in Garden City, KS



# AWARD WINNER

## GREATEST GRAIN YIELD

### FIRST PLACE: FARM 15 — 226 BU/ACRE

**Ryan Jagels** & **Jalen Jagels** achieved a yield of 226.1 bu/acre using Pioneer® hybrid P14364PCUE, planted at a seeding rate of 23,000 per acre, with irrigation of 9.4 inches and 182 lb N/acre fertilizer.

### SECOND PLACE: FARM 13 — 223 BU/ACRE

**Todd Roth**, **Troy Roth**, **Dwane Roth**, **Leah Beaulac**, **Rachel O'Conner**, **William Madudike** & **Keatlegile Mnguni** achieved a yield of 222.7 bu/acre using Taylor® hybrid 8824, planted at a seeding rate of 26,000 per acre, with irrigation of 7 inches and 187 lb N/acre fertilizer.

### THIRD PLACE: FARM 12 — 221 BU/ACRE

**Troy Dumler** achieved a yield of 221.1 bu/acre using Channel® hybrid 212-02VT2PRIB, planted at a seeding rate of 25,000 per acre, with irrigation of 7.8 inches and 217 lb N/acre fertilizer.

# 2025 TAPS EVENTS

*Where decisions, data, and relationships come together*

## Kickoff Meeting

March 26, 2025 - Colby
March 27, 2025 - Garden City

Competition Overview
Rules and Guidelines
Team Portal Credentials

## Field Tour and Technology Day

July 29, 2025 - Colby
July 31, 2025 - Garden City

Competition Update
Touring of Plots
Technology Demonstrations

## Agronomy Twilight Tours

September 4, 2025 - Garden City
September 8, 2025 - Colby

Competition Update
Agronomic Update

## Awards Banquet

February 21, 2026
Garden City, KS

Dinner
Competition Summary
Awards and Acknowledgments



## Turning Data Into Decisions


Long before he ever saw an irrigation pivot, Rayhaan Kabenge was trying to solve everyday problems in Kampala, Uganda — building small systems and asking a simple question: how can technology make work easier?

Today, that same curiosity has brought him to western Kansas. Kabenge is a post doctorate research associate with Kansas State University's Testing Ag Performance Solutions (TAPS) team, where he is helping develop decision tools designed specifically for farmers.

Kabenge studied water and irrigation engineering at Makerere University. While there, he designed a wireless irrigation control system and became interested in technology that could directly improve farm productivity. His path changed in 2023 when TAPS director Daran Rudnick visited his university and described a program where farmers, researchers and industry partners make real management decisions together on Kansas research farms.

"That was the type of work I had been looking for," Kabenge said. "It was practical and connected directly to producers."

Within months he was in Kansas, collecting field data, attending producer meetings and learning how farmers actually make decisions under weather, market and labor pressure.

Kabenge is now building part of the TAPS Decision Support Suite — a web-based dashboard that brings together weather data, soil moisture, irrigation records, nitrogen applications, drone imagery and crop-health measurements.

The goal is simple: make complex research information usable during the season, not just after harvest.

An artificial-intelligence component translates technical analytics into plain-language explanations so producers can quickly understand what the data is telling them.

He describes the tool as "bridging the gap between technical analysis and practical decision-making."

Working directly with TAPS competitors changed how he approaches engineering.

"I start with the producer's problem and then design the solution," he said. "Understanding how farmers actually make decisions ensures the tools are useful, not just technically impressive."

Moving from Uganda to Kansas came with adjustments — climate, culture and long drives between Manhattan and Colby for field work — but Kabenge says the interaction with farmers has been the most important part of his education.

He was struck by how openly producers shared experiences, successes and mistakes during the competition.

"Seeing that level of engagement showed me how impactful research can be when farmers are directly involved," he said.

The TAPS program's small team and wide producer participation also left an impression. Managing trials, outreach and data quality simultaneously showed him how applied research works when it is built around real farm decisions.

Kabenge's work focuses on helping producers make timely decisions about irrigation and nitrogen — two of the most expensive and risky inputs on the High Plains. Instead of sorting through spreadsheets, graphs and sensor readings, farmers will be able to see clear recommendations and explanations.

"My aim is to help producers get more from what they invest," he said. "If we can simplify decisions and improve efficiency, that benefits both profitability and water resources."

While the tools are being developed in Kansas, he hopes they eventually help producers worldwide. The challenges of input costs, weather uncertainty and water management are shared across continents.

