Florida Stakeholder Engagement Program

UF TAPS
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Florida Stakeholder Engagement Program (STEP)

https://step.ifas.ufl.edu/

Agricultural and Biological Engineering Department
North Florida Research and Education Center-Suwannee Valley (NFREC-SV)
Institute of Food and Agricultural Sciences
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Mission Statement:

The University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS) is dedicated to developing knowledge in agriculture, human and natural resources, and the life sciences. To that end, the Florida Stakeholder Engagement Program (STEP) engages farmers and other agricultural stakeholders in friendly crop management competitions focused on input use efficiency and profitability. The program creates a shared learning experience for growers, industry representatives, policymakers, researchers, and extension agents. The goal is to improve crop management and increase the adoption of Agricultural Best Management Practices (BMPs) to sustain agriculture and protect water quality.

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Program Overview:

Pursuant to the Florida Watershed Restoration Act (FWRA), section 403.067(7)(c)3, F.S., the FDACS, Office of Agricultural Water Policy (OAWP), develops, adopts, and assists with the implementation of agricultural Best Management Practices (BMPs) to protect and conserve water resources. Funding for BMP projects that complement the OAWP's mission is consistent with FWRA objectives. In this regard, the University of Florida's, Institute of Food and Agricultural Sciences (UF/IFAS) continues to play an important role in assisting the industry with implementing BMPs. To this end, the Florida Innovative Stakeholder Engagement Program (STEP) aims to provide science-based education and outreach on BMPs through farm management competition focusing on input-use efficiency and profitability that assists agricultural producers with the implementation of water quality and water conservation BMPs.

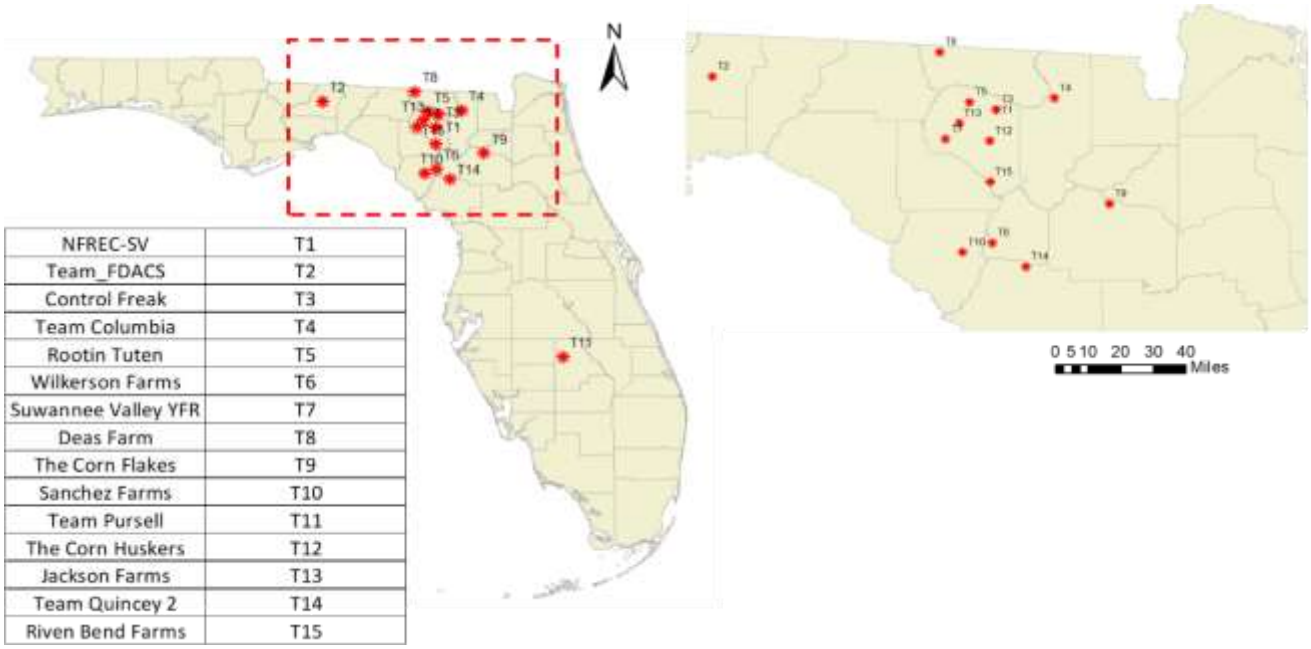
Agriculture is a main driver of land-cover change globally resulting in decreased biodiversity, increased carbon emissions, and land desertification. Environmental best management practices reduce risk to the environment caused by agricultural operations. However, the adoption of BMPs in agriculture is crucial for promoting sustainable farming, enhancing crop yields, and reducing environmental impacts. BMPs encompass a range of strategies designed to improve farm productivity while conserving natural resources, such as soil, water, and biodiversity. These practices are particularly significant in regions like North Florida, where the agricultural landscape is dominated by sandy soils prone to nutrient leaching, especially nitrogen.

Despite the documented benefits of BMPs, their adoption among growers varies significantly. However, the adoption of environmental BMPs by farmers often is lower than what would be possible. While prior studies have investigated determinants of environmental BMPs, it is not well understood how social psychological drivers of various BMPs may be modified by contextual factors. Understanding growers' perceptions of BMPs is essential to identify barriers to adoption, tailor extension services, and develop policies that support sustainable agricultural practices. Perceptions can be influenced by various factors including economic considerations, environmental awareness, knowledge level, and the perceived complexity and effectiveness of the practices.

This study aims to assess growers' perceptions of BMPs in the context of field management competition. By evaluating their experience, knowledge, and decision making, we can gain insights into the current state of BMP adoption and identify opportunities for improvement. This understanding will help in designing effective extension programs and policies that encourage the adoption of BMPs, ultimately leading to enhanced agricultural sustainability and environmental protection. The Florida STEP is an innovative extension programming to engage growers, Ag industry, agricultural research, and extension in an interactive real-world system to increase productivity, sustainability, and profitability and assessing grower's perceptions through farm management competition focused on input use efficiency and profitability. This competition covers aspects such as science-based education, creating a safe environment for action-oriented learning, outreach of BMPs, the influence of economic

incentives, and the role of extension services and peer to peer interaction. This competition-based assessment will provide valuable information for stakeholders, including policymakers, researchers, and extension agents, to support the transition to more sustainable farming systems in Florida.

The 3rd annual sprinkler irrigated corn farm management contest was conducted under a Valmont Variable Rate Linear Move Lateral Irrigation System at the North Florida Research and Education Center-Suwannee Valley (NFREC-SV). The corn contest was made possible by the funding from the Florida Department of Agricultural and Consumer Services (FDACS) – Office of Agricultural Water Policy and donations by industry partners. The 2024 corn STEP competition included fifteen growers teams participating in collaboration with consultants and state agency personnel to test, observe, experiment, and implement new and emerging water and fertilizer BMPs and technologies (Figure 1). Each competing team managed four randomized plots, structured within a randomized complete block design to ensure robust statistical evaluation and to determine the contest winners (Figures 2 and 3). Participants had control over six major production factors i.e., (i) corn hybrid selection, (ii) seeding rate, (iii) nitrogen management, (iv) irrigation management, (v) insurance selection, and (vi) grain marketing (Figure 4). A detailed description of each management decision is provided in the following section.



NFREC-SV	T1
Team_FDACS	T2
Control Freak	T3
Team Columbia	T4
Rootin Tuten	T5
Wilkerson Farms	T6
Suwannee Valley YFR	T7
Deas Farm	T8
The Corn Flakes	T9
Sanchez Farms	T10
Team Pursell	T11
The Corn Huskers	T12
Jackson Farms	T13
Team Quincey 2	T14
Riven Bend Farms	T15

Figure 1. Team names and the location of the 2024 STEP competition participants.

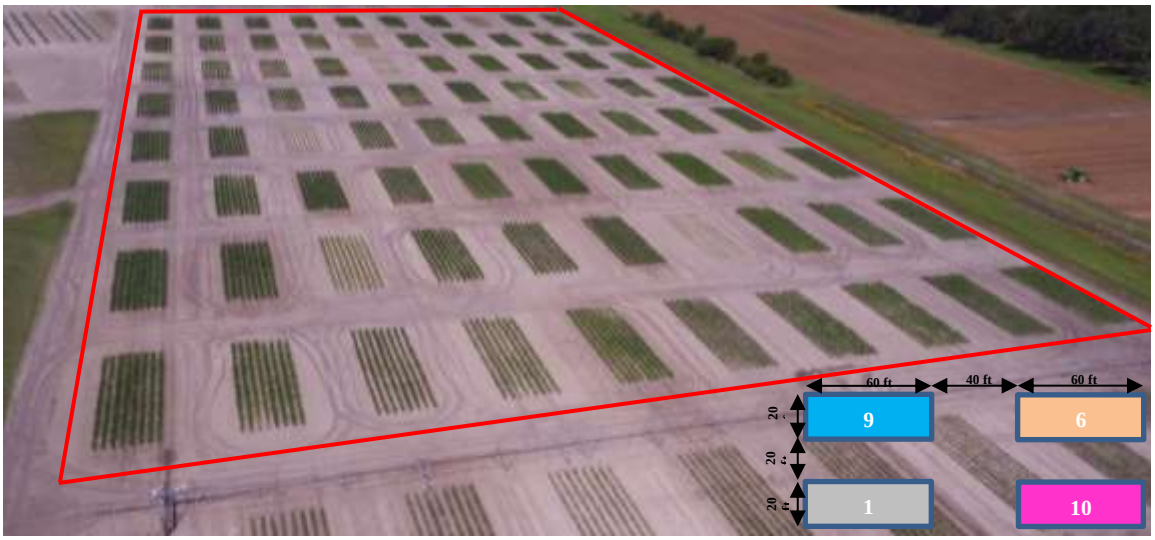


Figure 2. Aerial Imagery of 2024 Florida Stakeholder Engagement Program (STEP) competition held at the North Florida Research and Education Center-Suwannee Valley (NFREC-SV).

Hybrid Selection and Seeding Rate:

Each team was tasked with choosing a commercially available corn seed variety from a list of default corn hybrids and selecting a seeding rate from six options, ranging from 26,000 to 36,000 seeds per acre, in an increment of 2,000. For corn hybrids, sales representatives from different seed companies including Pioneer, Integra, Dyna-Gro, Agritech, Revere, Croplan, and Northup-King Seed provided a total of fifteen hybrids in 2024, which acted as default options for the contest. In addition to selecting from the default hybrids, teams were also allowed to work with different seed company representatives to choose their own corn seed hybrid. If teams selected one of the default hybrids, the STEP project management team provided the seed. However, if a team wanted to participate with their own hybrid, it was the team's responsibility to procure the seed and deliver it to the competition site two weeks before planting.

Nitrogen Management:

All the plots received 13 gallons per acre (30 lbs of N/ac) of startup fertilizer at the time of planting. The startup fertilizer was applied using a double-coulter liquid applicator at a 2-inch depth and 2inches to the side of the planted row. Before the competition began, teams were asked to choose either in-season conventional fertilizer applications or controlled-release fertilizer (CRF) applied at planting. In the conventional fertilizer program, teams were allowed to pick any fertilizer rate and timing. Options for fertilizer material and application method included dry ammonium nitrate (34-0-0) either broadcast or banded, and UAN 28% (28-0-0-5) applied as liquid side dressing. Teams had the flexibility to pick different application methods for different timings of fertilizer application. The banding nitrogen application was applied using the 1st Products rig. Liquid side- dressing was applied at the ground surface neighboring each row using the Miller High Boy 360 Y-drops (Figure 5). For the CRF program, teams could choose 43-0-0 from Harrell's or 42-0-0 from Florikan at a rate ranging from 150 to 300 lbs/ac of N. All the CRF applications were applied at

planting. Options were provided for additional application of 30 lbs N/ac in case of a leaching rain event.

Irrigation Management:

The irrigation was applied using a two-span Valley lateral move zone control Variable Rate Irrigation (VRI) System (Valmont Industries, Inc.). The irrigation system was operated everyday throughout the growing season. Teams submitted their irrigation decisions one day before irrigation via the STEP website. The maximum irrigation depth per event was limited to 0.5 inches. If a team failed to submit its irrigation decision, no irrigation was applied. Teams had three options for irrigation scheduling (i) soil moisture-based irrigation scheduling, (ii) evapotranspiration- based irrigation scheduling, and (iii) pre- determined calendar-based irrigation scheduling. One set of soil moisture sensors was installed per team for soil moisture monitoring. Teams were given the flexibility to choose between one of the following types of soil moisture sensors: (i) Sentek Drill and Drop probe from Holder Ag, (ii) Sentek Drill and Drop probe from BMP logic, and (iii) Aqua-Spy Probe. Based on the sensor selection, teams received free access to soil moisture data for irrigation scheduling. For evapotranspiration-based irrigation scheduling, teams were also provided free access to smart irrigation apps.

