



**2018**  
**FARM MANAGEMENT**  
**COMPETITION REPORT**



[taps.unl.edu](http://taps.unl.edu)

West Central Research and Extension Center  
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**Mission Statement:** To fully engage agriculturalists, scientists, educators, students, and industry in an innovative endeavor, to TAP into the University of Nebraska-Lincoln's potential to facilitate and create an environment for all stakeholders to work together in finding solutions through innovation, entrepreneurialism, technology 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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## **Reference**

Lo, T., D.R. Rudnick, C.A. Burr, M.C. Stockton, and R. Werle. 2019. Approaches to evaluating grower irrigation and fertilizer nitrogen amount and timing. *Agricultural Water Management* 213: 693-706.

## EXECUTIVE SUMMARY

The University of Nebraska–Lincoln Testing Ag Performance Solutions (TAPS) farm management education and solutions program is winding down its second year. This most recent year, 2018, has proven to be one of growth and continued excitement about this new and evolving program, which was created to keep pace with ever-increasing innovation and technical capacity of producers. This program represents an evolution of the university's research and extension efforts, to meet these needs. The many challenges related and faced by agricultural production indicates a need for a deeper level of engagement among all the stakeholders.

This second year of the TAPS program has been successful and now includes a second contest for sorghum in addition to the ongoing corn contest. The program expanded to 28 teams (20 teams for corn and 8 teams for sorghum) with participants from Nebraska and Kansas representing twelve Nebraska Natural Resources Districts (NRDs) and two Kansas Groundwater Management Districts (Figure 1). The expansion of the TAPS program allowed for the inclusion of new and returning producers as well as non-producer teams, including Nebraska Farmer writers, Nebraska Department of Environmental Quality (NDEQ), and Nebraska Department of Natural Resources (NeDNR). The Nebraska Farmer team competed and documented the decision-making process for managing sorghum, whereas NDEQ and NeDNR competed in the corn competition. Producers and agency personnel competing and engaging with each other will bear fruit to a better understanding of challenges and identification of solutions that will lead to efficient and profitable agricultural production.

One of the key benefits of the TAPS program is that it encourages peer-to-peer exchange of ideas and innovation. For example, winners of the 2017 TAPS competition and participants of the 2018 TAPS competitions served as speakers at the 2018 West Central Water and Crops Field Day on August 23, in North Platte, NE. Winners of the 2017 TAPS competition, Tim Schmeeckle and Roric Paulman, presented their strategies on efficient and profitable production of corn in packed rooms. The 2018 TAPS participants were part of a growers panel that engaged an audience of 300 people as they discussed their management philosophy, how they utilize technology in their operation, and what they hope to get out of competing in TAPS.

Not surprisingly many entities have contributed in many different ways to this program's development and support. We are especially grateful to the Nebraska Corn Board, Nebraska Sorghum Board, and the National Sorghum Checkoff for their support of the TAPS program. In addition, we are very appreciative of the many different support organizations and entities that provided resources, new technology, technical assistance, and innovative approaches made available to the program's participants and observers. The TAPS partners and sponsors are highlighted in the back of the booklet.

We thank all those who have actively participated and given of their time and/or treasure. We look forward to adding new partners in the coming seasons and anticipate the discovery of many new friends, innovations, and solutions that come from such an effort.

Sincerely,

TAPS Executive Board

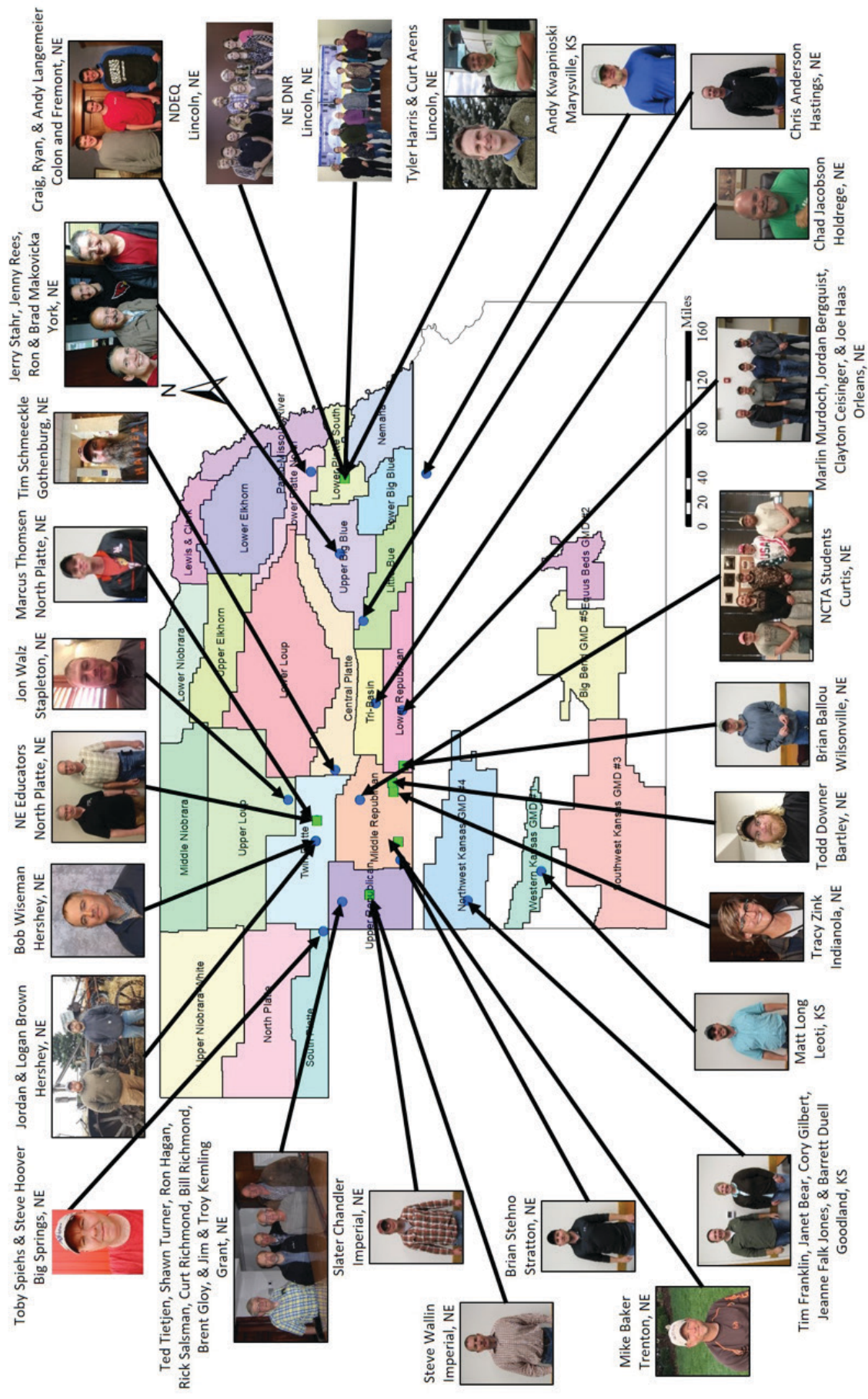


Figure 1. Location of the 2018 TAPS Farm Management Competition participants. Blue circles indicate participants competing in the corn competition and the green squares represent those competing in the sorghum competition. The Nebraska Natural Resources Districts and Kansas Groundwater Management Districts' boundaries are also presented.

# PARTICIPANTS

## PROGRAM OVERVIEW

The 2nd Annual Sprinkler Irrigated Corn Farm Management Competition and the 1st Annual Sprinkler Irrigated Sorghum Farm Management Competition were established in 2018 under a Zimmatic by Lindsay Variable Rate Center Pivot at the West Central Research and Extension Center (WCREC) in North Platte, Nebraska. The corn competition included twenty farms (i.e., teams), whereas the sorghum competition had eight farms. Each farm was randomly assigned a set of three experiment-sized plots, totaling about one half of an acre (Figures 2 and 3). All farms were managed by WCREC personnel. However, the yields and costs from each farm were amplified to represent 3,000 harvested acres for the corn competition and 1,000 harvested acres for the sorghum competition. This amplification provided the opportunity to market an amount of grain more representative of that of a modern farm.