For TAPS participants, his work means the data they generate in the competition is not just being studied — it is being turned into tools they can actually use on their own farms.

In the end, Kabenge sees the project as a partnership.

"Farmers bring the experience," he said. "We bring the analysis. The best solutions come when those two work together."

# TAPS AGRONOMY
Twilight Tours

## Seed Sponsors

Axis Seed – Red Barn Enterprises

Hoegemeyer – The Right Seed

Pioneer

Channel

Brevant seeds

Golden Harvest

Dekalb

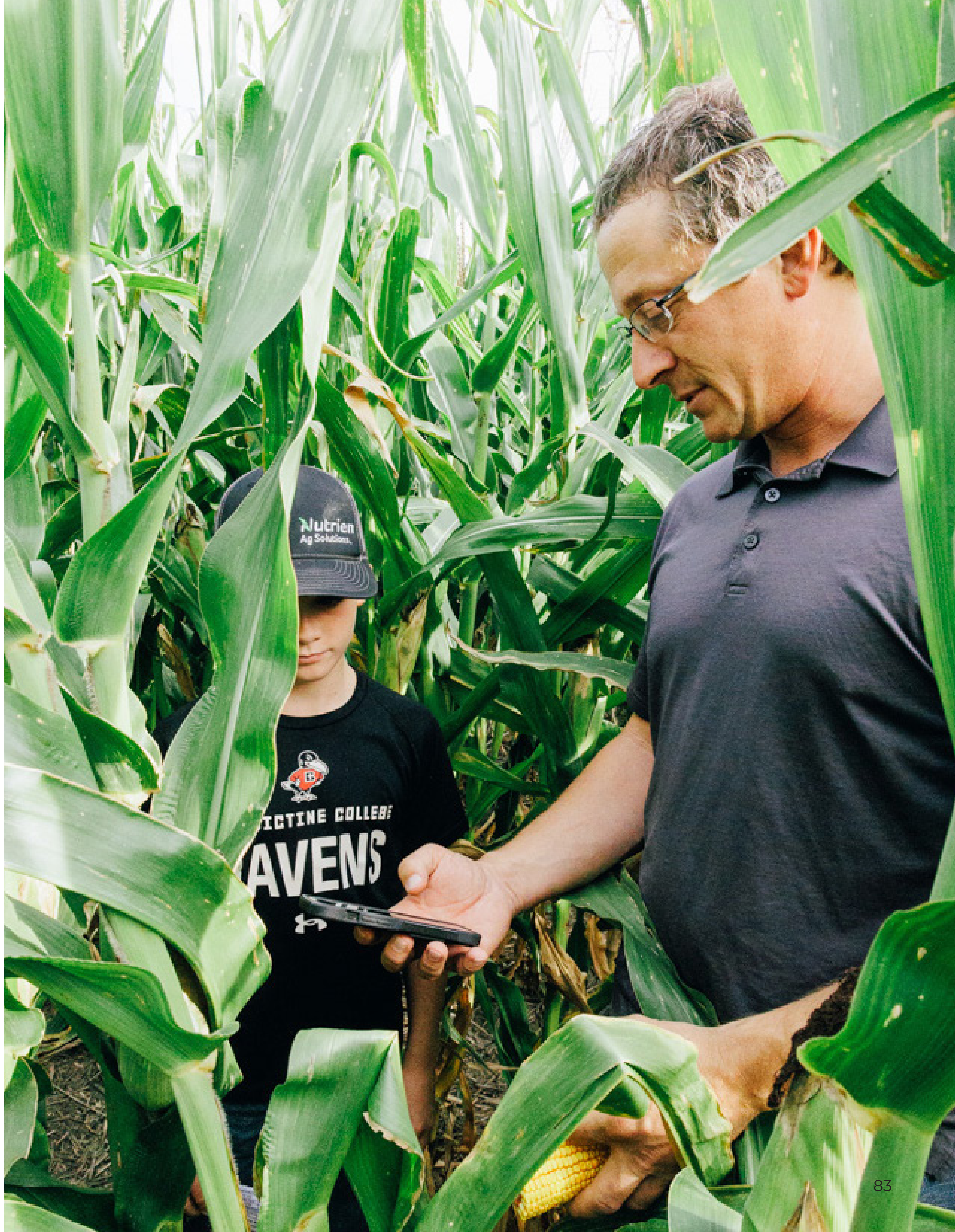
Dynagro Seed

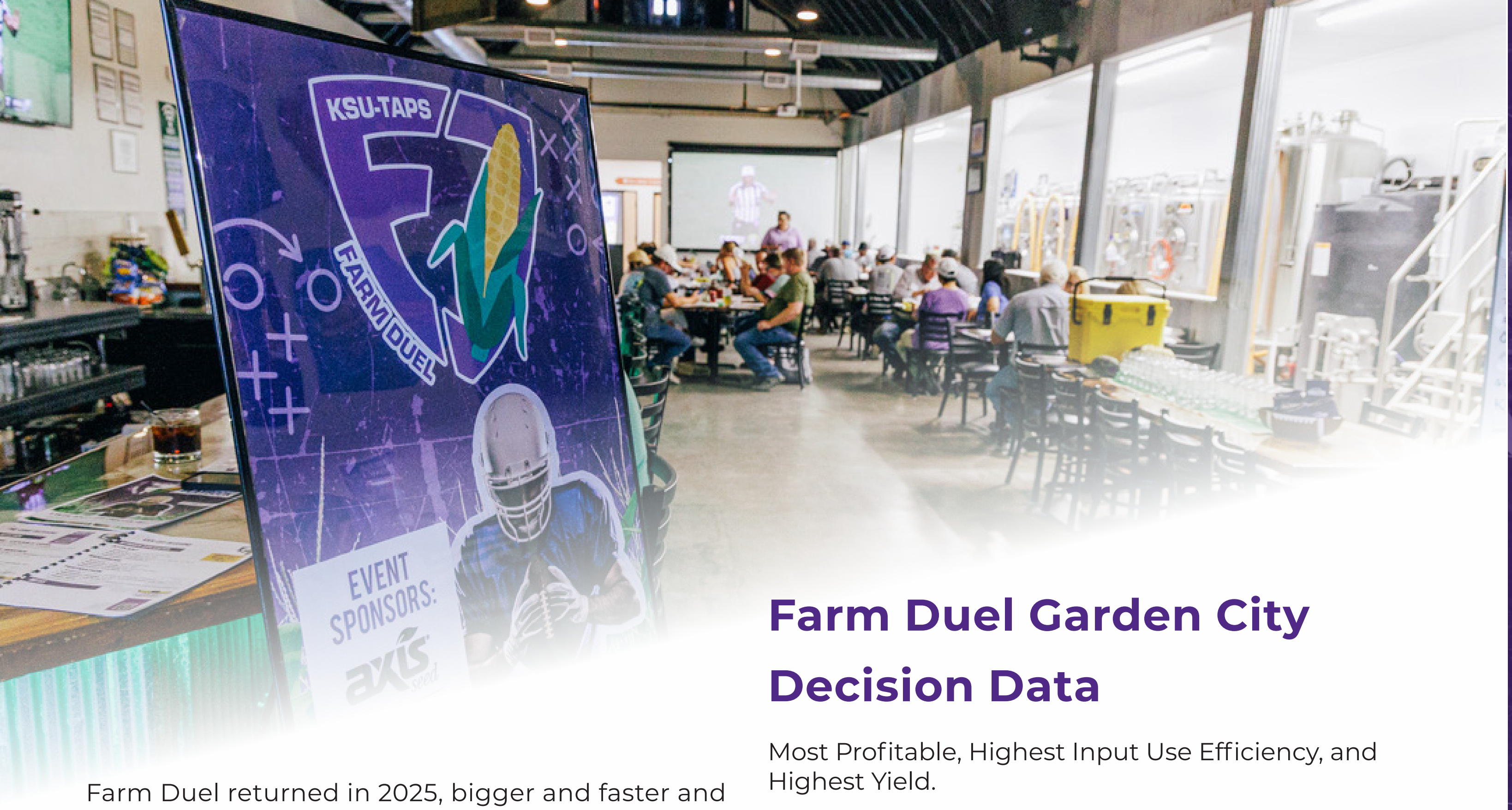
The TAPS Agronomy Twilight Tours brought together the farmers who competed in the 2025 season, along with researchers, industry partners, students, and community members, to reflect on how management decisions played out under real world conditions.

Held at TAPS competition sites in Garden City and Colby, the events provided competitors the opportunity to walk their plots, compare outcomes, and discuss irrigation strategy, hybrid selection, fertility management, and in-season decision-making shaped by limited water, variable weather, and economic pressure. These conversations turned data into context, allowing farms to better understand how small decisions influenced agronomic and economic results.

Peer-to-peer learning remained central to the Twilight Tours. Competitors shared observations, questioned assumptions, and reflected on how their strategies compared with others in the field. Faculty and Extension specialists provided research context, helping translate plot-level results into broader insights that can inform future seasons and on-farm decisions.