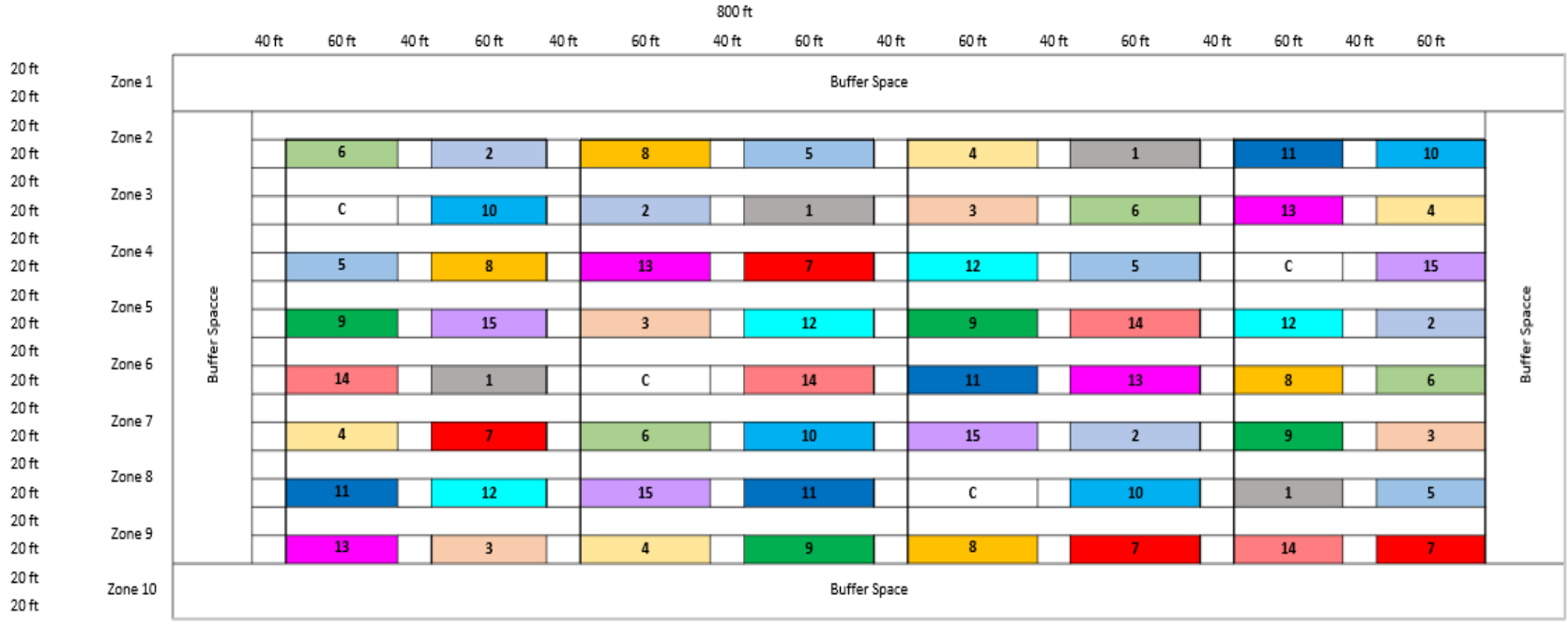


Figure 3. Plot map for the 2024 Florida Stakeholder Engagement Program (STEP) competition held at the North Florida Research and Education Center-Suwannee Valley (NFREC-SV).

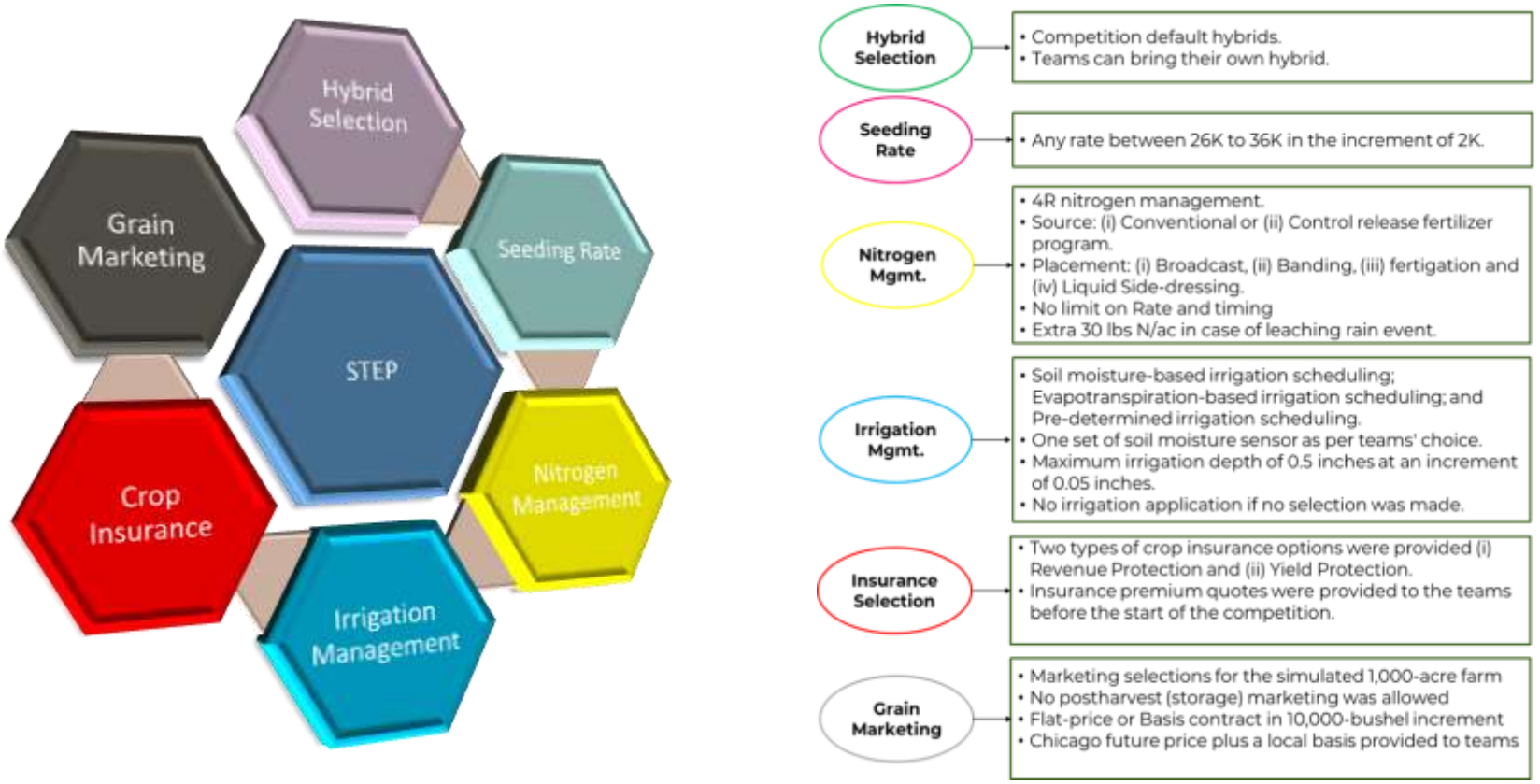


Figure 4. Management Decisions for 2024 STEP Competition.

Figure 5. Miller High Boy 360 Y-drops used for liquid side dressing.

Insurance Selection

Teams selected a multi-peril crop insurance plan from two options: (i) Revenue Protection, and (ii) Yield Protection. Revenue Protection crop insurance protects against loss of revenue due to yield losses and price changes. Contrastingly, Yield Protection crop insurance protects against yield losses only. Losses from adverse weather conditions, failure of irrigation water supply (if caused by an insured peril), fire, insects, or plant disease (but not damage due to insufficient or improper application of control measures), and wildlife are covered. Premium rates for the two plans and different coverage levels were obtained from a local insurance company and provided to each team before the competition. Premiums were based on 1,000 acres of corn with an actual production history (APH) of 220 bushels per acre. The projected corn price (set by USDA-RMA) was $4.67 per bushel. Revenue Protection has higher insurance premiums than Yield Protection (Table 1). Available coverage levels ranged from 50% to 85% in 5% increments.

Table 1. Premium rates for crop insurance provided to teams prior to the competition.

Coverage Level	Revenue Protection Premium Cost per Acre	Yield Protection Premium Cost per Acre
50%	$3.18	$2.34
55%	$4.66	$3.26
60%	$6.43	$4.24
65%	$10.03	$6.31
70%	$13.49	$8.22
75%	$19.60	$11.98

80%	$29.76	$18.53
85%	$45.82	$29.17

Grain Marketing

Each team was responsible for marketing corn from a simulated (on paper) 1,000-acre harvest. This upscaling provided teams an opportunity to market grain in quantities consistent with real-world agricultural operations. The total number of bushels marketed was the average yield per acre harvested from their research plots (at 15.5% moisture) times 1,000 acres. The simulated corn harvest was assumed to be delivered to a local buying point during the week of harvest at 15.5% moisture. No storage, drying, or long- distance transport options were allowed.

Teams could choose flat-price or basis contracts in 10,000-bushel increments (for August delivery) between the competition start date and the actual research plot harvest date. Contract prices are determined by the daily closing Chicago Board of Trade September futures price plus a local basis posted weekly on the STEP webpage (https://step.ifas.ufl.edu/). The local basis used for the contest was the average of quotes we obtained from three local buying points. Any bushels not sold through contracts (total bushels harvested for the simulated 1,000-acre farm minus the number of bushels contracted) were "sold" at the average spot market price during the week of harvest. If more bushels were contracted than harvested, the team was charged the difference between the spot market price and the highest contract price (if the spot market price is higher), plus a $0.20/bu handling fee, on the number of bushels over contracted.

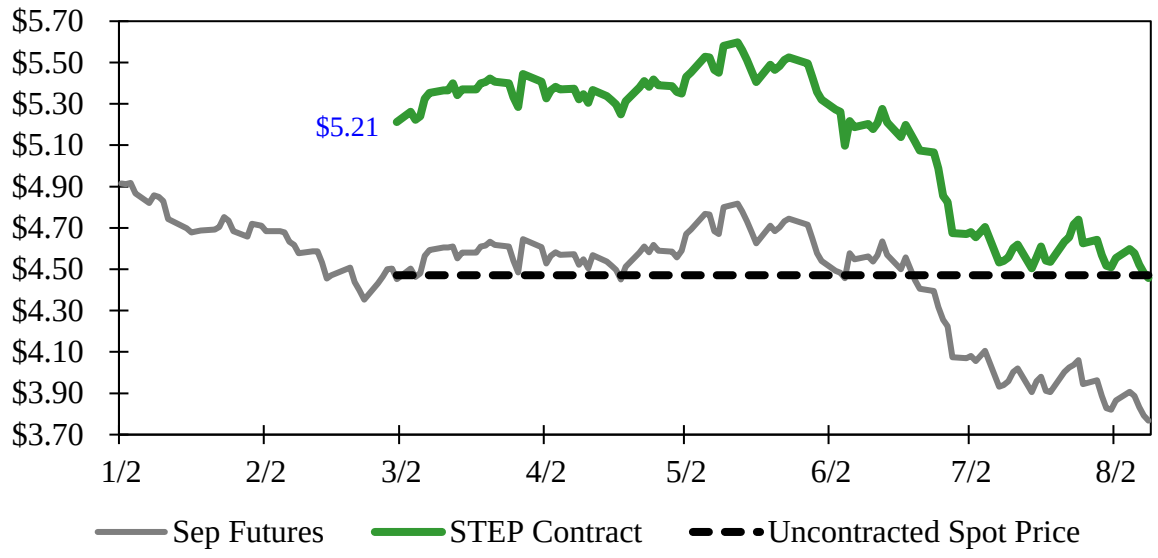


Figure 6. Corn price ($/bu) for the 2024 corn growing season.

Other Management Decisions:

All other management decisions, such as pesticide use, tillage, residue management, etc., were fixed by the university and were the same for all teams. The STEP project team conducted the actual physical management, such as the operation of machinery, irrigation system, application of chemicals, and harvesting. The variable decisions were made in real-time by the participating teams using a secure online submission form (STEP Website; https://step.ifas.ufl.edu/) provided to participating teams at the start of the competition. Competition plots were open to participating teams to observe and to collect additional data throughout the growing season.