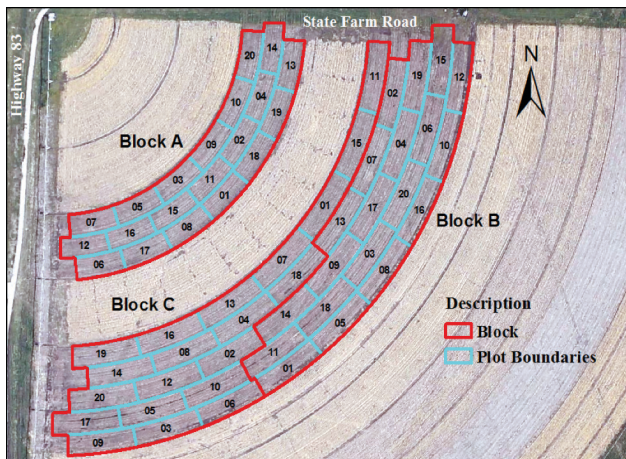


Figure 2. Farm IDs (i.e., treatments) for the 2018 Corn Farm Management Competition held at the West Central Research and Extension Center in North Platte, NE. Each team had a randomized plot located in blocks A, B, and C. The background Aircourt imagery was collected by Flying M Aviation on May 5, 2018.

Participants had control over six parameters:

### *Irrigation Management*

The Zimmatic irrigation system (Lindsay Corporation, Omaha, NE) was operated every Monday and Thursday throughout the growing season. The participants had until 10 a.m. on the irrigation days to note whether they would like to irrigate using a form located on the competition website. If participants failed to indicate their intent to irrigate by 10 a.m., no irrigation water was applied on that irrigation day. Irrigation depth per application could be between 0 and 1.0 inch in intervals of 0.05 inches. The variable cost to pump an acre-inch of water was \$7.80.

### *Nitrogen Management*

Participants had to decide the amount of preplant and/or in-season (via side-dress and/or fertigation) nitrogen fertilizer in the form of UAN 32%. All plots received a baseline 5 gallons per acre of starter fertilizer (10-34-0) at time of planting. Preplant and side-dress nitrogen was applied using a double-coultter liquid applicator that dribbled UAN 32% at an approximate depth of 1 inch and at a dis-

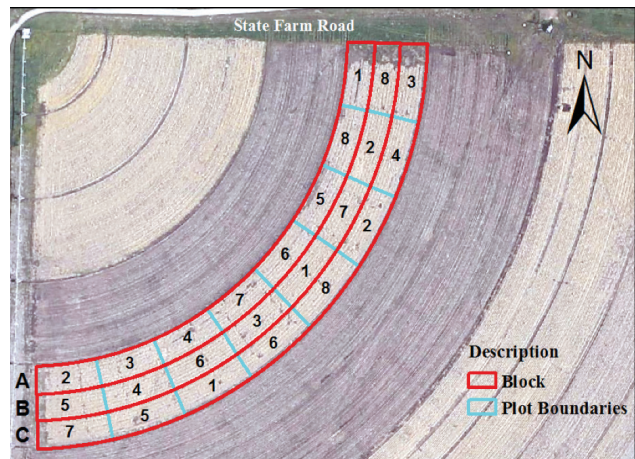


Figure 3. Farm IDs (i.e., treatments) for the 2018 Sorghum Farm Management Competition held at the West Central Research and Extension Center in North Platte, NE. Each team had a randomized plot located in blocks A, B, and C. The background Aircourt imagery was collected by Flying M Aviation on May 5, 2018.

tance of 5 inches from the center of the crop row on both sides. Fertigation was applied through the center pivot using a variable rate injection pump (Agri-Inject, Yuma, CO) that maintained the system concentration as the irrigation system flow rate changed. Maximum application amount allowed was 180 lb/acre for preplant, 180 lb/acre for side-dress, and 30 lb/acre for each fertigation event (i.e., total possible fertigation amount was 120 lb/acre). Preplant, side-dress (V4-V6), and four fertigation events (V9, V12, VT/R1, and R2) were made available to the corn participants, whereas preplant and four fertigation events (Stages 2, 3, 4, and 5) were made available to the sorghum participants. A custom application cost of \$7.00 per acre was charged for the preplant and side-dress applications and \$1.00 per acre for the fertigation applications”.

### ***Hybrid Selection and Seeding Rate***

Participants were responsible for selecting a hybrid as well as seeding rate. District sales managers (DSMs) of several seed companies (Pioneer, Dekalb, Channel, Hefty, Fontanelle, Dyna-Gro, and NuTech) provided a recommended list of five corn and two sorghum hybrids, with respective seeding rates, for the competition field. Participants had the option of selecting a DSM recommended hybrid or they could supply their own seed. If participants selected a recommended hybrid, the DSM provided the seed. The base corn hybrid for the competition was a 112-113 day maturity. The corn competition field was picked when this hybrid reached 18% moisture content. At time of harvest, all hybrids were charged a drying cost of \$0.04 per point per bushel above 15.5% moisture content for corn and 14% for sorghum.

### ***Grain Marketing***

Participants were given the following options: spot (cash) sales, forward contract, basis contract with delivery at harvest, simple hedge to arrive, and futures contract to market grain. Marketing was allowed between

March 13 and November 15 for corn and November 22 for sorghum. Participants were not allowed to speculate.

### ***Crop Insurance***

Participants were allowed to select a coverage package from the following options: Revenue Protection (either enterprise or optional units), Revenue Protection with Harvest Price Exclusion (either enterprise or optional units), and Yield Protection (either enterprise or optional units) at the levels of 65, 70, 75, 80, or 85%. These rates were for the university’s farm located at North Platte, NE. Hail and wind coverage options were also available. Indemnity payments were based on the estimated field loss of Lincoln County, Nebraska.

### ***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 plots (farms). The actual physical management such as the operation of machinery, irrigation system, application of chemicals, and harvesting was conducted by the WCREC staff. Participants were allowed to observe, install their own equipment and/or collect additional data from their plots throughout the growing season at their own expense. However, no additional inputs, such as fertilizers, additives, etc., were allowed to be applied to the individual plots.

## **DESCRIPTION OF AWARDS**

Participants in their respective competitions competed for three awards, 1) Most Profitable Farm, 2) Highest Input Use Efficiency, and 3) Greatest Grain Yield. Cash awards of \$2,000, \$1,000, and \$500 (minus penalty) and honorary plaques were presented to both the corn and sorghum competition winners, respectively. Award descriptions are presented below.

1. Most Profitable – included average yield from the plots, marketing decisions, and cost of production (variable and fixed) based on prescribed management decisions.
2. Highest Input Use Efficiency – Water-Nitrogen Intensification Performance Index (WNIPI, Lo et al., 2019)

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

where “control” is a farm managed by UNL that receives no irrigation or N fertilizer (except for 10-34-0 at planting), “ET” is seasonal evapotranspiration, “I” is seasonal irrigation, “N” is total seasonal applied nitrogen, and “ANU” is aboveground nitrogen uptake. The farm with the highest value was determined the winner.

3. Greatest Grain Yield – adjusted by the winner’s percent of total possible profit. Total possible profit was the range of difference between the most and least profitable farms.



Figure 4. Ron Makovicka (York, NE) inspecting his TAPS corn plots on June 27.

## TIMELINE

The 2018 corn and sorghum competitions started with a kick-off meeting on March 13 at WCREC in North Platte, NE, where the rules and regulations of the two competitions were described. Planting occurred on May 1 and May 24 for corn and sorghum, respectively. The crops reached physiological maturity on September 29 and October 10 and were harvested on October 23 and November 14, respectively. There was a formal field tour and barbeque on June 27 where participants were able to visit the field and observe differences among participants’ plots. Figure 4 shows Ron Makovicka inspecting his corn plots. However, participants were allowed to visit their plots anytime throughout the growing season. The primary in-season TAPS event was the West Central Water and Crops Field Day on August 23. The field day centered on the TAPS program and included a program overview, growers panel (Figure 5), and breakout sessions with last year’s winners. The field events



Figure 5. The TAPS Participant Panel at the 2018 West Central Water and Crops Field Day in North Platte, NE, on August 23. Panelists included Jerry Stahr (York, NE), Matt Long (Leoti, KS), Andy Langemeier (Scribner, NE), Sam Radford (NDEQ, Lincoln, NE), Tracy Zink (Indianola, NE), and Tim Schmeeckle (Gothenburg, NE). Facilitator was Amy Kremen, program coordinator for the USDA-NIFA Funded Grant titled “Sustaining agriculture through adaptive management to preserve the Ogallala aquifer under a changing climate”.