The Agronomy Field Day extended these discussions by highlighting applied research that supports the Testing Ag Performance Solutions model and the producers who make it possible. The program is grateful to the farmers who committed time, management, and curiosity to the competition, as well as to Western Kansas Irrigation and seed partners Axis Seed–Red Barn Enterprises, Hoegemeyer, Pioneer, Channel, Brevant, Golden Harvest, Dekalb, and Dyna-Gro Seed, whose support helped create a realistic, competitive environment for learning.






Farm Duel returned in 2025, bigger and faster and at more locations than ever before. Developed by faculty and staff from the K-State Western Kansas Research-Extension Centers and the Carl & Melinda Helwig Department of Biological and Agricultural Engineering, Farm Duel is a high-energy way to demonstrate what "smart management decisions" look like on a simulated farm—adding just enough time pressure to keep the experience engaging.

The program blends practical agronomy with real-time decision-making as farms work through rapid choices related to hybrid selection, seeding rate, fertilizer application, and irrigation strategy. Each decision was entered into the Decision Support System for Agrotechnology Transfer (DSSAT) model. DSSAT functions as a virtual growing season, allowing management decisions to be evaluated through a well-established crop model before a single seed goes in the ground. The model uses historical weather data and local soil properties to estimate baseline crop water and nutrient needs and predict potential outcomes such as yield. Farm Duel was held at two Kansas locations: September 4 in Garden City following the TAPS Agronomy Twilight Tour, and November 25 in Wichita during the final day of the Kansas Association of Conservation Districts (KACD) Annual Convention.

Twenty-five farms competed in Garden City and 23 farms in Wichita, with farms made up of two to four participants. Each team worked collaboratively to make the best possible management decisions using the information provided, with the goal of earning top honors in the same three categories used in the KSU-TAPS sprinkler irrigated corn competition:

## Farm Duel Garden City Decision Data

Most Profitable, Highest Input Use Efficiency, and Highest Yield.

**Four hybrids were offered for selection:**

1. Moser-Ture Master, 12 Farms
2. Buffa-Grow, 5 Farms
3. Un-Bri-Lievable Corn, 5 Farms
4. Plain Jane...NOT!, 3 Farms

**Seeding Rate per Acre:**

- 12,100
- 16,200
- 20,200
- 24,300
- 28,300
- 32,400

***Nitrogen Decisions***

Nitrogen management decisions were made using Urea Ammonium Nitrate (UAN) applied across multiple timing options. Farms could apply nitrogen at planting, during a sidedress application, and across up to three fertigation events. At both planting and sidedress, nitrogen rates ranged from 0 to 150 lb N per acre. For each fertigation event, farms could apply 0, 10, 20, or 30 lb N per acre. Each fertigation selection automatically included 0.3 inches of irrigation in addition to the irrigation amount chosen by the team.

As shown in Table 13, nitrogen strategies varied widely across farms. Total nitrogen application ranged from a low of 30 lb per acre to a high of 205 lb per acre, with an average application rate of 121 lb per acre across all farms.



**Table 13**: Summary of each Team's agronomic decisions, including hybrid and seeding rate, nitrogen fertilizer, and seasonal irrigation. Nitrogen was applied in the form of urea ammonium nitrate (UAN) 32%.