Data Collection:

One of the main goals of the Florida STEP is to test, observe, experiment, and implement new and emerging water and fertilizer conservation technologies and management techniques in a risk-free environment. In 2024, eighteen industry partners and technology providers joined the STEP corn contest. Teams received free access to ag technologies and services. For example, for irrigation management, one set of soil moisture sensors (as per the teams' choice) was installed in one replication. To support the nutrient management decisions, corn growth data (i.e., plant height, growth stages, etc.), soil samples, and leaf tissue samples were collected throughout the corn growing season and shared with the teams. Soil and tissue data were sent to Waters Lab for nutrient analysis. All the information and data were shared with the participating teams through the STEP website (https://step.ifas.ufl.edu/). In addition, drone images were collected throughout the growing season. Drone images were processed using the SOLVI platform, and the information on the different vegetative indices and thermal imagery were shared with the teams using the SOLVI web platform. Detailed information on SOLVI is available at (https://solvi.ag/).

Awards and Award Calculations

In 2024, the teams competed for two awards (i) Most profitable and (ii) Highest input use efficiency. In each category, 1st, 2nd, and 3rd place teams were awarded $2000, $1000, and $500, respectively. In addition, a plaque was presented to the first-place winner in each category.

Most Profitable: The "most profitable" award was based on the highest simulated profit per acre. Gross profit per acre was calculated as follows.

$$
\begin{aligned}
Gross\ Profit\ \left(\frac{\$}{ac}\right) &= Yield\ \left(\frac{bu}{ac}\right) \\
&* Average\ farm\ gate\ price\ \left(\frac{\$}{bu}\right) \\
&- STEP\ Variable\ cost\ \left(\frac{\$}{ac}\right) \\
&- Fixed\ production\ cost\ \left(\frac{\$}{ac}\right)
\end{aligned}
$$

Average farm-gate price = weighted average delivered price minus $0.30/bu hauling charge. Yield (bu/acre) was calculated based on the average yield from each team's corn plots, at

15.5% moisture. The average delivered price per bushel was determined by each team's marketing choices. Material and application costs for seed, fertilizer and irrigation were determined by each team's management choices. The seed costs for different hybrids are presented in Table 1. The start-up fertilizer (23-9-0) was included as a fixed cost and remained the same for all teams. The cost of in-season fertilizer varied, with ammonium nitrate (34-0-0) priced at $0.60 per pound of nitrogen ($405 per ton), UAN 28% with sulfur (28-0-0-5) at $0.63 per pound of nitrogen ($355 per ton), Harrell's controlled-release fertilizer (43-0-0) at $1.48 per pound of nitrogen ($1,275 per ton), and Pursell CRF (44.5-0-0) at $1.04 per pound of nitrogen ($925 per ton). The fertilizer application cost was set at $14 per acre per application for side-dress application of ammonium nitrate or CRF, $7 per acre per application for broadcast application of ammonium nitrate or CRF, and $12 per acre per application for liquid side-dress application of UAN 28-0-0-5. Additionally, irrigation costs were established at $13 per acre-inch of water applied.

Most Efficient: The Water-Nitrogen Intensification Performance Index (WNIPI) was used to assess input use efficiency. This integrated index combines the Water Intensification Performance Index and the Nitrogen Intensification Performance Index (Lo et al., 2019). WNIPI is designed to encourage efficient irrigation and nitrogen management while maintaining production and profitability. It measures the yield increase relative to the control farm, considering the additional water use (evapotranspiration, ET) and aboveground nitrogen uptake. A higher WNIPI value indicates greater efficiency in resource use, whereas a lower value suggests reduced efficiency in converting inputs into yield. The WNIPI equally weights the influence of irrigation and nitrogen fertilizer on efficiency; therefore, both inputs have to be managed well to receive a high value and calculated as:

$$WINIP = \frac{\left[\frac{Y - Y_n}{Y_n}\right]}{\left[\frac{ET_n + I}{ET_n}\right] * \left[\frac{G_n + N}{G_n}\right]}$$

Where, Y = grain yield of the farm under evaluation; Yn = grain yield of the zero-input treatment; ET = crop evapotranspiration of the farm under evaluation; ETn = crop evapotranspiration of the zero-input treatment; Gn = grain nitrogen uptake of the zero-input treatment; and N = fertilizer nitrogen applied by the farm under evaluation. Yield (bu/acre) was calculated based on the average yield from each team's corn plots, at 15.5% moisture. ETn was calculated using the water balance approach.

2024 Competition Results:

Timeline:

The competition commenced with a kickoff meeting on March 4, 2024, at NFREC-SV in Live Oak, FL, where the rules and regulations were outlined for participating teams, industry partners, and stakeholders. Field operations officially began with corn planting on March 21, 2024. Throughout the growing season, multiple seminars and field tours were conducted, providing an opportunity for growers to engage with UF faculty, industry personnel, and fellow participants. A STEP plot demonstration for the Blue and Green Algae Task Force Group took place on June 4, followed by the STEP Corn Field Day in collaboration with the Suwannee River Partnership on June 6. Additional demonstrations were held during the Corn IST on June 11, 2024. The STEP corn contest data and findings were presented at the North Florida Research and Education Center – Suwannee Valley annual corn field day, as well as at the Annual Florida Section American Society of Agricultural and Biological Engineers Conference in Jensen Beach, FL. The corn harvest was completed on August 14, and the competition results and awards were announced at the STEP Awards Banquet on October 24, 2024 (Figure7).

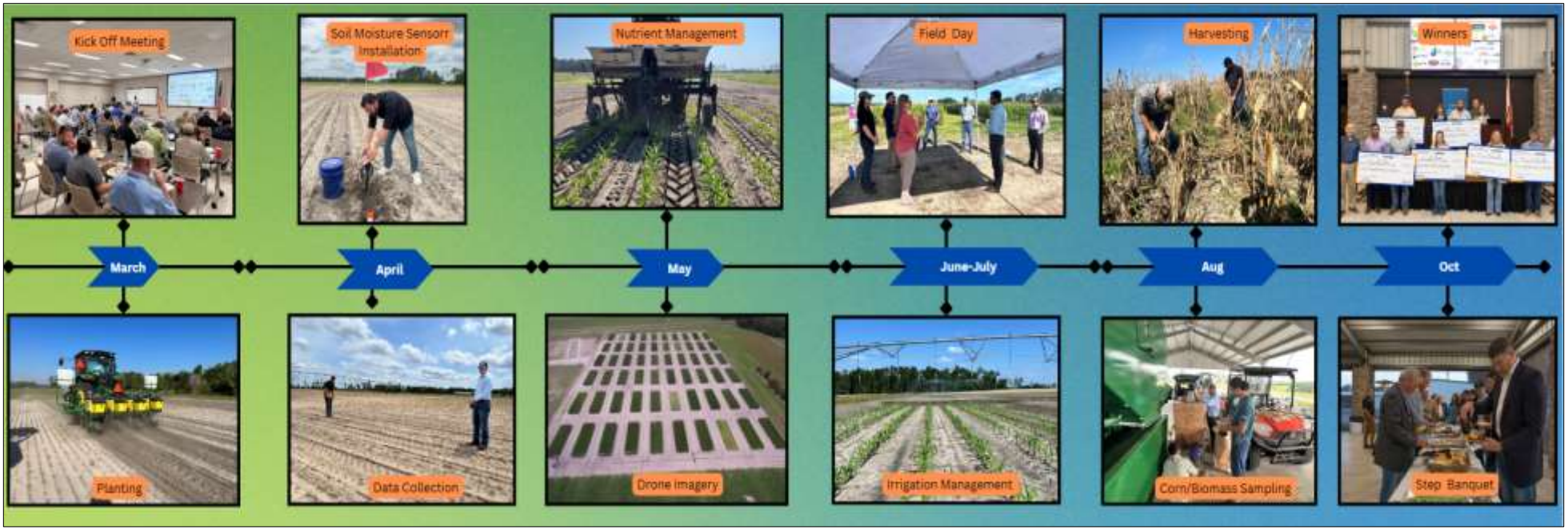


Figure 7. The Florida Stakeholder Engagement Program (STEP) project Timeline

Weather conditions:

The study site received a total of 39 inches of rainfall from planting to physiological maturity, with the majority occurring between early July and harvest. The highest single precipitation event was recorded on August 8, 2024, with 9.27 inches of rainfall. Since all fertilizer applications had been completed before this event, it was not classified as a leaching rain event (Figure 8). Apart from rainfall, high wind speeds of 73 mph and 54 mph were recorded during the plant development stage (05/10/2024) amd near harvest. Minor damage (stand bending, etc) were observed in both events.

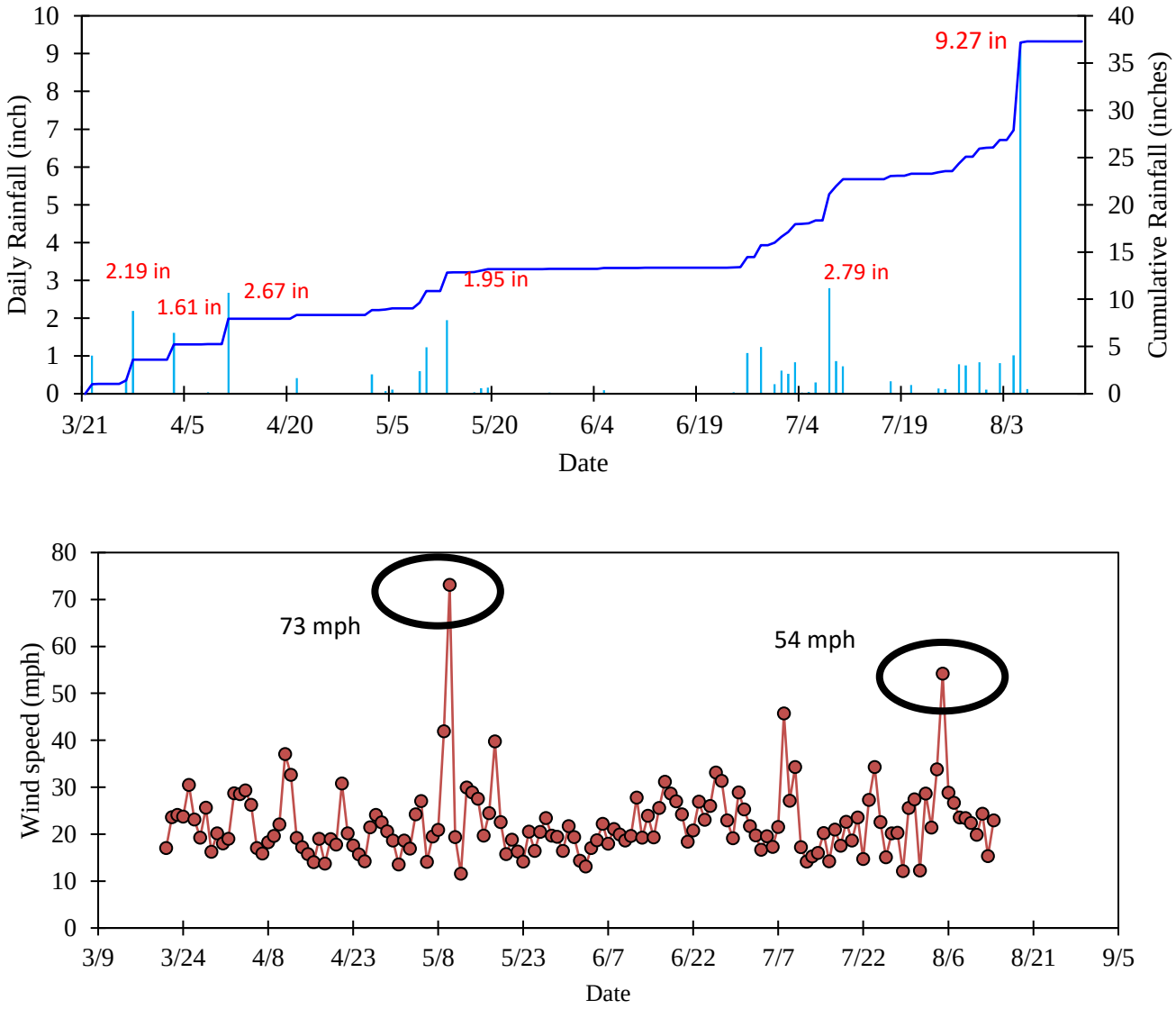


Figure 8. Daily and cumulative seasonal rainfall and wind speed from planting to harvesting at the NFREC-SV, Live Oak, FL.