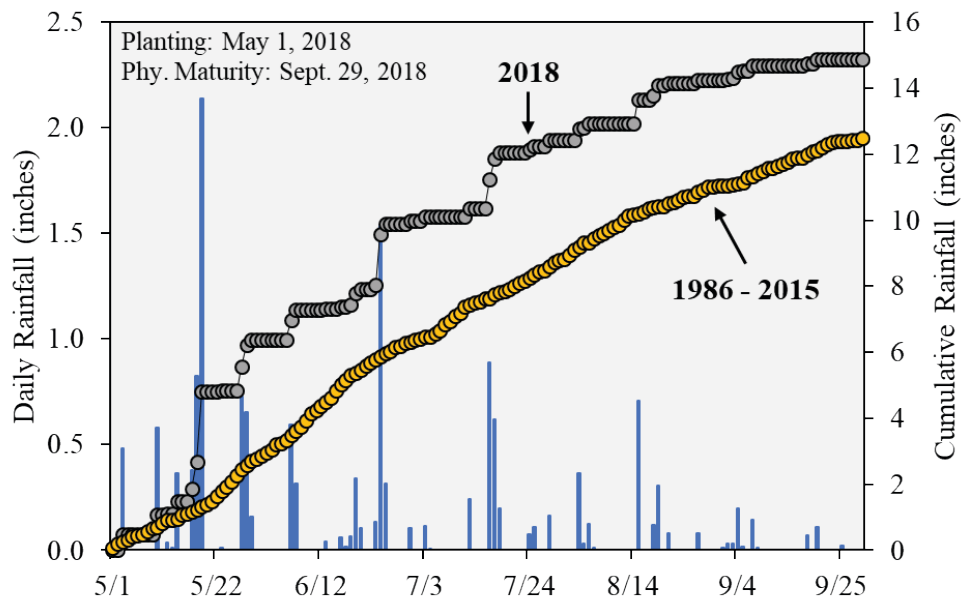


Figure 6. Daily and cumulative rainfall (inches) from corn planting (May 1, 2018) to physiological maturity (September 29, 2018), along with long-term (1986-2015) cumulative precipitation at the field site in North Platte, NE.

provided an opportunity for growers to interact with each other as well as UNL faculty and industry personnel. The competition officially ended on November 15 for corn and November 22 for sorghum, which was the final day for the participants to market their grain.

## MANAGEMENT DECISIONS

### WEATHER CONDITIONS

The TAPS site at WCREC received above normal rainfall in 2018 (Figure 6). The seasonal rainfall from corn planting to physiological maturity (May 1 to Sept. 29) was 14.9 inches, which exceeded the long-term (1986-2015) average rainfall of 12.5 inches (High Plains Regional Climate Center’s Automated Weather Data Network, HPRCC-AWDN; [www.hprcc.unl.edu/awdn](http://www.hprcc.unl.edu/awdn)). There were 53 days with rain of which 66% were below 0.25”, 15% between 0.25” and 0.50”, 15% between 0.50” and 1.0”, and 4% exceeded 1.0”. The growing season experienced mild temperatures with average maximum daily temperature of 75, 84, 85, 84, and 79°F for the months of May, June, July, August, and September.

### CROP INSURANCE

Crop insurance is important for several reasons. First, it can directly affect profitability as it provides loss coverage related to many types of incidents, including market losses and physical destruction of the crop. Second, it provides hedging-like properties so that forward contracting and other mechanisms to make future pricing of yet unproduced grain less risky. Due to the nature of the grain markets, which are both seasonal and cyclical, forward pricing, when used properly, provides a viable option in obtaining higher average annual prices. Therefore, crop insurance can be a critical tool to reduce risk and increase profitability.

All corn competitors purchased crop insurance of some type (Figure 7). Sixteen of the 19 purchased revenue protection (RP) policies, which averaged close to 73% coverage. Half of those that bought RP bought enterprise unit (EU) coverage with an average of 75% coverage at a cost of \$8.83/acre. The other half purchased operational units (OU) with an average cost of \$14.76/acre and 70% coverage. One farm bought RP with a harvest price exclusion or RPHPE for OU at 75% coverage at a cost of \$13.98/acre. The remaining three farms bought yield protection (YP) insurance. Two of these farms had OU coverage with one

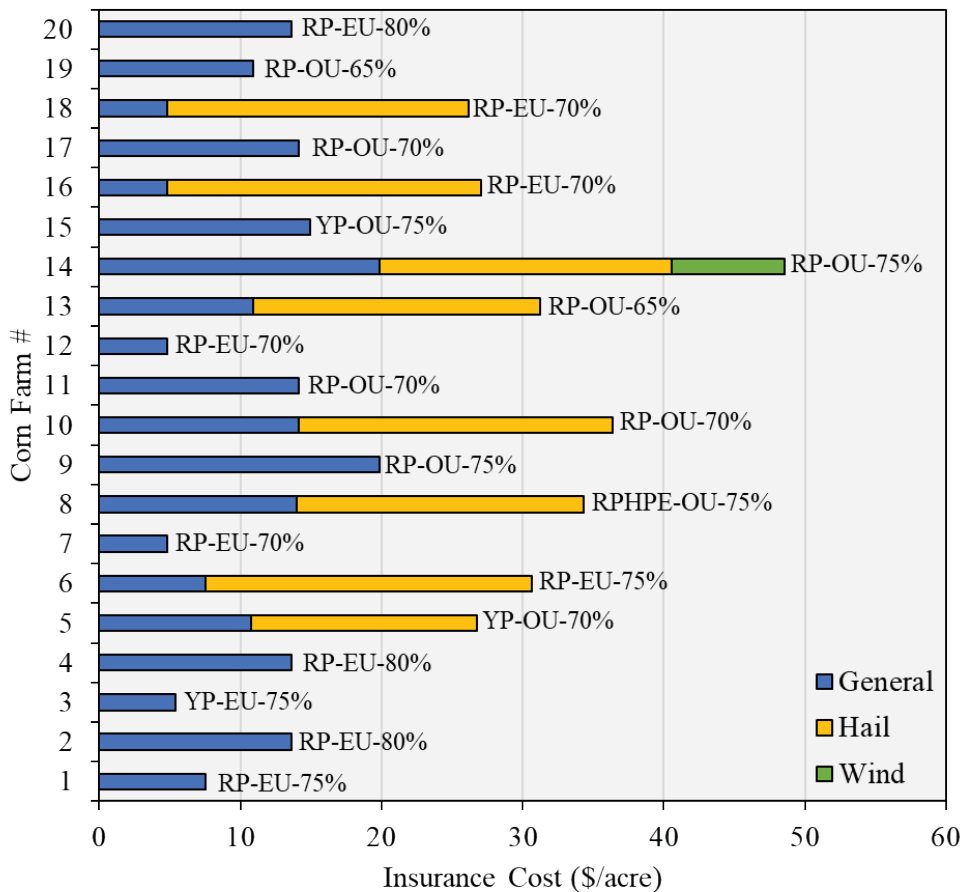


Figure 7. Cost for insurance as well as hail and wind coverage (\$ per acre) for the 20 teams competing in the corn farm management competition. The insurance package and coverage rate is noted next to each team. RP stands for revenue protection, YP for yield protection, EU for enterprise units, OU for operational units, and RPHPE for revenue protection with harvest price exclusion.

at the 70% level of protection and the other at the 75% level, with a cost of \$10.77/acre and \$13.94/acre, respectively. The third farm of YP bought EU crop insurance for \$5.38/acre at a coverage rate of 75%.

In addition to RP and YP insurance, eight of the farms bought hail coverage at varying rates, with one of the eight also pur-

chasing wind insurance. The highest cost for insurance was \$48.54/acre, which included RP-OU-75%, hail and wind. The least costly coverage was a simple RP-EU-70% for \$4.86/acre.

All sorghum competitors purchased revenue protection (RP) crop insurance (Figure 8). Two of the farms purchased operation units

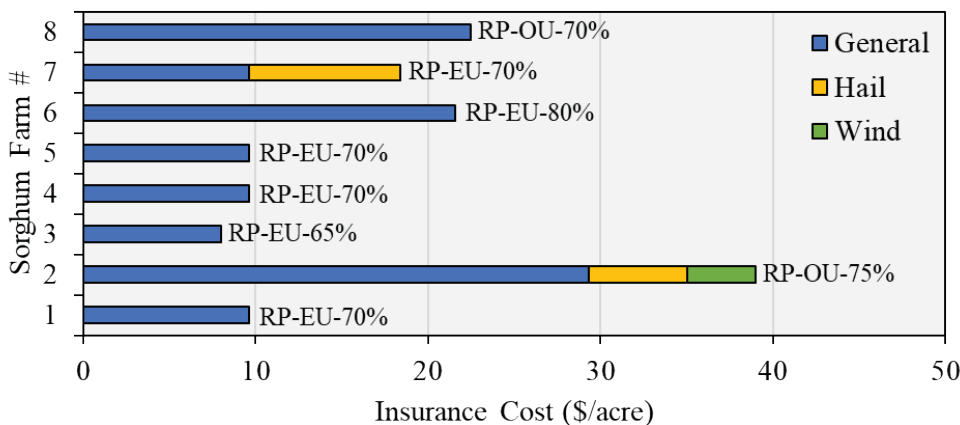


Figure 8. Cost for insurance as well as hail and wind coverage (\$ per acre) for the eight teams competing in the sorghum farm management competition. The insurance package and coverage rate is noted next to each team. RP stands for revenue protection, EU for enterprise units, and OU for operational units.