| Farm ID | Hybrid Name | Seeding Rate (seeds/acre) | Irrigation (in/acre) | Nitrogen (lbs/acre) | Yield (bu/acre) | WNIPI (unitless) | Profit ($/acre) |
|---|---|---|---|---|---|---|---|
| A | Moser-Ture Master | 28,300 | 1.97 | 175 | 209.49 | 0.497 | $429.47 |
| B | Plain Jane...NOT! | 24,300 | 7.50 | 80 | 193.86 | 0.555 | $356.34 |
| C | Moser-Ture Master | 24,300 | 10.60 | 30 | 146.95 | 0.387 | $165.61 |
| D | Buffa-Grow | 20,200 | 7.55 | 180 | 249.50 | 0.475 | $548.87 |
| E | Buffa-Grow | 24,300 | 7.00 | 123 | 234.53 | 0.594 | $508.26 |
| F | Plain Jane...NOT! | 20,200 | 6.55 | 205 | 235.96 | 0.414 | $496.47 |
| G | Moser-Ture Master | 28,300 | 7.50 | 120 | 230.36 | 0.549 | $483.55 |
| H | Un-Bri-Lievable Corn | 12100 | 0.00 | 30 | 140.80 | 0.401 | $249.42 |
| I | Moser-Ture Master | 24,300 | 6.45 | 140 | 230.40 | 0.502 | $488.48 |
| J | Moser-Ture Master | 20,200 | 6.30 | 130 | 215.75 | 0.481 | $440.50 |
| K | Moser-Ture Master | 28,300 | 3.73 | 150 | 244.31 | 0.626 | $558.05 |
| L | Buffa-Grow | 32,400 | 9.35 | 140 | 263.39 | 0.603 | $592.16 |
| M | Moser-Ture Master | 28,300 | 9.15 | 155 | 256.38 | 0.506 | $569.65 |
| N | Un-Bri-Lievable Corn | 12100 | 0.00 | 180 | 195.69 | 0.364 | $420.96 |
| O | Buffa-Grow | 24,300 | 8.90 | 180 | 257.87 | 0.485 | $567.23 |
| P | Buffa-Grow | 24,300 | 10.95 | 165 | 257.38 | 0.472 | $552.65 |
| Q | Plain Jane...NOT! | 28,300 | 8.80 | 104 | 225.84 | 0.591 | $466.77 |
| R | Moser-Ture Master | 28,300 | 10.35 | 200 | 269.80 | 0.434 | $597.50 |
| S | Moser-Ture Master | 24,300 | 9.70 | 120 | 228.51 | 0.472 | $462.21 |
| T | Moser-Ture Master | 28,300 | 6.60 | 160 | 249.12 | 0.533 | $549.69 |
| U | Un-Bri-Lievable Corn | 12100 | 0.00 | 30 | 140.80 | 0.401 | $249.42 |
| V | Un-Bri-Lievable Corn | 12100 | 0.00 | 30 | 140.80 | 0.401 | $249.42 |
| W | Moser-Ture Master | 16,200 | 8.50 | 150 | 215.96 | 0.368 | $422.23 |
| X | Un-Bri-Lievable Corn | 12100 | 0.00 | 30 | 140.80 | 0.401 | $249.42 |
| Y | Moser-Ture Master | 24,300 | 0.00 | 30 | 130.66 | 0.515 | $190.55 |

### *Irrigation Decisions*

The competition was structured around 17 rounds of rapid-fire decision-making, designed to mirror weekly irrigation planning during the growing season. In each round, farms were limited to a maximum application of 1.25 inches of water per week, which included the 0.3 inches automatically applied during fertigation events when selected. Over the full simulated season, farms operated under a strict total irrigation cap of 10.95 inches.

This 10.95-inch seasonal limit was intentional and science-based. It reflects the concept of "Q-stable", a groundwater sustainability target developed by the Kansas Geological Survey. Q-stable represents a pumping level that balances groundwater withdrawals with long-term aquifer recharge, helping maintain water availability for future generations.

To support informed decision-making, farms were provided with observed weather data, short-term forecasts, and alfalfa reference evapotranspiration (ET) rates— tools commonly used by producers to guide real-world irrigation scheduling. To increase the challenge and reflect the pressure of in-season management, the time allowed to make decisions decreased with each successive round. By the final stages of the simulation, farms were managing water under tight time constraints, much like late season irrigation decisions during a hot, dry stretch.

Across all farms, the average cumulative irrigation applied was 5.9 inches. Some farms chose to fully utilize the available allocation, reaching the maximum of 10.95 inches, while others elected not to irrigate at all during the simulated season, applying a total of 0 inches.