Farm Management Decisions and Yield Results:

Hybrid Selection and Seeding Rate Decisions: Growers opted for different seed varieties from different companies, each varying in traits (physiological, growth), yield potential, and cost. For the 2024 STEP competition, fifteen default hybrids from Pioneer, Integra, Dyna-Gro, Triangle Seed, Gateway Seed, Croplan, and Northup-King Seed were provided to the teams. Eight teams chose Pioneer hybrids—P2042VYHR (MSRP $372) and P17677YHR (MSRP $400). Among them, P2042VYHR was the most selected hybrid, chosen by six teams, while two teams selected P17677YHR. Among the default hybrids, Revere 1939 (MSRP $360) was selected by two teams, whereas other hybrids—Dekalb 70-45 (MSRP $394), Agrigold 643-52 (MSRP $295), Agritech 85VT2P (MSRP $285), Croplan 1447 (MSRP $275), and Dynagro (Nutrient) 57VC51 (MSRP $300)—were each selected by one team. It was exciting to see the teams' enthusiasm for the competition, as four growers chose to work with multiple seed companies and introduced their own hybrids, including Agritech 85VT2P, Croplan 1447, and Dekalb 70-45 (Figure 9). The seeding rate also played a significant role in management decisions, as it affects production costs and grain yield. For the 2024 competition, plant populations ranged from 28,000 seeds/acre to 34,000 seeds/acre. Six teams opted for 34,000 seeds/acre, while four teams each selected seeding rates of 30,000 and 34,000 seeds/acre, respectively. The lowest seeding rate, 28,000 seeds/acre, was selected by Team C (Figure 10). In the 2024 competition, seed costs ranged from $112.63 to $164.05 per acre (Figure 11).

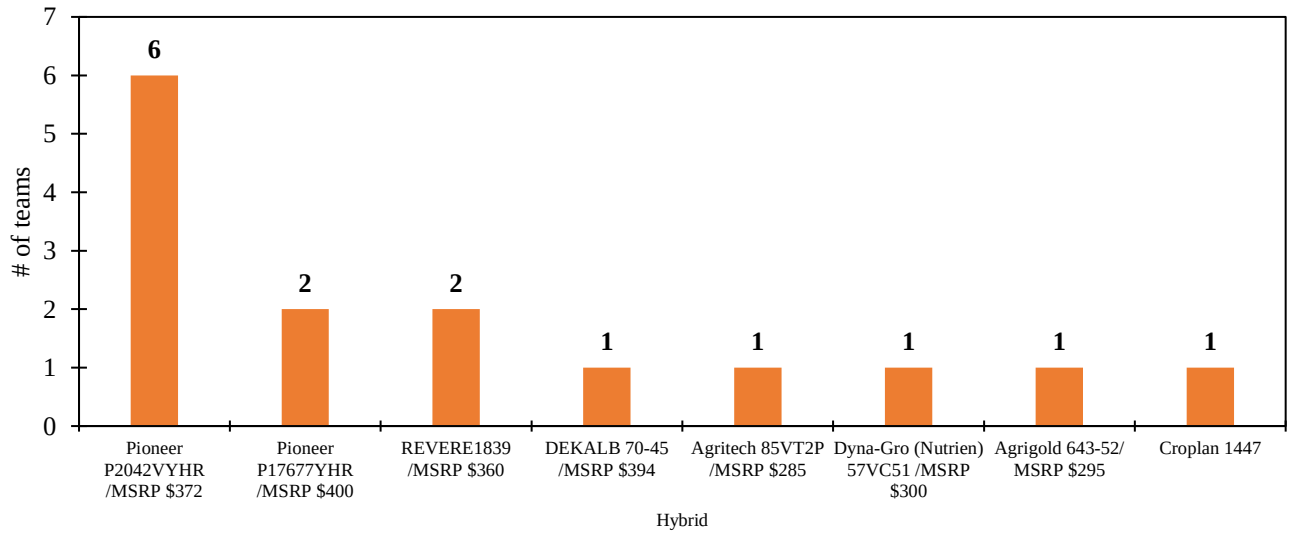


Figure 9. Hybrid selected in the 2024 STEP competition. The red box includes hybrids other than the competition's default hybrids.

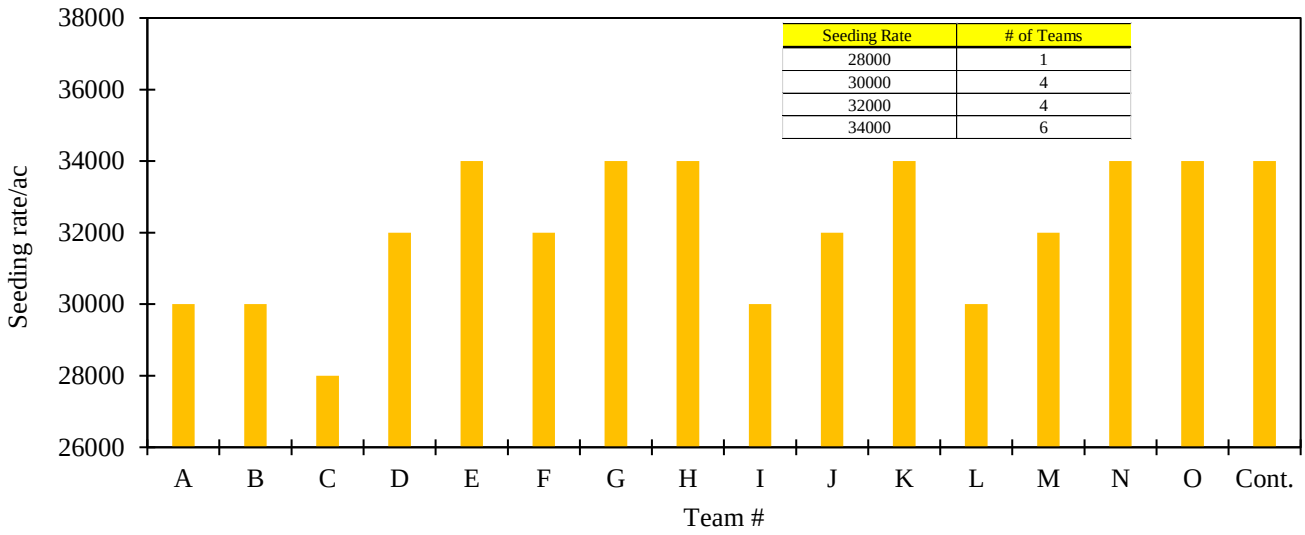


Figure 10. Seeding rate selected by different participating teams.

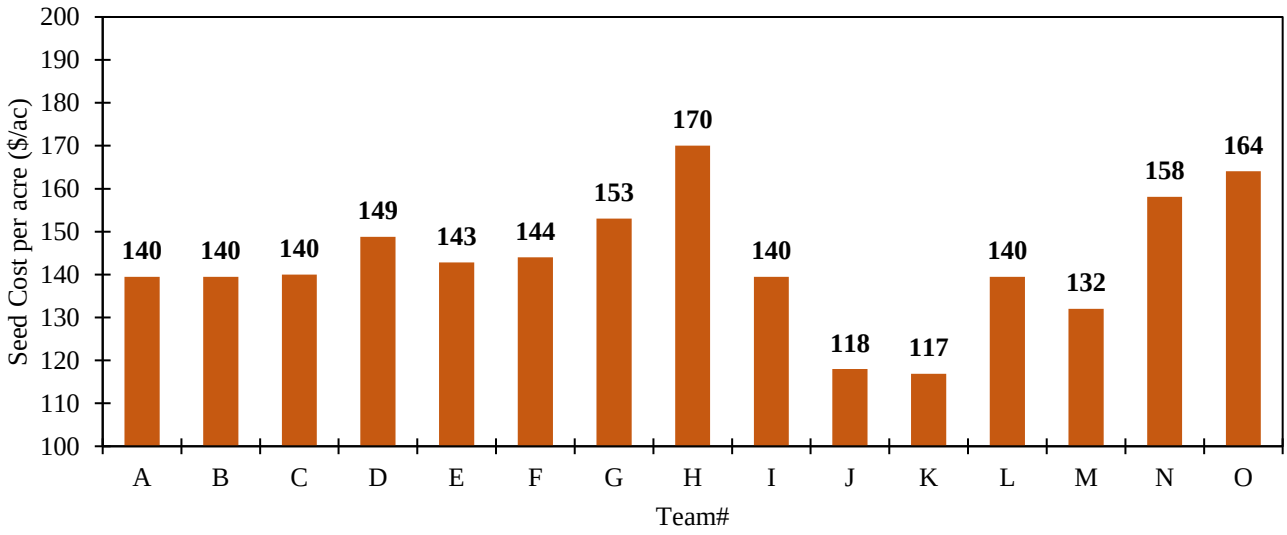


Figure 11. Total seed cost based on team's hybrid selection and seeding rate.

Nitrogen Management

All the plots received 13 gals/ac (~ 30lb/ac of N) of startup fertilizer (23-9-0) at the time of planting. Participants had the opportunity to apply granularly nitrogen (34-0-0), liquid nitrogen UAN 28% (28-0-0-5), and controlled-release fertilizer (CRF blend 43-0-0 by Harrell's and 44.5-0-0 by Pursell) using three application methods: (i) broadcast, (ii) banding, and (iii) liquid side dressing using the Miller High-Boy 360 Y- drop. For the 2024 competition, the total nitrogen application ranged from 155 lbs of N/ac to 355 lbs of N/ac. The teams G, K, M and O for the control release fertilizer program,

opted to broadcast fertilizer at the beginning of the crop growing season along with liquid side dressing with a total target application. Four teams A, F, I and N opted to apply control release fertilizer by banding it approximately 5-inches away from the planting row. The remaining teams used a combination of banding (granular application of ammonium nitrate with the 1st Products Rig) and liquid side-dressing using the Miller High-Boy 360 Y-Drop. The major variation in nitrogen application was observed in liquid side-dressing, where nitrogen application ranged from 50 lbs N/ac to 250 lbs N/ac, representing 32% to 65% of the total nitrogen applied (Figure 12).

In 2024, based on teams' selection of fertilizer material, application amount, and method, total fertilizer costs ranged from Team F's $391.40/ac ($377.40 material cost plus $14 for application) down to $121.35/ac ($76.35 material cost plus $45 for application) for team M (Figure 13) (This does exclude team E which had no attempt at inputs throughout the competition). Throughout the growing season, soil samples at 1ft, 2ft, and 3ft depth and plant tissue samples were provided to the participating teams for decision-making. Additionally, plant and grain tissue samples were collected at physiological maturity to calculate the nitrogen intensification performance index.

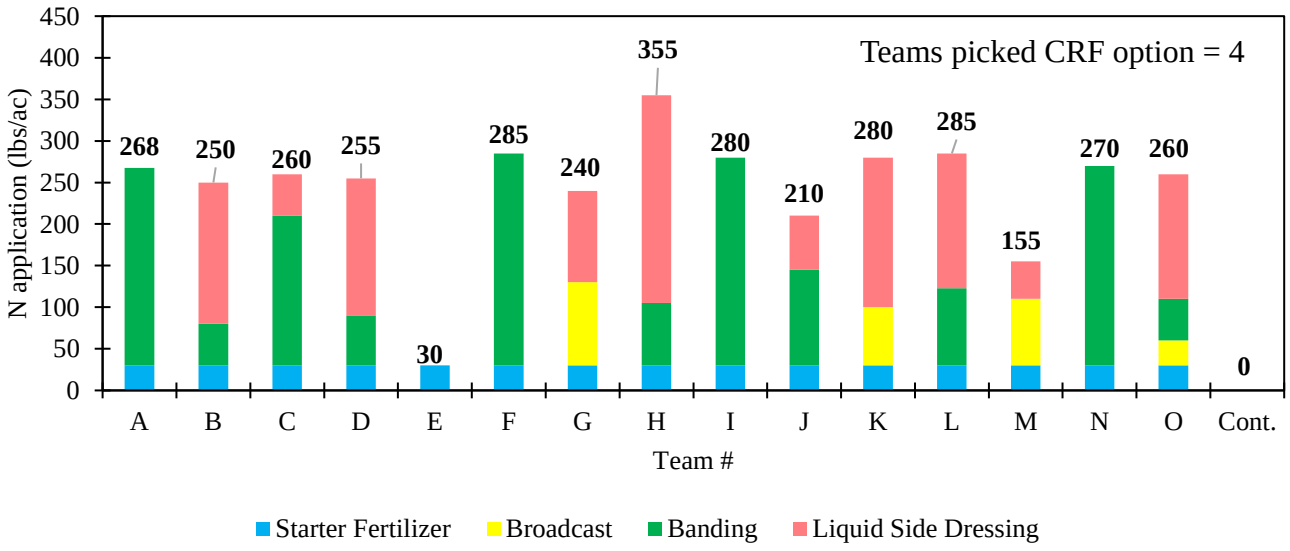


Figure 12. Nitrogen application method and amount (lbs of N/ac) for the participating teams.