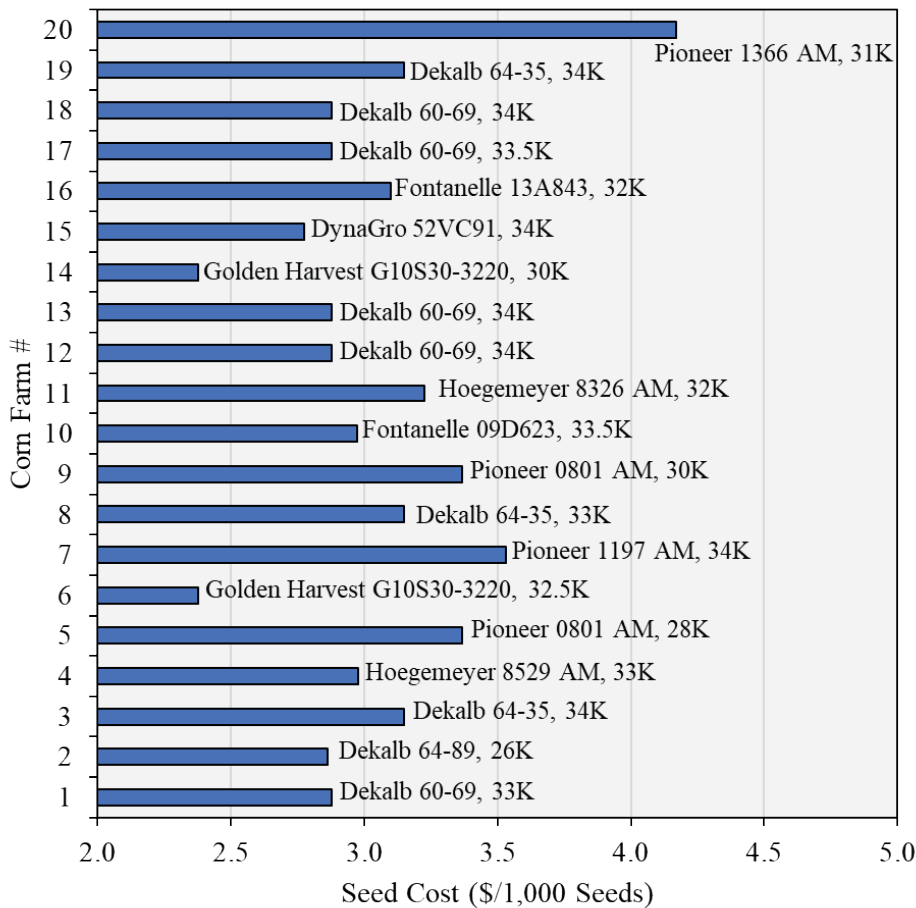


Figure 9. Hybrid selection, cost, and seeding rate in thousands (K) for the corn competition.

(OU) with the remaining buying enterprise units (EU). Those that enlisted RP-OU did so at the 70% or 75% coverage level with costs of \$22.47 and \$29.32/acre, respectively. Those that bought RP-EU purchased policies at the 65, 70, and 80% level with costs of \$7.98, \$9.62, and \$21.54 per acre, respectively.

In addition to crop insurance, two of the farms bought hail coverage, one at a cost of \$8.78/acre and the other at \$5.00/acre. Wind insurance was also purchased by one of those that purchased hail insurance at a cost of \$4.00/acre. The highest cost for insurance was \$39.02/acre, which included RP-OU-75%, hail and wind. The least costly coverage was a simple RP-EU-65% for \$7.98/acre.

### HYBRID SELECTION AND SEEDING RATE

All corn participants with the exception of Farm 20 selected a seed from the

recommended hybrid list provided by various district sale managers (DSMs). Twelve different hybrids were selected (Figure 9). The most common hybrid (Farms 1, 12, 13, 17, and 18) was Dekalb 60-69 RIB, which has a 110-day maturity with an associated cost of \$230.17 per bag or \$2.88 per 1,000 seeds (Figure 9). The range in seed cost varied from \$2.38 (Golden Harvest 10S30-3220) to \$4.17 (Pioneer 1366 AM) per 1,000 seeds with an average cost of \$3.12 per 1,000 seeds. Consequently, the maximum difference in seed cost per acre would be \$46.54 at a seeding rate of 26,000 seeds per acre to \$60.86 at a seeding rate of 34,000 seeds per acre.

The seeding rate per acre selected by the corn teams ranged from 26,000 (Farm 2) to 34,000 (Farms 3, 7, 12, 13, 15, 18, and 19) with a median of 33,000 and average of 32,275. In general, most teams with the exception of Farms 2 and 5 planted above 30,000 seeds per acre. Considering seed cost and seeding rate

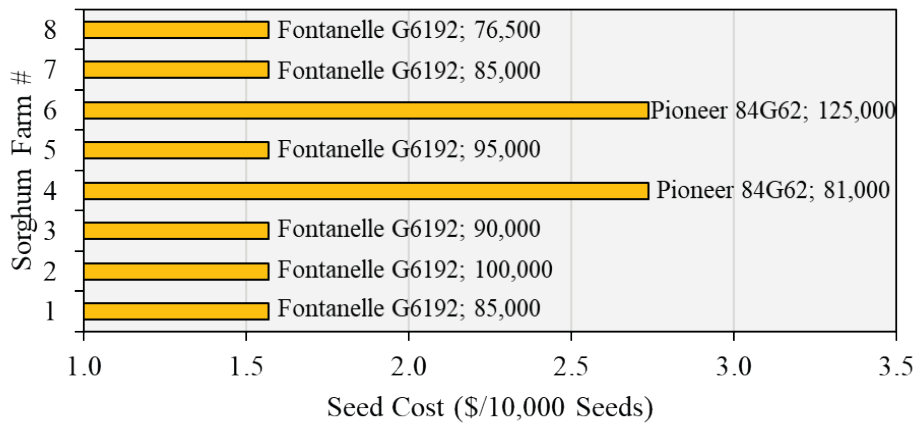


Figure 10. Hybrid selection, cost, and seeding rate for the sorghum competition.

the total seed cost per acre ranged from \$71.25 (Farm 15) to \$129.24 (Farm 20) with an average of \$98.25.

Only two hybrids, Pioneer 84G62 and Fontanelle G6192, were selected among the sorghum teams. Farms 1, 2, 3, 5, 7, and 8 selected Fontanelle G6192 and Farms 4 and 6 selected Pioneer 84G62 (Figure 10). Fontanelle describes this hybrid as having its best performance under intermediate dryland to irrigated conditions. Likewise, Pioneer rates its hybrid as highly suitable under irrigated conditions. Seed cost varied among the two hybrids, with the Fontanelle G6192 having a cost of \$1.57 per 10,000 seeds and Pioneer 84G62 having a cost of \$2.74 per 10,000 seeds. Unlike hybrid selection, there were considerable differences in seeding rate among the sorghum teams. Seeding rate per acre ranged from 76,500 (Farm 8) to 125,000 (Farm 6) with an average of 92,188. Consequently, total seed cost per acre ranged from \$12.00 (Farm 8) to \$34.22 (Farm 6) with an average of \$17.47.

### IRRIGATION SCHEDULING

The irrigation system was initiated on June 14 with corn Farms 1 and 14 scheduling irrigation. It concluded on September 13 when the final irrigations were scheduled by Farms 4 and 9. With the exception of the control farm (Farm 12), the total irrigation applied among the corn teams ranged from 1.05 (Farm 17) to 11.70 inches (Farm 1) with an average

and median of 6.88 and 6.55 inches, respectively (Figure 11). All teams, with the exception of Farm 17, applied irrigation in the second half of June, first half of July, and first half of August. Not considering Farms 12 and 17, on average, 11, 24, 26, and 27% of irrigation was applied during the second half of June, first half of July, second half of July, and first half of August, respectively. Following the first half of August, the management strategy changed as seven teams (Farms 2, 6, 8, 11, 14, 15, and 18) terminated their irrigation and solely relied on stored soil water and precipitation for the remainder of the growing season. Farms 3, 5, 13, 16, 19, and 20 terminated their irrigation in the second half of August, and Farms 1, 4, 7, 9, and 10 continued to irrigate into September. As expected, most teams concentrated their irrigation around the critical growth period from tasseling to blister, which occurred from the middle to the end of July.