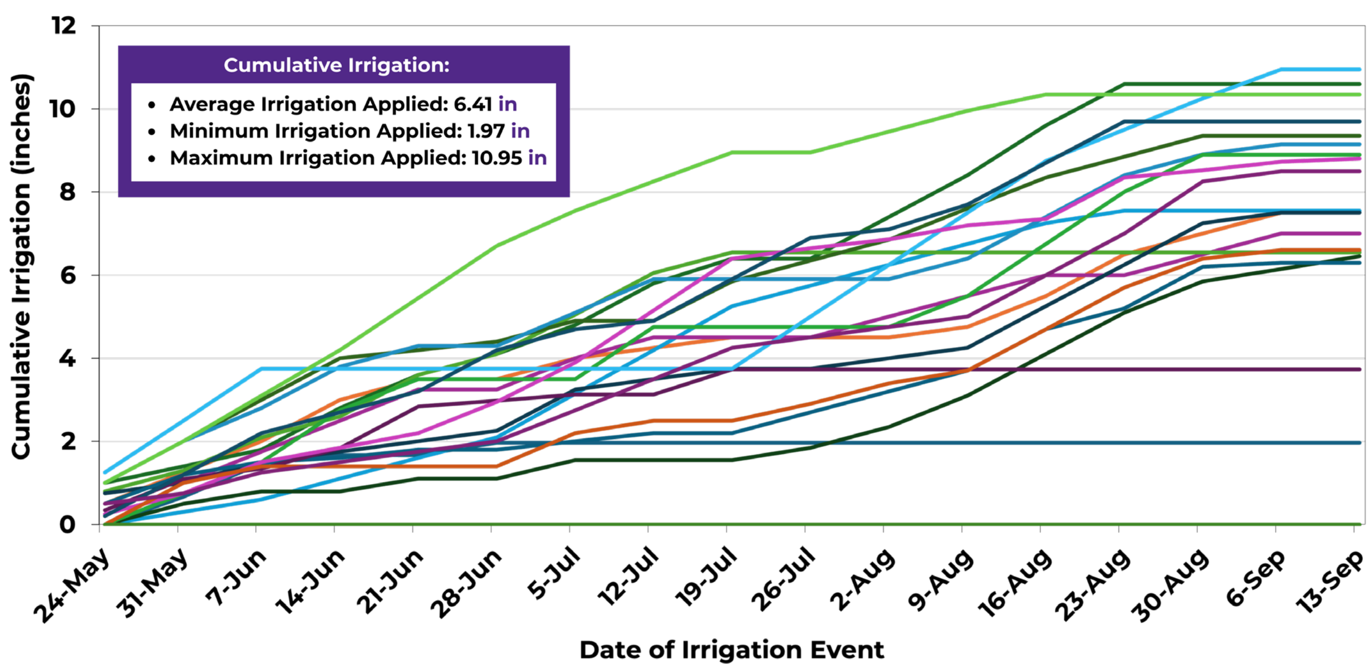



**Figure 40.** *Cumulative irrigation (inches) applied to corn by the Farm Duel teams during the TAPS Agronomy Twilight Tour in Garden City, KS.*



**Garden City Farm Duel Winners:**

- Most Profitable: Roscoe (Bill Simshauser: Lakin, KS): $597/acre
- Highest Input Use Efficiency: KCole (Michael Cole: Garden City, KS) WNIPI value of 0.626
- Highest Yield: Roscoe (Bill Simshauser: Lakin, KS): 270 bu/acre



The KSU-TAPS High Roller Competition brings farm management decisions to life by putting outcomes in the hands of the dice. Based upon curriculum developed by the Virginia Foundation for Agriculture in the Classroom, High Roller gives participants of all ages an interactive way to experience TAPS and understand the reasoning behind both the competition framework and the real-world decisions farmers make every day.

Through a mix of chance, strategy, and discussion, participants work through production and management scenarios that highlight risk, uncertainty, and tradeoffs—key components of modern agriculture. From the TAPS Twilight Tour to classroom settings and events such as GMD 4 Water Day, High Roller has proven to be an engaging and accessible tool for expanding the reach of TAPS while reinforcing core concepts of agronomic and economic decision-making.

# Farm Duel: Kansas Association of Conservation Districts – Decision Data

While the Farm Duel methodology in Wichita mirrored the Garden City event— using the same DSSAT simulations and decision rules— the management strategies differed noticeably, as expected with a new group of participants. Changes in experience, risk tolerance, and priorities led to a wider spread in how farms allocated inputs. The following section highlights these differences, summarizing the management approaches and decision patterns of farms competing in Farm Duel at the Kansas Association of Conservation Districts (KACD) Annual Convention.

At the KACD event, farms selected from four conservation-themed corn hybrids.

1. Water-Wise Warrior: 13 teams
2. Kansas Conservation King: 4 teams
3. The District Defender: 4 teams
4. Soil Stewards: 2 teams

Compared to Garden City, Wichita farms were offered a broader range of seeding rates, ranging from 12,100 to 36,400 seeds per acre.

### Nitrogen Decisions

In Wichita nitrogen management strategies showed a higher overall investment compared to Garden City. Across the 23 participating farms, the average total nitrogen applied was 171.5 lb N per acre. Application rates ranged from a low of 65 lb N per acre to a high of 280 lb N per acre, highlighting substantial differences in how farms approached yield potential versus input risk.