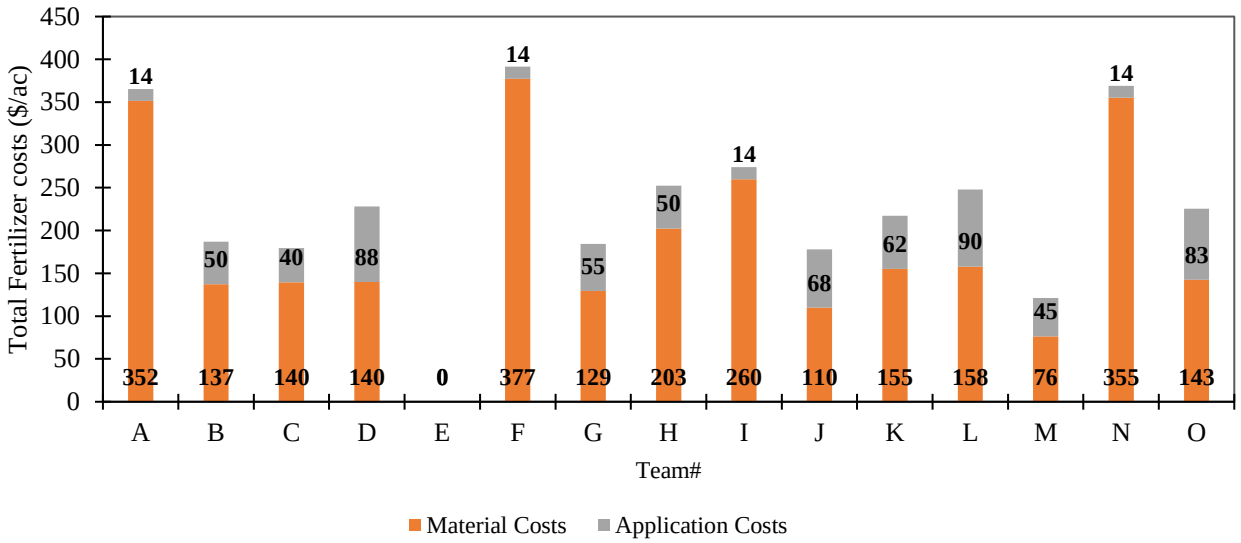


Figure 13. Fertilizer material and application cost ($/ac) for the participating teams.

Irrigation Management:

Before the start of the competition, participating teams were asked to select their preferred method of irrigation scheduling. All teams opted for soil moisture-based irrigation scheduling. Based on their preferences, they were provided with three local soil moisture sensor company options. In 2024, eight teams chose BMP Logic, while seven teams selected Aqua Spy. Participating teams had the opportunity to apply between 0 and 0.5 inches of water per irrigation event, in increments of 0.05 inches, throughout the growing season. Total irrigation applied ranged from 4.9 inches (17 irrigation events) for Team C to 19.7 inches (41 irrigation events) for Team L. Almost all teams began irrigating immediately after sowing in the first week of April. Most teams applied a significant portion of irrigation during May and June to avoid water stress during the critical tasseling (VT) growth stage. In contrast, many teams restricted irrigation in July and effectively utilized precipitation instead (Figure 14). In 2024, total irrigation costs ranged from $63.05 per acre for Team C to $256.10 per acre for Team L (Figure 15).

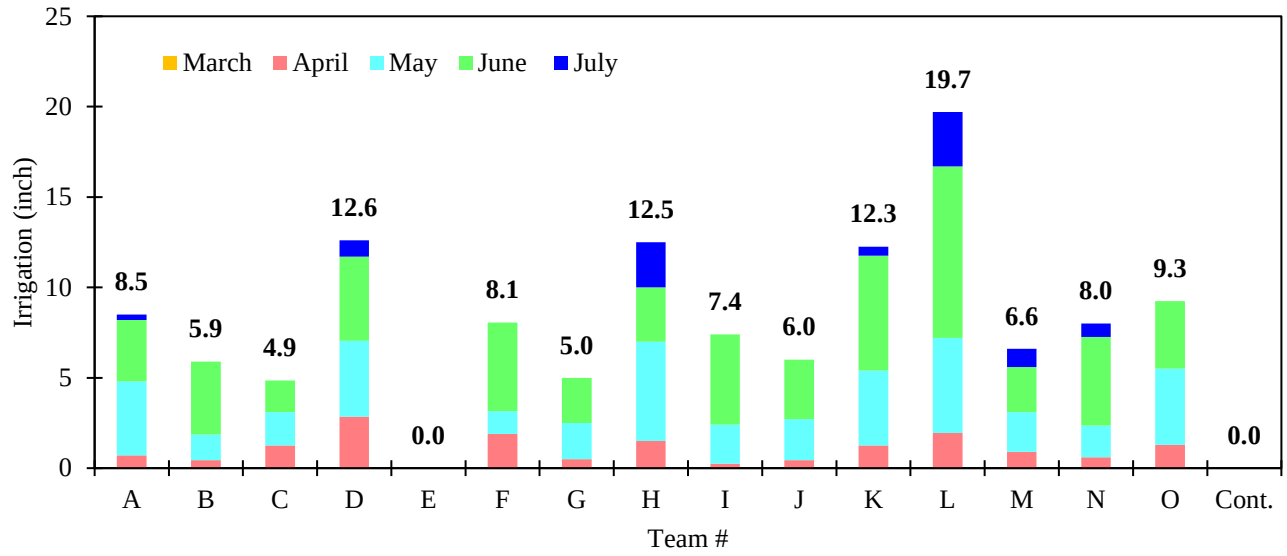


Figure 14. Monthly and cumulative season irrigation applied by the participating teams.

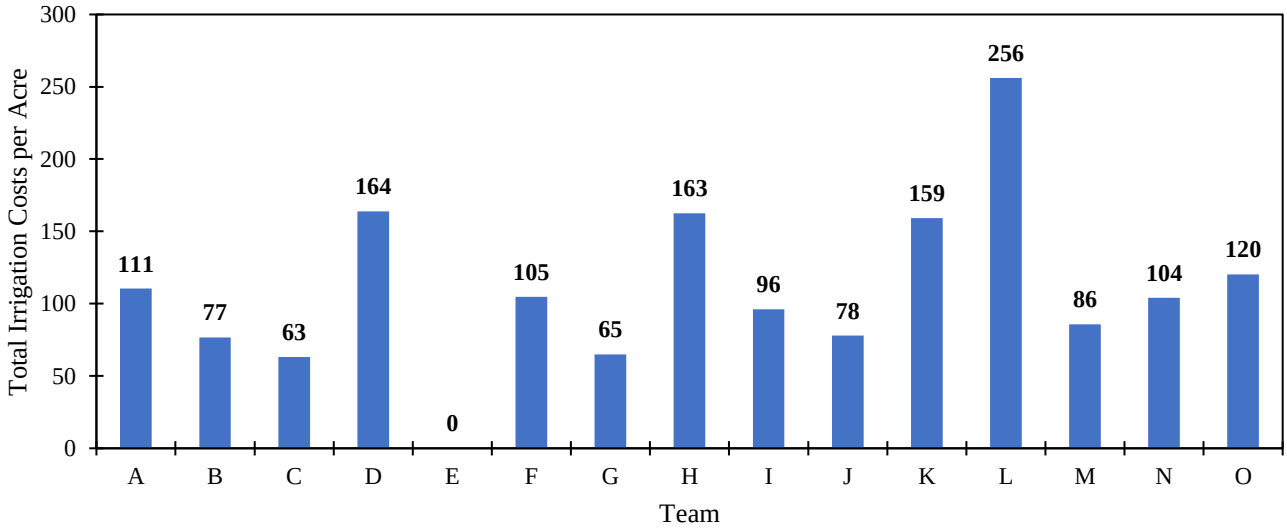


Figure 15. Total irrigation cost ($/ac) for the participating teams.

Insurance Selection:

Teams were required to select either a Revenue Protection or Yield Protection crop insurance policy by March 15. Fourteen teams opted for Yield Protection with a 50% coverage level, whereas only one team chose the Revenue Protection insurance plan with a 60% coverage level (Table 2 and Figure 16). Team E selected Yield Protection at the 50% coverage level and would have been the only team eligible for an indemnity payment of $420.30 per acre due to an extremely low yield. However, since this team did not make any attempt to manage their crop throughout the growing season, their indemnity payment was denied under the policy stipulation of neglect. Insurance selection was a critical shortcoming for all teams this year. Had all teams selected Revenue Protection at 85% coverage, the premium would have cost them $45.82 per acre. However, in that scenario, every team would have received an indemnity payment, ranging from $146 to $372 per acre. One team (Team J) would have made a positive profit on corn ($31/acre), while three

other teams would have had losses of less than $100 per acre.

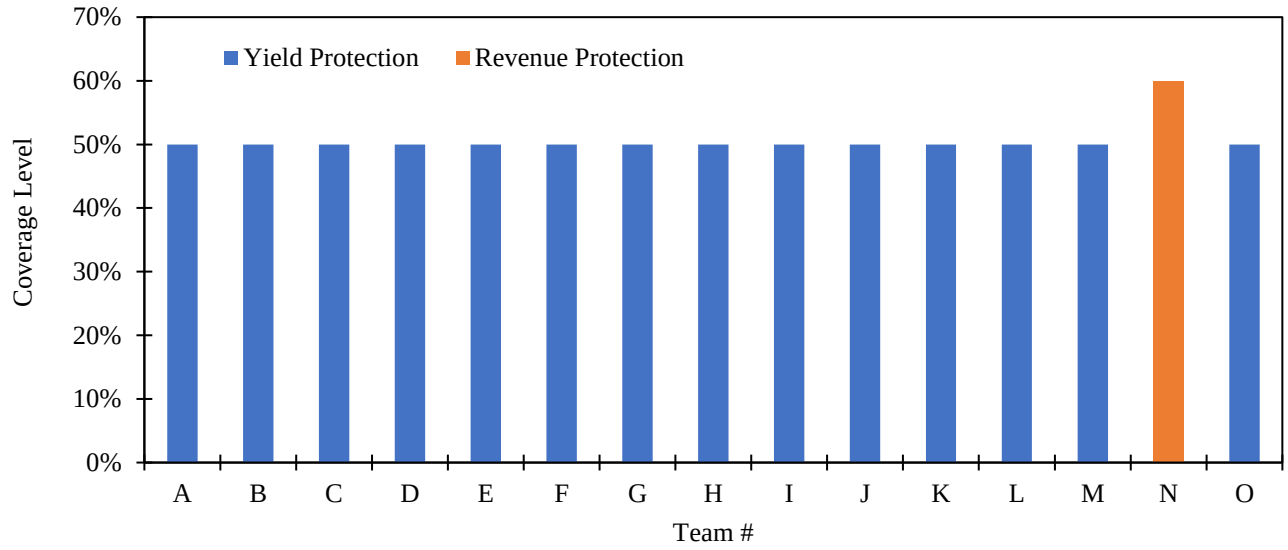


Figure 16. Insurance selections by team.

Table 2. Insurance coverage level and premium per acre selected by different participating teams.

Team	Insurance Type	Coverage Level	Premium per Acre
A	Yield Protection	50%	$2.34
B	Yield Protection	50%	$2.34
C	Yield Protection	50%	$2.34
D	Yield Protection	50%	$2.34
E	Yield Protection	50%	$2.34
F	Yield Protection	50%	$2.34
G	Yield Protection	50%	$2.34
I	Yield Protection	50%	$2.34
K	Yield Protection	50%	$2.34
L	Yield Protection	50%	$2.34
M	Yield Protection	50%	$2.34
N	Revenue Protection	60%	$6.43
O	Yield Protection	50%	$2.34
P	Yield Protection	50%	$2.34

Grain Marketing:

Each team had the opportunity to choose how to market their simulated corn harvest. The yield (bushels per acre) from each team's research plots was multiplied by 1,000 acres to determine the simulated harvest amount that each team sold. The simulated corn harvest was assumed to be delivered to a local buying point during the week of harvest at 15.5% moisture. No storage, drying, or long-distance transport options were permitted. The corn contract price on a given date was determined by the closing Chicago September futures price on that date, plus the local basis in effect at that time. For example, on May 5, 2024, the Chicago September futures closing price was $5.37, and the local basis was $0.80. Therefore, the local flat contract price on

May 5 was $6.17. The Chicago futures price fluctuated daily and was posted on various publicly available sites. In contrast, the local basis was updated weekly for the competition, based on quotes obtained from three local buying points. During the 2024 competition the basis price ranged from $0.60 to $0.80 above the September futures price. The local basis amount was posted on the competition website weekly and remained in effect for calculating contract prices until it was updated the following week. Contract prices between March 1st and August 9th, and the uncontracted spot price during the harvest week (August 12-16) are shown in Figure 6. During the duration of the competition the local contract price ranged from a low of $4.46 per bushel on August 9th to a high of $5.60 per bushel on May 13, 2024. The local spot price offered for corn harvested the week of August 12th was $4.47 per bushel.