Following the procedure outlined in Lo et al., (2019) the optimal estimated range of seasonal irrigation requirement to achieve maximum yield was between 7.5 and 8.0 inches. The optimal upper range was estimated using a model that was calibrated from the 2017 TAPS evapotranspiration data generated from a LI-COR eddy covariance station; whereas the lower range was based on maximum yield response of Pioneer 1197 (coincidentally the highest yielding hybrid in the 2018 corn TAPS competition) in an adjacent field at WCREC in 2018. Understanding that maximum yield

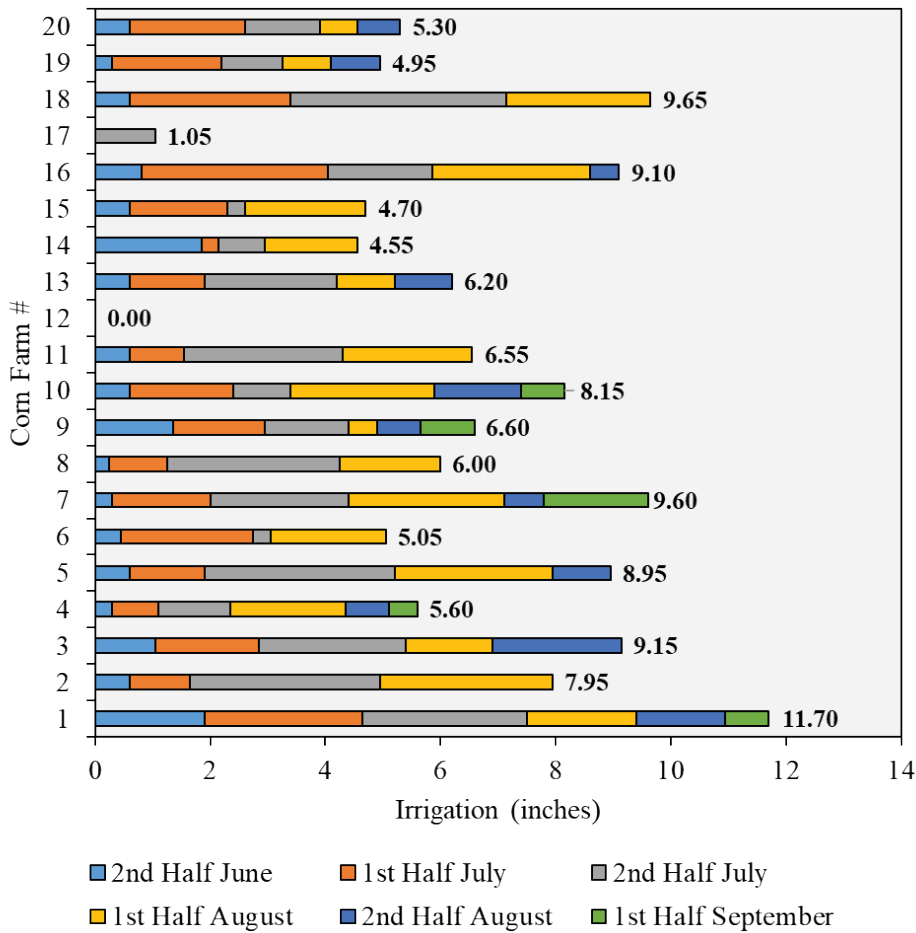


Figure 11. Cumulative irrigation (inches) for half months for the individual corn farms.

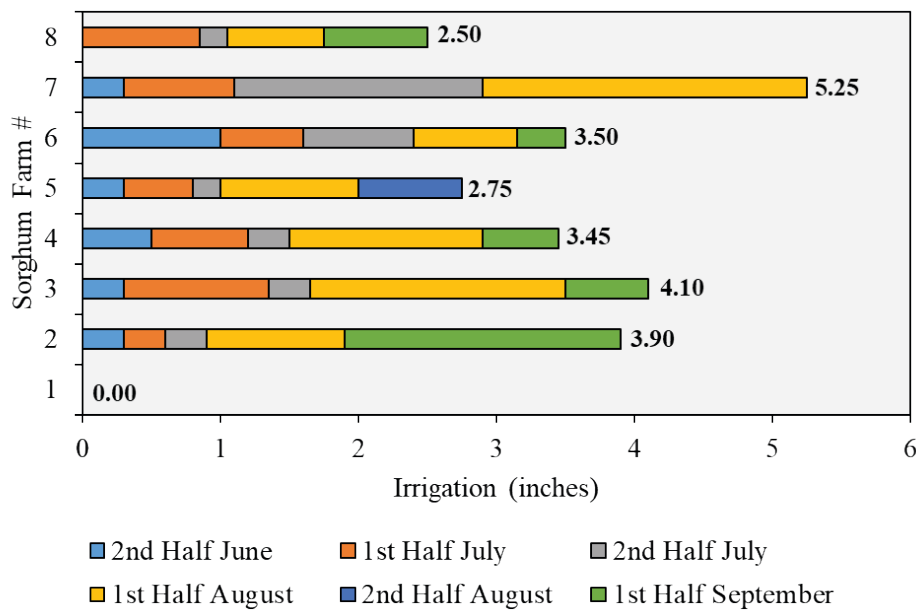


Figure 12. Cumulative irrigation (inches) for half months for the individual sorghum farms.

does not necessarily translate into maximum profit and that different hybrids may have different yield responses to irrigation, it is difficult to evaluate the economic outcome when irrigation is applied below the suggested range. However, the suggested range provides a good indication of the upper bound of water requirement. With that in mind, seven teams (Farms 1, 3, 5, 7, 10, 16, and 18) exceeded and 11 teams (Farms 4, 6, 8, 9, 11, 13, 14, 15, 17, 19 and 20) were below the estimated irrigation range.

Similar to corn, the sorghum irrigation season was initiated on June 14 with a scheduled irrigation event by Farm 6. It concluded on September 13 with irrigation applied by Farms 2 and 3. With the exception of the control farm (Farm 1) seasonal irrigation amounts ranged from 2.50 (Farm 8) to 5.25 inches (Farm 7). See Figure 12. Farm 8 was the most conservative in its irrigation scheduling and did not initiate irrigation until fertigation on

July 12. In contrast, Farm 7 was more aggressive with irrigation scheduling and applied more irrigation in the second half of July and first half of August compared to the other farms, but terminated irrigation on August 13.

### NITROGEN APPLICATION

The amount and distribution of nitrogen fertilizer prescribed by the corn participant teams are shown in Figure 13. The total seasonal nitrogen fertilizer, not including the control farm (Farm 12), ranged from 130 lb/acre (Farm 17) to 225 lb/acre (Farm 9). All teams opted to split apply their nitrogen fertilizer by applying a portion via fertigation (Figure 13). Total fertigation accounted for 23% (Farm 17) to 86% (Farm 13) of the total nitrogen applied. Four fertigation options were available to the participants. Seven teams opted to fertigate each time. Eight teams fertigated only three times. The most

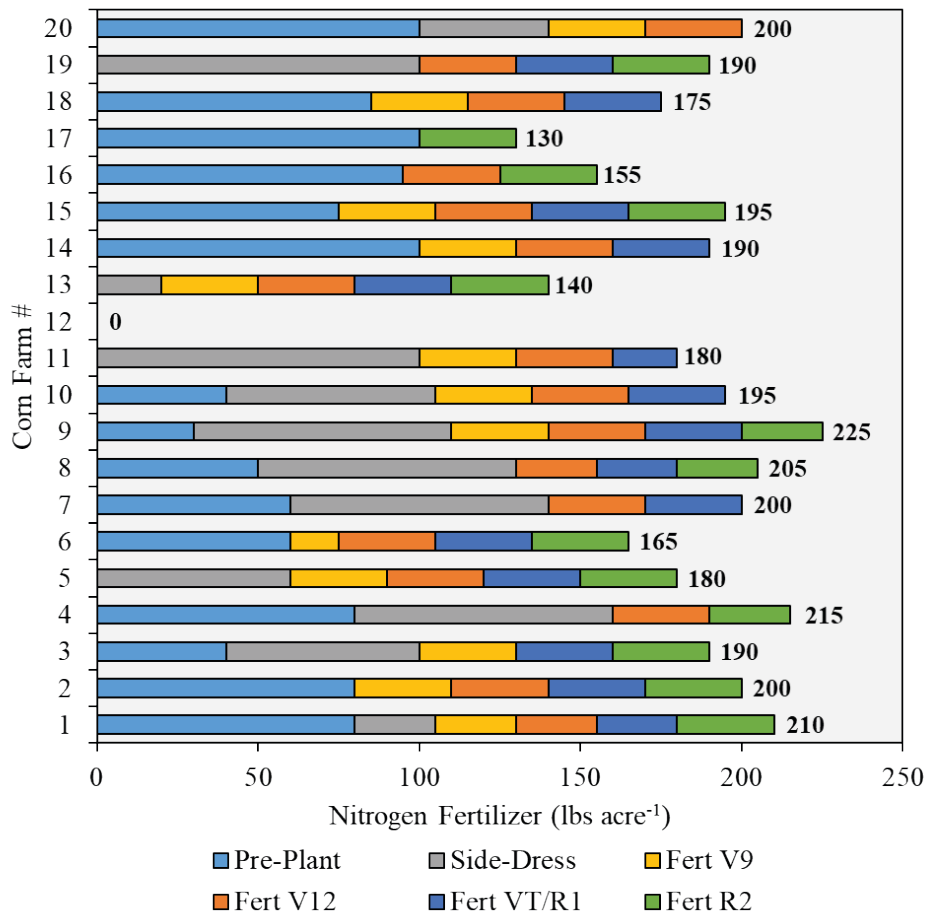


Figure 13. Nitrogen application method and amount (pounds per acre) for the individual corn farms.