### Irrigation Management

Irrigation strategies followed a similar pattern. Farms applied an average of 9.42 inches of irrigation water over the simulated season. Some farms utilized nearly the full allocation, reaching the maximum of 10.95 inches, while the most conservative strategies applied 5.25 inches. These decisions reflected varying approaches to managing water risk, crop demand, and profitability under the same seasonal constraints.

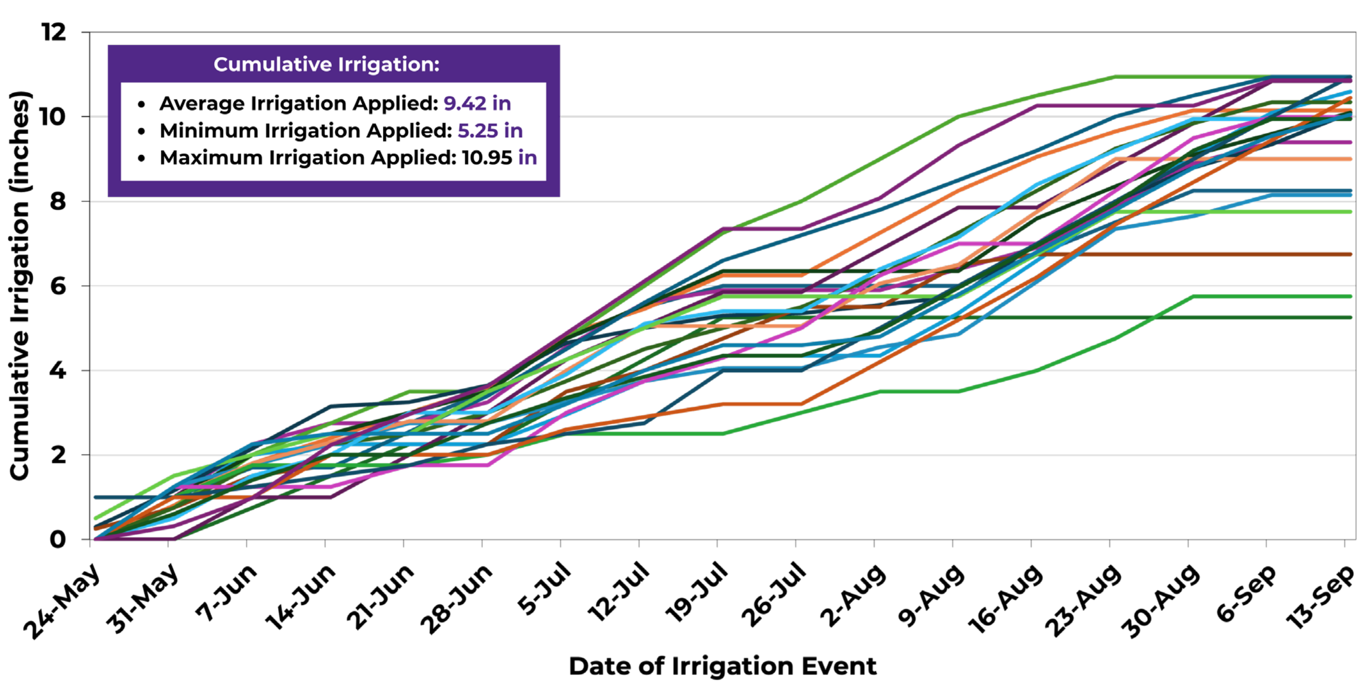



**Figure 41:** Cumulative irrigation (inches) applied to corn by Farm Duel Teams during the Kansas Association of Conservation Districts (KACD) Annual Meeting in Wichita, KS.



**Table 14:** Summary of each Team's agronomic decisions, including hybrid and seeding rate, nitrogen fertilizer, and seasonal irrigation. Nitrogen was applied in the form of urea ammonium nitrate (UAN) 32%.