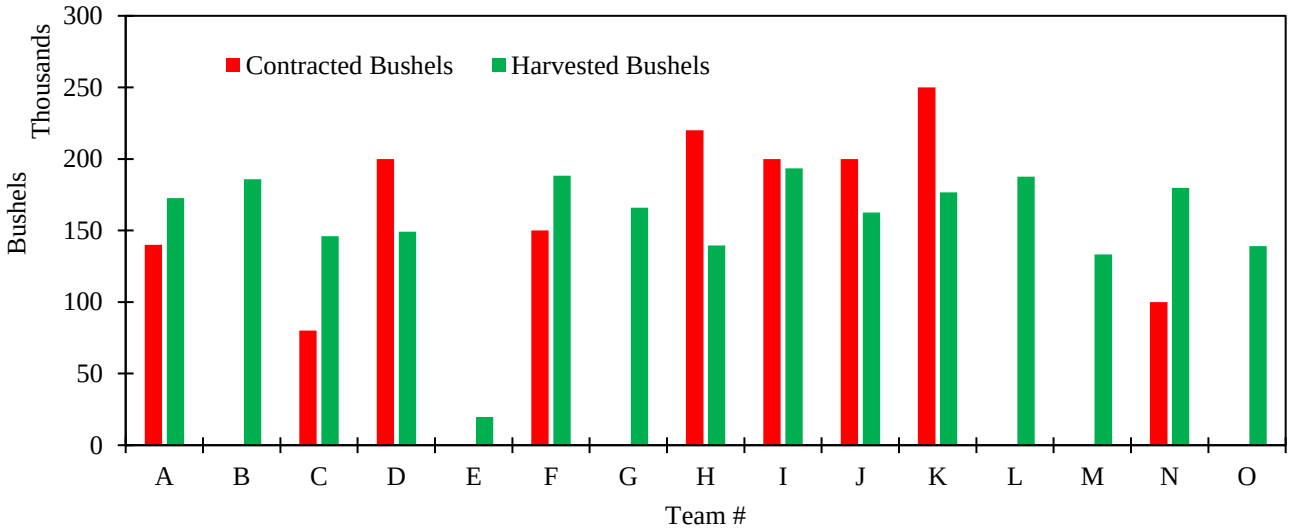


Figure 17. Actual bushels harvested compared to the number of contracted bushels marketed per team

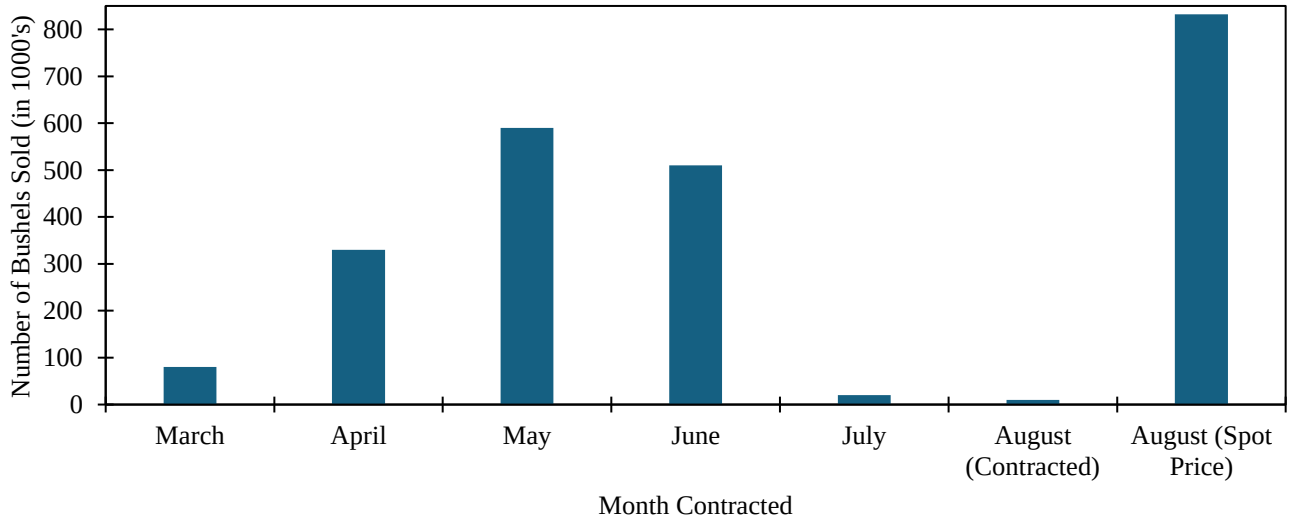


Figure 18. Bushels contracted and sold by month in 2024 STEP corn contest.

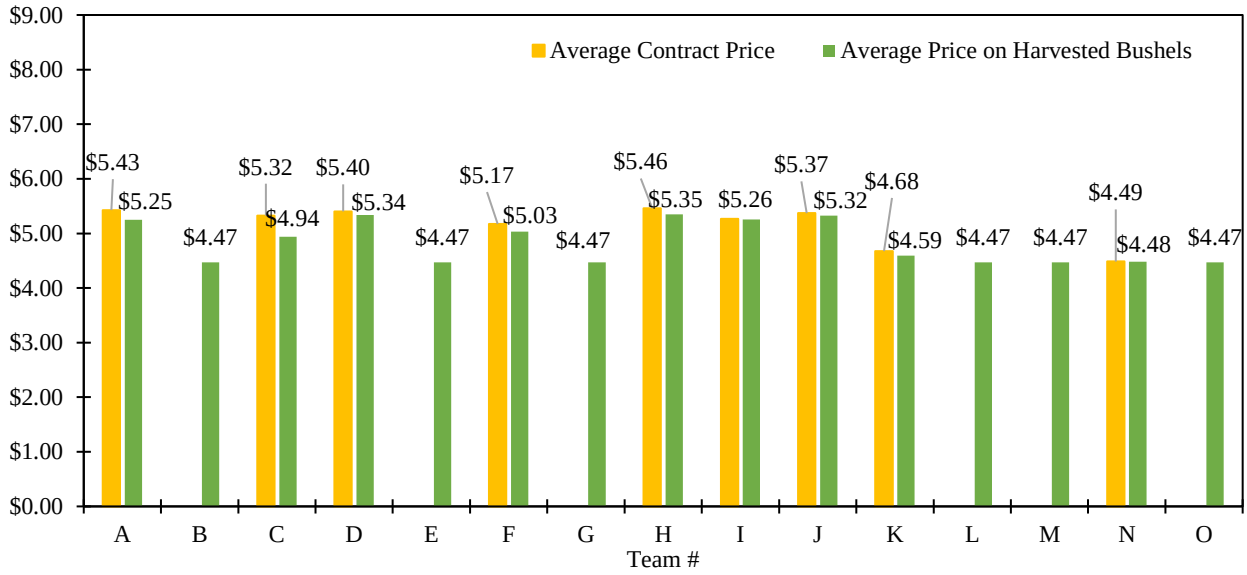


Figure 19. Average prices obtained by each team in 2024 STEP corn contest.

On average, teams contracted 154,358 bushels but harvested slightly more at 158,679 bushels, with total harvested bushels exceeding total contracted bushels (Figure 17). Some teams, like D, H, J, and K, contracted more bushels than they harvested, indicating potential shortfalls. Others, such as B, F, L, M, and O, harvested more than they contracted, allowing for excess grain sales. Across all teams, 1,540,000 bushels were contracted between March and August. 832,000 uncontracted bushels from the 6 remaining team's simulated harvest were assigned the harvest-week spot price. Figure 18 shows the number of bushels contracted or sold by the month. May was the month with the highest number of bushels contracted. Five teams contracted more bushels than they harvested, partly because of low yields in 2024. The $0.20/bu handling fee was applied on the number of bushels over contracted, resulting in over $49,742.80 of penalties for these 5 teams. The weighted average delivered price and farm-gate price (subtracting a hauling cost of $0.30/bu) were calculated for each team. Figure 19 compares the average contract price to the average delivered price on all harvested bushels. The average price on all harvested bushels is lower than the average contract price, either because the harvest price assigned to uncontracted bushels was lower than any contract price or because of the penalty assigned to teams that over contracted. The average delivered price for teams that did not contract any bushels was the harvest-week spot price of $4.47 per bushel.

Yield Results:

For the 2024 STEP competition, the corn yield per team ranged from 133 bu/ac to 193 bu/ac. The control plot that received no irrigation and no fertilizer yielded only 8 bu/ac. Team E stopped giving inputs during the competition and got a low yield of 20 bu/ac. Team I achieved the highest yield using the corn hybrid Pioneer P2042VYHR at a rate of 30000 seeds per acre. (Figure 20).

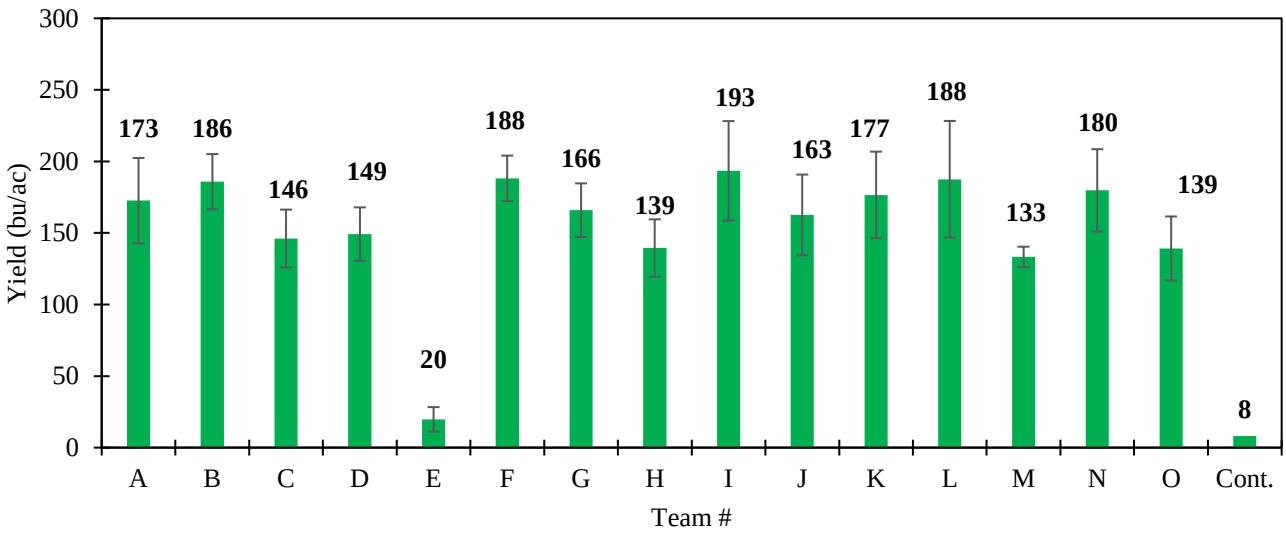


Figure 20. Average crop yield of individual teams and control plot in 2024 STEP corn contest.

To further understand the differences in yield, grain yield was compared based on hybrid selection, seeding rate, and seasonal cumulative irrigation and nitrogen applications. Figure 21 presents the average grain yield for different hybrids selected by the participating teams. The highest and lowest average grain yields were 178 bu/ac and 133 bu/ac, observed for Pioneer P2042YHR and Dyna-Gro 57VC51, respectively. Pioneer P2042YHR, selected by six teams, resulted in an average yield of 178 bu/ac (SD = 25 bu/ac). The study also showed that higher yields do not solely depend on high seeding rates but are also influenced by factors such as hybrid selection, the yield potential of the hybrid, and management practices followed. For example, six teams selected P2042YHR, yet four of them achieved different yield results despite using the same seeding rate (30,000 seeds/acre, Figure 22). Additionally, teams that used the same seeding rate of 34,000 seeds/acre also produced varying yields, emphasizing the significance of other management decisions, including irrigation and nitrogen management.