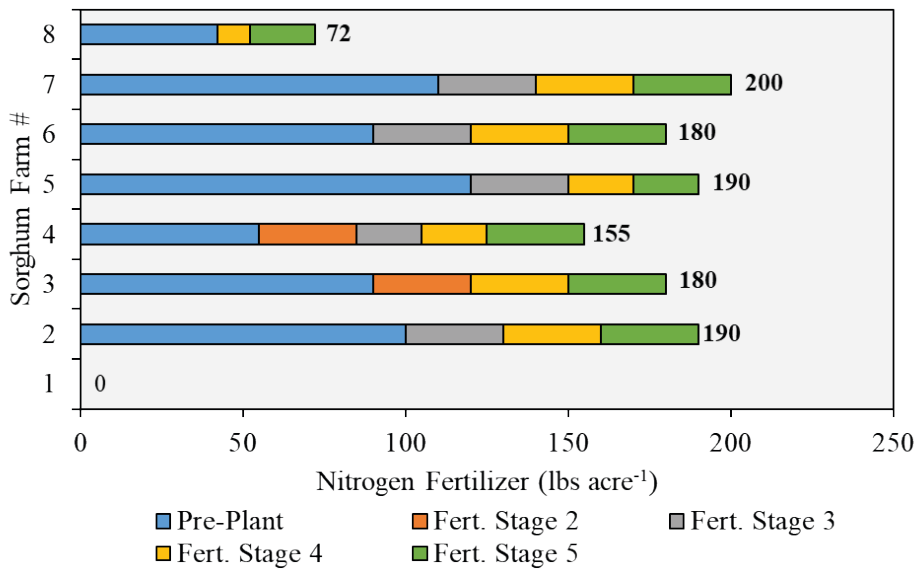


Figure 14. Nitrogen application method and amount (pounds per acre) for the individual sorghum farms.

commonly fertigated growth stage was V12, where all teams fertigated except for Farms 3, 12, and 17. Not all teams opted to apply their nitrogen as preplant or side-dress. Farms 5, 11, 13, and 19 did not apply preplant nitrogen and Farms 2, 6, 14, 15, 16, 17, and 18 did not apply side-dress nitrogen. Preplant accounted for 0 to 77% (Farm 17) and side-dress accounted for 0 to 56% (Farm 11) of the total nitrogen fertilizer. Interestingly, eight teams (Farms 1, 3, 4, 7, 8, 9, 10, and 20) applied nitrogen via preplant, side-dress, and fertigation, and therefore, incurred the highest application cost.

Similar to the irrigation section, a suggested upper limit for total nitrogen fertilizer was estimated using the UNL nitrogen algorithm (Shapiro et al., 2008). Prior to planting, the nitrogen algorithm was run with the following information: soybean credit of 45 lb/ac, nitrogen fertilizer cost of \$0.32 per lb, corn price of \$3.20 per bushel and yield goal of 235 bu/acre. The resulting recommended nitrogen application amount was 175 lb/acre. However, the recommendation made by Ward Laboratories was 200 lb/acre due to a lower soybean credit of 40 lb/ac and a yield goal of 260 bu/ac, which was closer to last year's TAPS winner. Assuming those two recommendations serve as the lower and upper bounds, four teams were below (Farms 6, 13, 16, and 17), four teams above (Farms 1, 4, 8, and 9), and

the remaining within.

The amount and distribution of nitrogen fertilizer applied to the sorghum farms is shown in Figure 14. The sorghum participants had the option to apply nitrogen as preplant and/or fertigation. All teams opted to apply nitrogen using both methods; however, one farm (Farm 8) fertigated only two times, one farm (Farm 4) fertigated four times, and the rest fertigated three times. All farms opted to fertigate at growth stages 4 and 5, whereas only Farms 3 and 4 fertigated at growth stage 2. Preplant nitrogen was applied eight days prior to planting and contributed between 35% and 63% of the total prescribed nitrogen.

## MARKETING

Corn prices hit the high water mark in late spring, May of this year, 2018. Producers who forward contracted and used other pricing mechanisms early were able to take advantage of the market and secure higher prices than those who waited. The final pricing point for the contest was \$3.26 plus a \$0.01 payment from the government due to the tariff situation. Figure 15 shows each of the average prices by farm. Farm 13 was able to capture \$0.34 a bushel over the base price for its 772,845 bushels of production, netting an added value of \$262,767.30. Twenty percent of the farms (five of the twenty) did no mar-

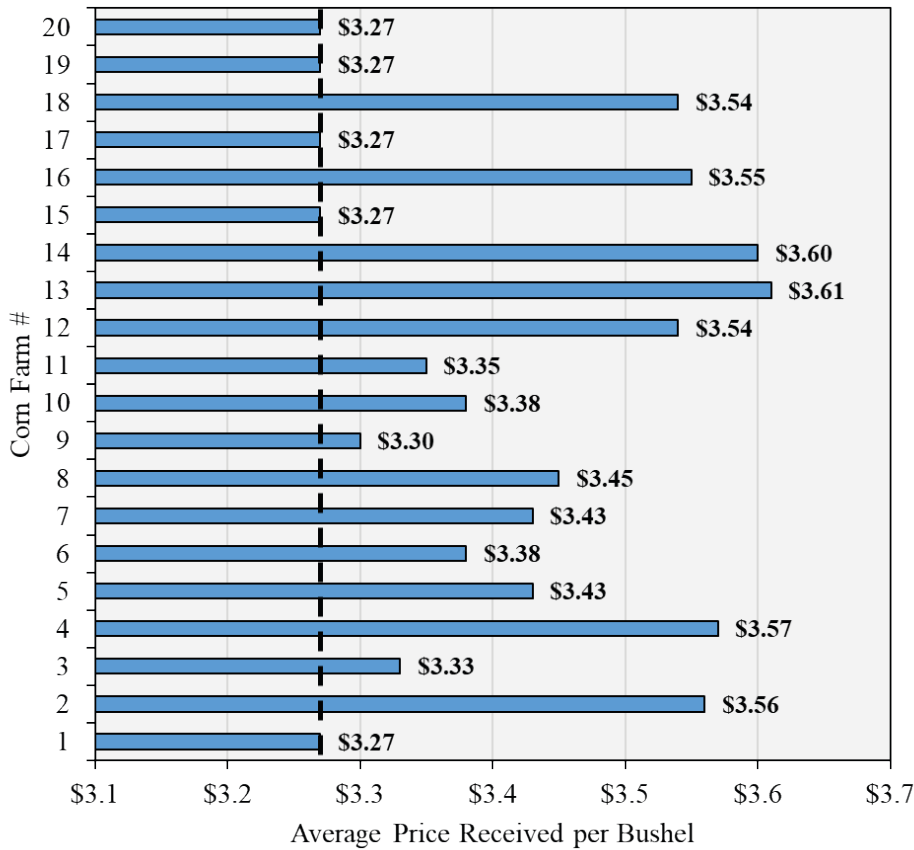


Figure 15. Average price received per bushel for the corn farm teams. The black dashed line represents the base price if grain was sold at market close value of \$3.27 per bushel.

keting other than selling at harvest, the \$3.27 base price. The best that any of these base-priced farms could generate revenue was sixth highest, which was due to high yields relative to many of the other farms. The top revenue generating team grossed \$989.32 per acre while the sixth highest revenue farm grossed \$908.94 per acre, a difference of more than \$80.00 per acre.