| Farm ID | Hybrid | Seeding Rate (seeds/acre) | Irrigation (in/acre) | Nitrogen (lbs/acre) | Yield (bu/acre) | WNIPI (unitless) | Profit ($/acre) |
|---|---|---|---|---|---|---|---|
| A | Water-Wise Warrior | 28,300 | 8.25 | 105 | 223.21 | 0.585 | $452.14 |
| B | Water-Wise Warrior | 36,400 | 10.15 | 145 | 261.47 | 0.586 | $561.56 |
| C | Water-Wise Warrior | 24,300 | 5.25 | 210 | 277.01 | 0.569 | $672.46 |
| D | Water-Wise Warrior | 20,200 | 10.6 | 255 | 258.21 | 0.339 | $533.79 |
| E | Kansas Conservation King | 24,300 | 9.4 | 200 | 269.41 | 0.432 | $608.74 |
| F | Soil Stewards Select | 20,200 | 10.95 | 105 | 208.51 | 0.437 | $388.52 |
| G | Soil Stewards Select | 36,400 | 10.1 | 260 | 292.13 | 0.452 | $649.07 |
| H | Water-Wise Warrior | 32,400 | 6.75 | 150 | 272.35 | 0.677 | $648.13 |
| I | Water-Wise Warrior | 32,400 | 10.1 | 115 | 235.38 | 0.566 | $481.71 |
| J | The District Defender | 28,300 | 10.95 | 200 | 269.88 | 0.424 | $591.45 |
| K | Kansas Conservation King | 24,300 | 10.85 | 280 | 269.44 | 0.317 | $562.46 |
| L | The District Defender | 24,300 | 10.35 | 65 | 182.77 | 0.445 | $292.57 |
| M | Water-Wise Warrior | 28,300 | 8.15 | 150 | 262.09 | 0.591 | $600.10 |
| N | Water-Wise Warrior | 32,400 | 9 | 150 | 274.48 | 0.619 | $638.78 |
| O | Water-Wise Warrior | 28,300 | 5.75 | 120 | 217.88 | 0.586 | $448.50 |
| P | Water-Wise Warrior | 28,300 | 9.95 | 210 | 291.69 | 0.499 | $684.01 |
| Q | Kansas Conservation King | 24,300 | 10 | 140 | 240.24 | 0.455 | $500.17 |
| R | Water-Wise Warrior | 24,300 | 7.75 | 150 | 243.92 | 0.534 | $528.30 |
| S | The District Defender | 28,300 | 10.95 | 180 | 260.09 | 0.434 | $552.71 |
| T | Water-Wise Warrior | 28,300 | 10.45 | 215 | 281.34 | 0.458 | $628.25 |
| U | Water-Wise Warrior | 32,400 | 9.95 | 185 | 268.73 | 0.501 | $585.50 |
| V | The District Defender | 28,300 | 10.05 | 260 | 269.86 | 0.361 | $571.32 |
| W | Kansas Conservation King | 20,200 | 10.86 | 94.5 | 199.74 | 0.393 | $357.57 |

**KACD Winners:**
Most Profitable: Team P – Phunny Pam: $684/acre
Highest Input Use Efficiency: Team H – Harvest Heros
Highest Yield: Team G – Grow Kings: 292 bu/acre

# CONCLUSION

*What the 2025 season reinforced about real-world decisions*

Decisions made under real constraints defined the 2025 TAPS season. Untimely rainfall and continued economic pressure underscored how management choices around inputs, risk, and water allocation shape outcomes over an entire growing season. Participants tested strategies, evaluated technologies, and benchmarked decisions under conditions that closely reflect real-world farming across the High Plains.

TAPS is a decision-driven, applied learning environment. By stepping into the role of farm managers, participants explored approaches to improve efficiency, profitability, and water stewardship. The insights generated are practical and transferable, extending beyond the plots and into on-farm decision-making.

This season was made possible through strong collaboration. We thank the participants; collaborators from Nebraska, Colorado, Oklahoma, Maryland, Texas, Florida, and Alabama; industry partners and sponsors; and our outstanding interns—Tumwesige (Maxwell) Tumwesige, Rayhaan Kabenge, and Simon Salcido.

We are grateful for the continued support of colleagues at Kansas State University, including Dr. Vaishali and her students in the Carl and Melinda Helwig Department of Biological and Agricultural Engineering, Dr. Jane Schuh, Interim Eldon Gideon Dean Dan Moser, Brian Olson, and the team at the Western Kansas Research-Extension Centers. We also thank the USDA Natural Resources Conservation Service for the technical agreement supporting TAPS, along with the Kansas Water Institute, the Kansas Water Office, Kansas Sorghum, and the Sorghum Checkoff for their leadership and investment in water-smart, producer driven solutions.

Looking ahead to 2026, with competitions planned for Garden City and Colby, TAPS will continue refining decision tools, strengthening networks, and supporting resilient farming systems for the future.

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**+(712)204-6772**

Email
**TAPS@KSU.EDU**

Website
**WWW.K-STATE.EDU/TAPS**

Office Address
**105 Experiment Farm Drive**
**Colby, KS 67701-786**