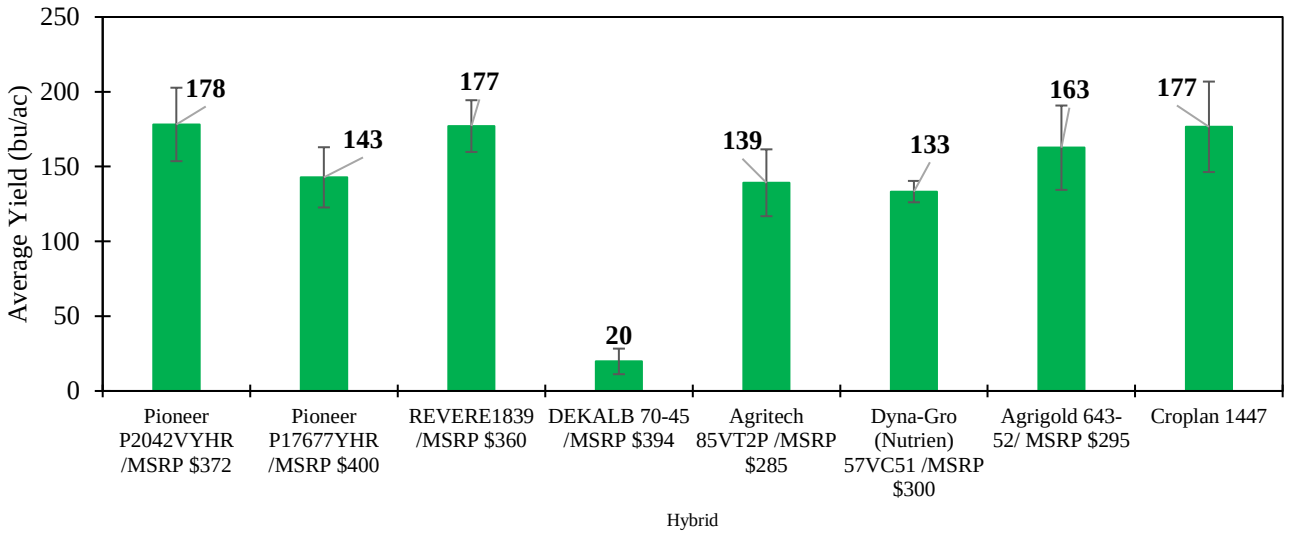


Figure 21. Grain yield response to hybrid in 2024 STEP corn contest.

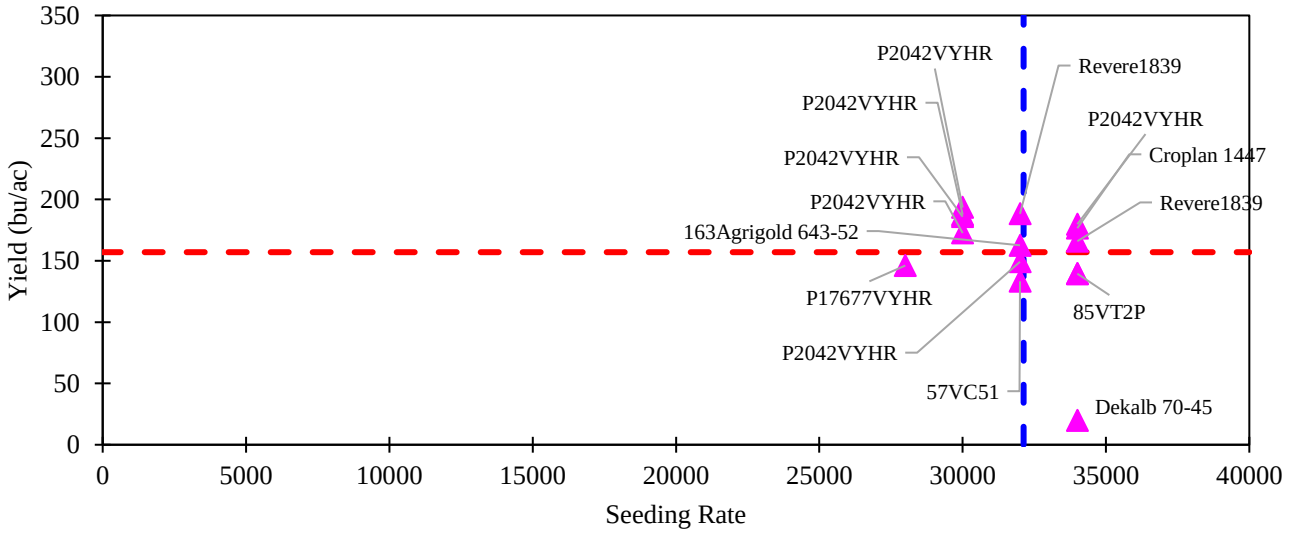


Figure 22. Corn yield at varying seeding rates. The red and blue dotted line represents the average yield and average seeding for the 2024 STEP corn contest.

Total nitrogen application had a significant effect on grain yield, as shown in Figure 23. The red and blue dotted lines in Figure 23 represent the average yield and average total nitrogen applied in the study. Blue and pink markers indicate the nitrogen application and corresponding yield for the team with the highest input-use efficiency and the most profitable team, respectively. The team with the highest yield applied 280 lbs/ac of nitrogen. Teams that applied 200 lbs/ac or less exhibited below-average yield results. Grain yield peaked at 270 lbs N/ac, after which additional nitrogen application resulted in no yield response or a slightly negative response.

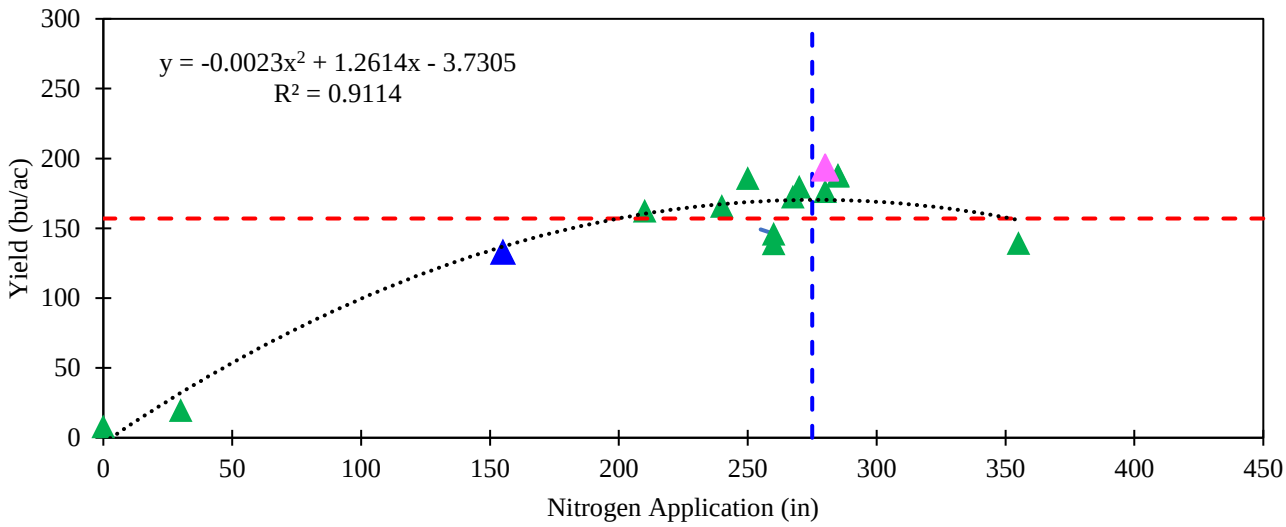


Figure 23. Corn yield (bu/ac) response to season total nitrogen application (lbs/ac). The most efficient and most profitable are indicated by blue and pink markers.

Grain yield showed a positive association with irrigation, with seasonal irrigation explaining 70% of yield variability (Figure 24). The average yield exhibited an increasing trend when irrigation was applied between 5.0 inches and 12.2 inches. The team that applied the least irrigation had the lowest yield. However, the team marked in blue, which applied the fifth-lowest amount of irrigation (6.6 inches), had a slightly below-average yield but was also the most efficient. In contrast, the team represented by the pink marker, which applied 7.4 inches of irrigation—slightly more than the blue-marker team—was the most efficient overall, achieving maximum yield and profitability. This further supports the assertion that yield, and irrigation are influenced by other management decisions and variables.

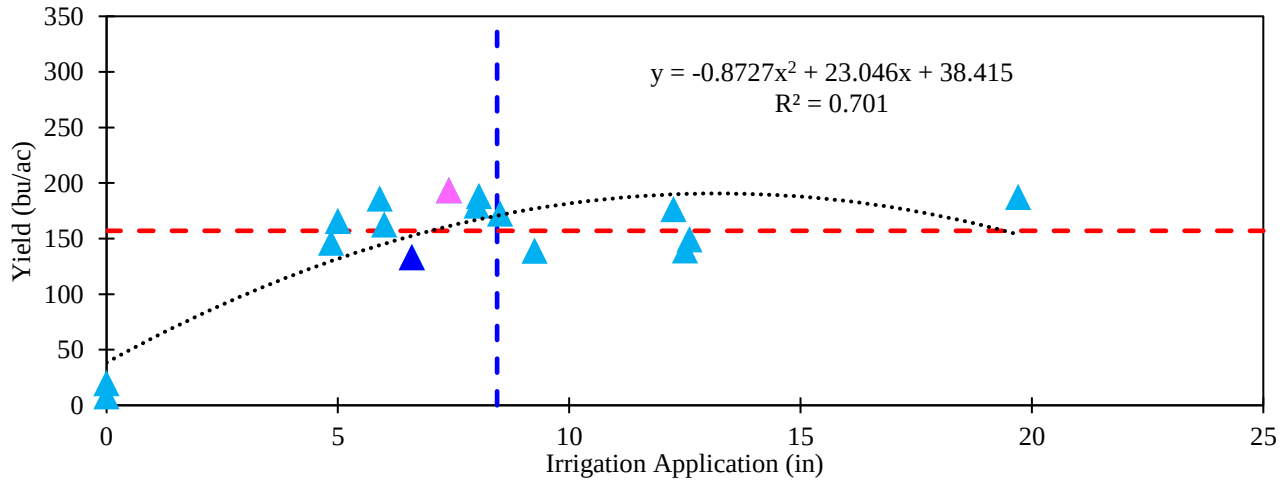


Figure 24. Corn yield (bu/ac) response to season total irrigation application (inches). The most efficient and most profitable are indicated by blue and pink markers.

2022 STEP Award Winners:

1. Most Profitable

For the most profitable award, gross profit was calculated by subtracting the total fixed production cost per acre and STEP variable cost per acre from corn sales revenue per acre. Gross profit does not account for the general and administrative costs of running a farm business. Revenue per acre was calculated by multiplying yield per acre by the average farm-gate price for each team. The average farm-gate price is the weighted average delivered price minus a $0.30 per bushel hauling charge to deliver the corn to the local buying point.

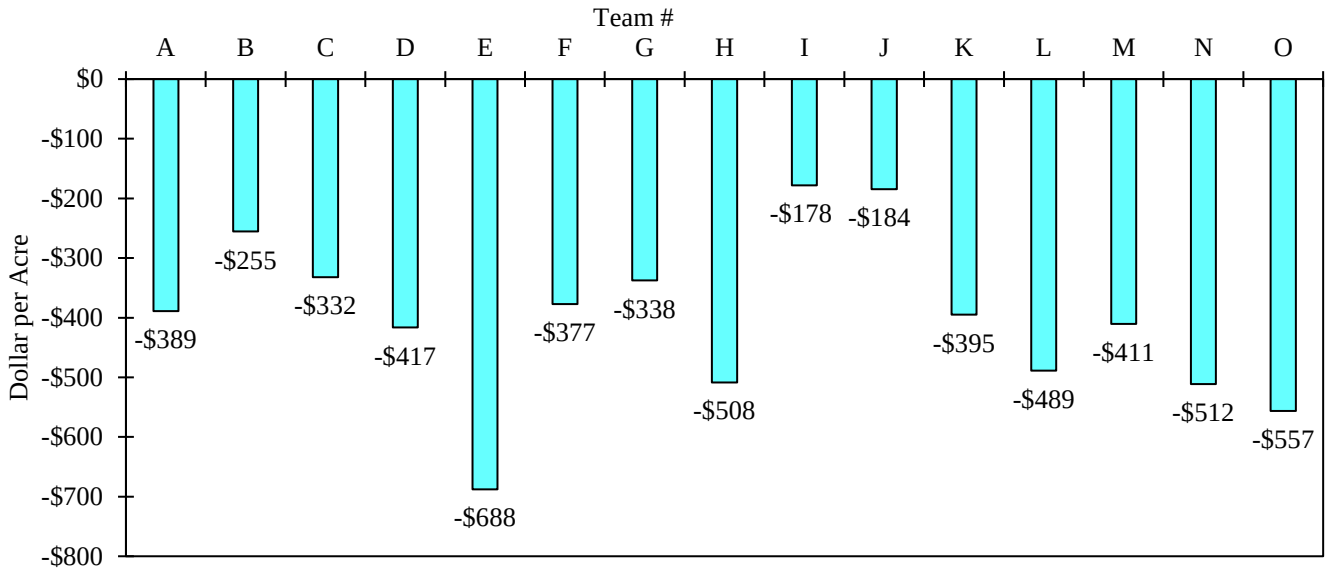


Figure 25. Gross profit per acre calculated for each team's corn program

Figure 25 shows the profit results for each team. In the 2024 corn contest all 15 teams had negative gross profit. Team Pursell had the highest gross profit with a loss of -$178.20 per acre. Their corn program consisted of planting Pioneer P2042VYHR seed at a rate of 30,000 seeds per acre. Team Pursell picked their controlled-release fertilizer program and applied a total of 280 lbs of N/ac (30 lbs/ac as a starter fertilizer and 250 lbs/ac of CRF (44.5-0-0) by banding at the time of planting.) They applied a total of 7.4 inches of irrigation and selected yield protection insurance coverage at 50% coverage. For marketing they marketed their grain with 4 flat contracts of 50,000 bushels at prices of $5,47, $5.20, $5.28, and $5.14 respectively. They over-contracted 6,577 bushels resulting in penalties of $1315.40. After hauling charges, their average farm-gate price was $4.96/bu with a farm-gate revenue per acre of $958.84. Team Pursell also had the highest yield of 193 bu/ac. Congratulations Team Pursell (Figure 26).