Grain sorghum prices followed a pattern similar to corn and five of the eight teams were able to capture some of the early year prices. However, two of the farms did not premarket any grain and received only the base price of \$3.33. Farm 4 did the best in capturing the most value per bushel, making on average \$0.56 a bushel above the base price. This difference amounted to an addi-

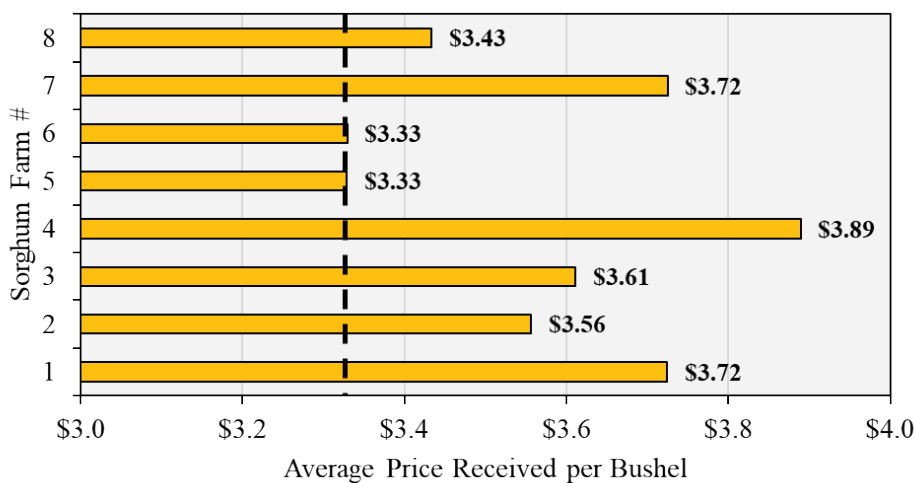


Figure 16. Average price received per bushel for the sorghum farm teams. The black dashed line represents the base price if grain was sold at market close value of \$3.33 per bushel.



tional \$100,268 for its 179,050 bushels of grain sorghum produced. Each of the farm's average market price per bushel is illustrated in Figure 16. The farm with the greatest revenue had a per acre revenue of \$696.64, while the farm with the greatest revenue using the base price was \$607.23, nearly \$90.00 per acre less, or netting nearly \$90,000 more in revenue.

acre was grown with Hybrid Pioneer 1197 AM planted at a population of 34,000 seeds per acre, and belongs to the Perkins Group, Farm 7. Team members of the Perkins group include Ted Tietjen, Shawn Turner, Ron Hagan, Rick Salsman, Bruce Young, Jim Kemling, Troy Kemling, Curt Richmond, Bill Richmond, and Brent Gloy. Congratulations Perkins group!

## RESULTS AND DISCUSSION

### CORN COMPETITION

#### *Greatest Grain Yield*

Individual corn farm grain yields ranged from 137.6 (control Farm 12) to 288.5 bu/acre (Farm 7) with an average of 258.1 bu/acre, not including the control farm. Favorable growing conditions allowed for high-yielding corn. All farms with the exception of Farms 12 and 17 exceeded the field's APH of 225 bu/acre (Figure 17). The maximum yield of 288.5 bu/

#### *Highest Input Use Efficiency*

Input use efficiency was quantified using the Water × Nitrogen Intensification Performance Index (WNIPI), which evaluates each farm relative to the control farm (Farm 12) that received no irrigation or nitrogen fertilizer. The WNIPI promotes effective irrigation and nitrogen management without sacrificing production and profitability. The WNIPI essentially evaluates the increase in yield above the control farm's, relative to the increase in inputs above the control farm's water use

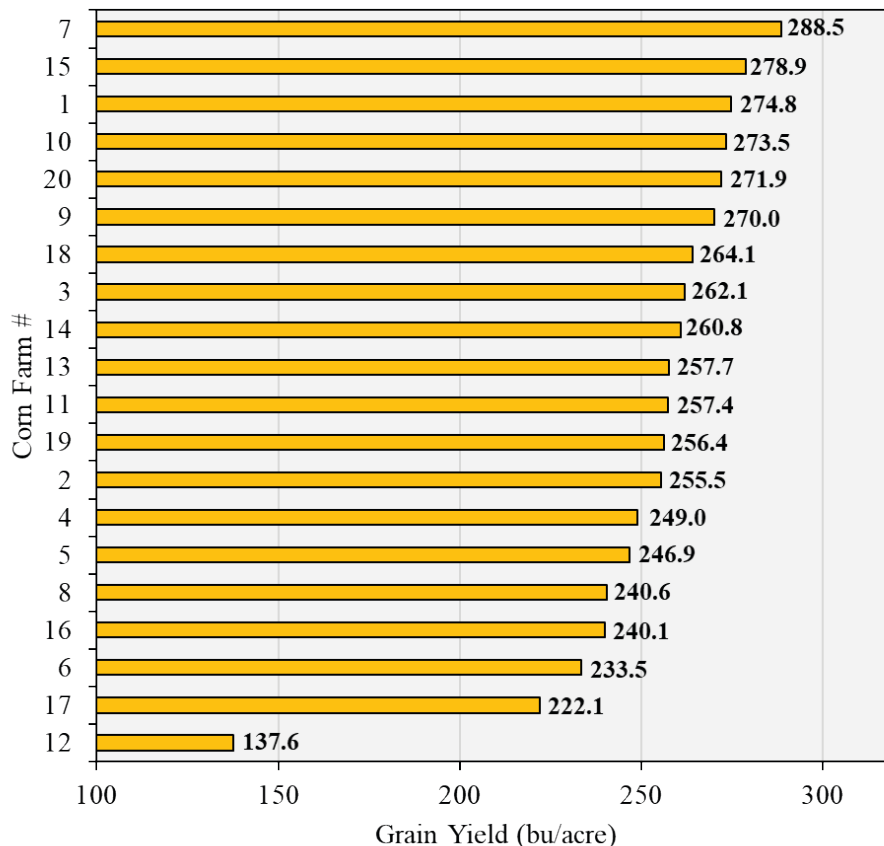


Figure 17. Grain yield (bu/acre) adjusted to 15.5% moisture content for the individual corn farms.

(evapotranspiration, ET) and aboveground nitrogen uptake. A higher WNIPI value indicates higher efficiency and a lower value indicates lower efficiency. 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.

The WNIPI values (and their ranking) for the individual corn farms are presented in Table 1, along with seasonal irrigation, nitrogen fertilizer, and grain yield. The WNIPI values ranged from 0.178 (Farm 8) to 0.267 (Farm 15) with an average and median of 0.215 and 0.211, respectively. The WNIPI values are displayed relative to grain yield, irrigation,

and nitrogen fertilizer in Figure 18. As can be seen, there is scatter in the WNIPI data relative to yield and inputs, which is somewhat expected as the index accounts for the interacting effects of inputs on yield. A few general observations: WNIPI tended to increase with increasing yield response and penalized higher applications of inputs due to the reduction of yield increase relative to input. As a reference, the UNL extension educator team, Farm 18, is shown in Figure 18. This team followed the UNL nitrogen algorithm and triggered its irrigation using the AquaSpy soil moisture probe. Consequently, they ranked 10th in efficiency with a WNIPI value of 0.211.

Farm #	Irrigation (inches)	Nitrogen (lb/ac)	Grain Yield (bu/ac)	WNIPI (unitless)	Efficiency Ranking
-----Corn Competition -----					
1	11.70	210	274.8	0.188	16
2	7.95	200	255.5	0.191	14
3	9.15	190	262.1	0.200	12
4	5.60	215	249.0	0.189	15
5	8.95	180	246.9	0.183	18
6	5.05	165	233.5	0.199	13
7	9.60	200	288.5	0.230	6
8	6.00	205	240.6	0.178	19
9	6.60	225	270.0	0.209	11
10	8.15	195	273.5	0.223	8
11	6.55	180	257.4	0.221	9
12	0.00	0	137.6	-	-
13	6.20	140	257.7	0.263	2
14	4.55	190	260.8	0.238	5
15	4.70	195	278.9	0.267	1
16	9.10	155	240.1	0.188	17
17	1.05	130	222.1	0.245	3
18	9.65	175	264.1	0.211	10
19	4.95	190	256.4	0.226	7
20	5.30	200	271.9	0.243	4

Table 1. Seasonal irrigation (inches), nitrogen fertilizer (lb/acre), grain yield (bu/acre) adjusted to 15.5% moisture content, Water × Nitrogen Intensification Performance Index (WNIPI), and final efficiency ranking for the individual corn farms.