Another noteworthy team that had second highest profitability with a gross profit loss of -$184.35 per acre is Team Riverbend. They planted the Agrigold 643-52 seed at a rate of 32,000 seeds per acre. They used 210 lbs of N/ac (30 lbs/ac as a starter fertilizer, 115 lbs/ac by banding from planting to V10, and 65 lbs/ac liquid side dressing). Team Riverbend applied a total of 6 inches of irrigation in 20 events. For marketing, they selected yield protection insurance coverage at 50% and marketed their grain with 2 basis

contracts of 100,000 bushels of corn at a price of $5.30 and $5.49 respectively. Their corn yielded an average of 163 bu/ac which left them with 37,383 over-contracted bushels resulting in $7476.60 penalties and an average farm-gate price of $5.02/bu (Figure 27).

Third place was Team Columbia with a gross profit loss of -$255.37 per acre. Team Columbia's corn program consisted of: Pioneer P2042VYHR hybrid seed with a seeding rate of 30,000 seeds per acre, 250 lbs of N/ac (30 lbs/ac as a starter fertilizer, 50 lbs/ac banding, 170 lbs/ac liquid side dressing respectively), and applied 5.9 inches of irrigation in 16 events. Team Columbia had a yield average of 186 bu/acre. They selected yield protection insurance coverage at 50% coverage and sold all bushels at the spot price of $4.47.

Figure 26. Team Pursell first place holder in 2024 STEP corn contest in most profitable award category - Receiving a check of $2000 from Mr. Stanley Posey, Nutrien and Dr. Kati Migliaccio, Dean UF/IFAS.

Figure 27. Team Riverbend Farms second position holder in STEP contest most profitable award category - receiving a check of $1000 from Mr. Stanley Posey, Nutrien and Dr. Kati Migliaccio, Dean UF/IFAS.

Figure 28. Team Columbia Farms third position holder in STEP competition Most Profitable Award category - receiving a check of $500 Mr. Stanley Posey, Nutrien and Dr. Kati Migliaccio, Dean UF/IFAS.

2. <u>Highest Input-use Efficiency:</u>

Input use efficiency was quantified using the Water and Nitrogen Intensification Performance Index (WNIPI), which was evaluated for each team relative to the control plot that received no irrigation or fertilizer inputs. The WNIPI values along with ranking, yield, irrigation, and nitrogen applied are presented in Table 3 and Figure 29. The WNIPI ranged from 0.10 to 0.28 (Figure 29).

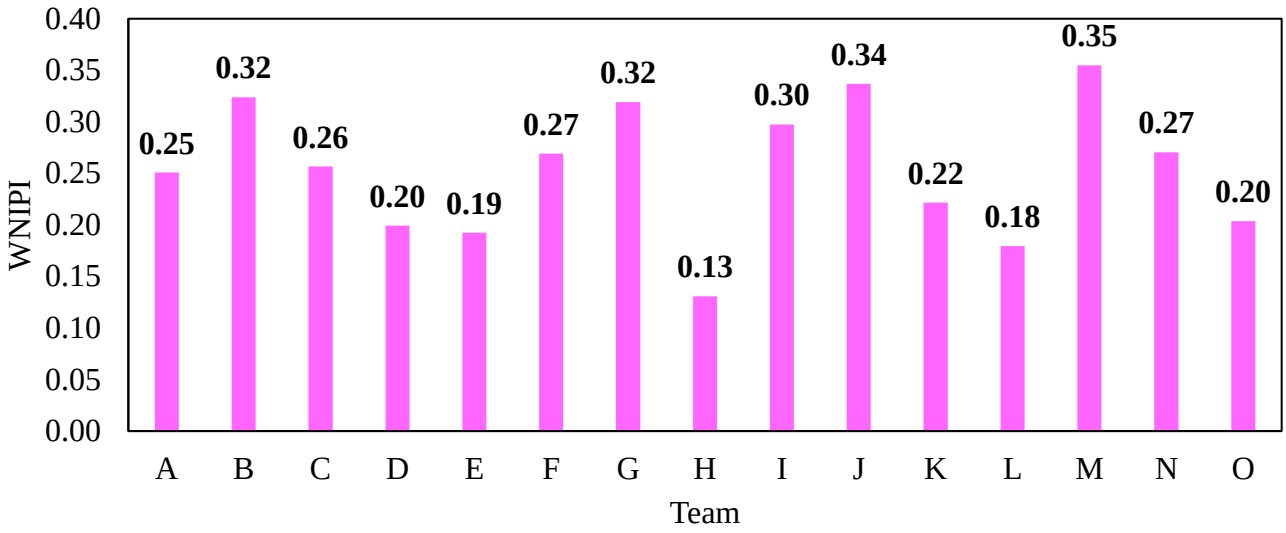


Figure 29. Water Nitrogen Intensification Performance Index (WNIPI) for different teams. Red box indicates the highest and lowest WNIPI values.

Table 3. Cumulative season irrigation, nitrogen application, yield, and Water Nitrogen Intensification Performance Index (WNIPI) for different teams.

Team	Irrigation (in)	Nitrogen Application	Yield	WNIPI
A	7	382	185	0.14
B	5.55	230	215	0.28
C	6.25	300	234	0.24
D	5.65	320	212	0.20
E	10.25	190	196	0.24
F	20.85	387	211	0.10
G	7.4	295	255	0.25
I	4.4	205	179	0.27
K	11.8	280	282	0.24
L	10.7	240	240	0.25
M	1.6	210	153	0.26
N	10.35	276	214	0.19
O	7.8	250	169	0.17
P	6.6	245	226	0.26

Team Wilkerson Farm bagged the first prize by attaining a WINIPI of 0.335. They applied a total seasonal irrigation of 6.6 inches over 17 events and applied 155 lbs/ac of nitrogen fertilizer (30 lbs/ac as starter fertilizer, 80 lbs/ac through broadcasting, and the remaining 45 lbs/ac as a liquid side-dress). They planted Dyna-Gro 75VC51 at a seeding rate of 32,000 seeds per acre. Although Team Wilkerson Farm had an average yield, their efficiency was the greatest among the competing teams due to their low nitrogen and water use. Congratulations Team Wilkerson Farm.

Team Riverbend Farms closely followed and bagged second place in the category with a WNIPI of 0.337. Team Riverbend Farms applied total seasonal irrigation of 6 inches in 20 events, applied 210 lbs/ac of nitrogen fertilizer (30 lbs/ac as starter fertilizer, banding 115 lbs/acre and liquid side dressing 65 lbs/acre), and planted corn hybrid Agrigold 643-52 with a seed rate of 32000 seeds per acre. Their yield was 163 bu/ac. Congratulations Team Riverbend Farms (Figure 31).

Third prize in this category went to Team Columbia with a WNIPI score of 0.324. Team Columbia applied total seasonal irrigation of 5.9 inches in 16 events, applied 250 lbs/ac. of nitrogen fertilizer (30 lbs/ac as starter fertilizer, banding 50 lbs/ac and liquid side dressing of 170 lbs/ac), and planted corn hybrid **P2042YHR** with a seed rate of 30,000 seeds per acre. The average yield obtained was 186 bu/ac. Congratulations Team Columbia. (Figure 32).

Figure 30. Team Wilkerson Farms (Members: BJ Wilkerson, and Kelsey Wilkerson) – First place in STEP contest input-use efficiency award category- Receiving a check of $1000 from Dr. Eric Simonne from UF-IFAS, and Mr. Stanley Posey of Nutrien.

Figure 31. Team Riverbend Farms (Members: Kyle Keley and Tera Kelley, and Kyle Dasher) – Second place in STEP contest input-use efficiency award category- Receiving a check of $1000 Dr. Eric Simonne from UF-IFAS, and Mr. Stanley Posey of Nutrien.

Figure 32. Team Columbia (Members: Ronald Norris) – Third place in STEP contest input-use efficiency award category- Receiving a check of $500 Dr. Eric Simonne from UF-IFAS, and Mr. Stanley Posey of Nutrien.

Conclusion:

The 2024 STEP competition was completed successfully and provided great insight into various management strategies that can lead to profitable and efficient corn production. This report summarizes the strategies and management decisions made by different teams and outcomes in relation to grain yield, profitability, and input use efficiency. The 2024 STEP corn competition was held at the UF-IFAS North Florida Research and Education Center – Suwannee Valley, Live Oak (NFREC-SV). Fourteen teams including the UF-IFAS team participated in the competition. Participants had control over six production parameters, including (i) crop hybrid type, (ii) seeding rate, (iii) irrigation management, (iv) nitrogen management, (v) insurance selection, and (vi) grain marketing. The teams competed for two awards: (i) Most profitable, and (ii) Highest input use efficiency. There are considerable differences in growers' decisions ranging from the selection of hybrid, seeding population to irrigation and nitrogen management. A scientific evaluation of these management practices is especially valuable to growers and other stakeholders as it provides a thorough understanding of grower-based management practices as they compare against their peers as well as against university recommendations. Significant findings of the 2024 STEP competition include:

- In 2024, 15 different corn hybrids were offered to the growers out of which 8 teams chose hybrids i.e., P2042YHR and P17667YHR from Pioneer, 85VT2P@ from Agratech, Dyna Gro D57VC51, Croplan 1447, Dekalab7045, Revere 1839 were planted with seed cost ranged from $117 to $170 per acre.
- The most common hybrid selection for the 2024 competition was Pioneer P2042YHR which was chosen by Six teams.
- Plant populations chosen ranged from 28000 seeds/ac to 34000 seeds/ac, where six teams opted for 34000 seeds/ac and four teams each opted for 32000 and 3000 seeds/ac respectively.
- The total nitrogen application ranged from 155 lbs of N/ac to 355 lbs of N/acre.
- Total irrigation applied ranged from 4.9 inches (17 irrigation events) to 19.7 inches (41 irrigation events).
- Fourteen teams opted for Yield Protection with a 50% coverage level, whereas only one team chose the Revenue Protection insurance plan with a 60% coverage level.
- During the duration of the competition the local contract price ranged from a low of $4.46 per bushel on August 9th to a high of $5.60 per bushel on May 13, 2024. The local spot price offered for corn harvested the week of August 12th was $4.47 per bushel.
- For the 2024 STEP competition, the corn yield per team ranged from 133 bu/ac to 193 bu/ac
- Team Pursell(Billy Browning) had the highest gross profit with a loss of -$178.20 per acre

Team Riverbend (Team Members: Wyatt Jackson) had the second highest gross profit at $-184 per acre.

- Team Columbia (Team Member: Ronald) had the third highest gross profit at $255.37 per acre.
- The WNIPI ranged from 0.10 to 0.28

Acknowledgement:

The successful completion of third year of Florida STEP corn competition is due to the commitment and support provided by our participating teams, industry partners, sponsors, funding agency, and many UF colleagues. Special thanks to the NFREC farm crew and UF-IFAS extension personnel for their support throughout the competition. The project is supported by Florida Department of Agriculture and Consumer Science (FDACS) Office of Agricultural Water Policy under award number AWD12685. Special thanks to our exclusive sponsor "Nutrien" for award sponsorship. We would also like to thank for industry sponsors for their sponsorship on seed, fertilizer, insurance quotes, marketing prices, and technology information.

Thank you for your support!