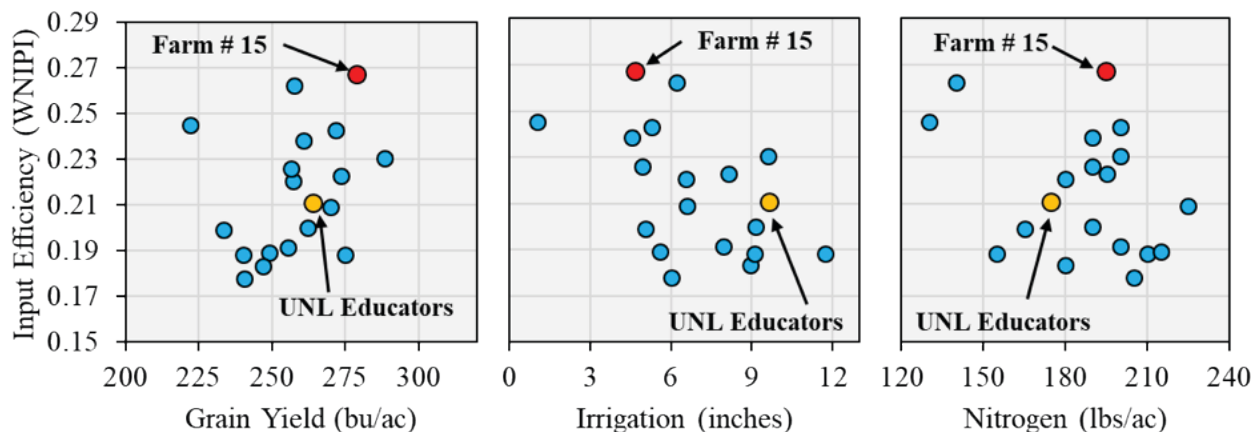


Figure 18. Input use efficiency (Water  $\times$  Nitrogen Intensification Performance Index) of the corn farms compared against grain yield (bu/acre), irrigation (inches), and nitrogen fertilizer (lb/acre). The most efficient farm (Farm 15) is highlighted in red and the UNL extension educator team (Farm 18) is highlighted in yellow.

The highest WNPI value and winner of the input use efficiency award was Tim Schmeckle, Farm 15. Tim planted DynaGro 52VC91 at a seeding rate of 34,000 per acre. His irrigation amount of 4.70 inches fell below the irrigation requirement range for maximum production and his nitrogen amount of 195 lb/acre was between the UNL nitrogen algorithm and Ward Laboratory recommendations. Although irrigation was below the estimated irrigation range, it had minor effect on yield response as his farm yielded the second highest with 278.9 bushels per acre. With the exception of fertigation, Tim did not initiate irrigation until July 9 and concentrated most of his water in mid-July and early to mid-August. His nitrogen management consisted of applying a base rate of 75 lb/acre as preplant and then fertigating 30 lb/acre at V9, V12, VT, and R2. Congratulations to Tim Schmeckle, winner of highest input use efficiency two years in a row.

### ***Most Profitable Farm***

Farm profitability ranged from a positive \$279.61 to \$134.42 per acre (Figure 19). All 19 competing teams showed a net profit. The magnitude of this number was marginally affected by the federal government's marketing compensation program. This compensation was set at \$0.01 per bushel, which amount-

ed to approximately \$2.58 per acre for Farm 13, the winning team, which had a profit of \$279.61 per acre. The next most profitable competitor, Farm 7, had only about \$1.86 per acre less in profit. While Farm 7 had superior yields with 288.4 bushels per acre versus Farm 13's 257.6 bushels per acre and lower costs of about \$0.05 per bushel, it was the \$0.18 per bushel average market value that pushed Farm 13, NDEQ, to win. Congratulations team NDEQ!

The most profitable farm didn't have the highest yield nor the lowest costs, but it did have respectable yields, costs in the lower ranges, and the highest average market value, compared to its competitors. Farm 15 did have the lowest per bushel costs and better yields than the winner, but it marketed its whole crop at the base price and therefore was unable to capture the win. The base price was \$3.27 per bushel, which resulted in this team only rising to third place. If Farm 15 had been able to increase average market price by \$0.064 (six point four cents) it would have been the most profitable. For this farm, that would have meant achieving an average market price of just over \$3.33, which seems quite doable given the results. Much like last year's outcome, the balance in cost control, productivity, and marketing brings about the best results.

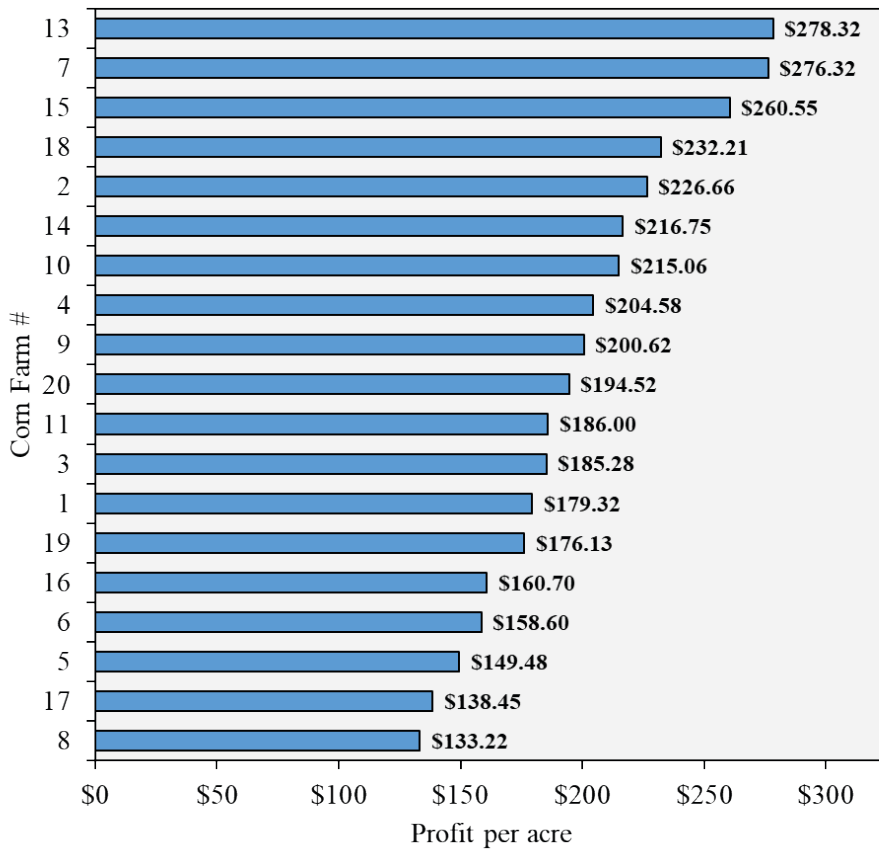


Figure 19. Profitability (\$ per acre) for individual corn farms ranked from highest to lowest.

## SORGHUM COMPETITION

### *Greatest Grain Yield*

Yields from the sorghum farms ranged from 117.2 (control Farm 1) to 182.4 bu/acre (Farm 6) with an average of 171 bu/acre, not

including the control farm (Figure 20). The two highest yielding teams were Farms 4 and 6, both of which planted Pioneer 84G62. Slater Chandler, Farm 6, had the greatest yield with 3.5 inches of irrigation, 180 lb/acre of nitrogen, and a seeding rate of 125,000. Congratulations Slater Chandler!

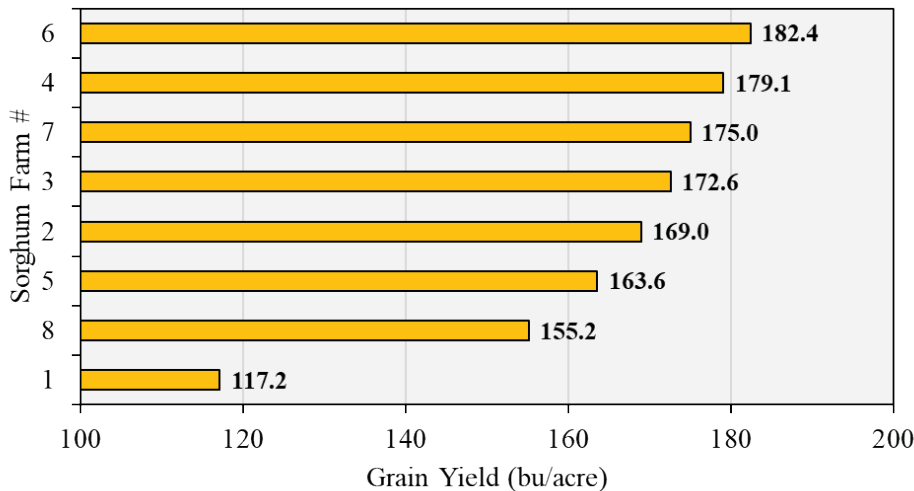


Figure 20. Grain yield (bu/acre) adjusted to 14% moisture content for the individual sorghum farms.

Farm #	Irrigation (inches)	Nitrogen (lb/ac)	Grain Yield (bu/ac)	WNIPI (unitless)	Efficiency Ranking
1	0.00	0	117.2	-	-
2	3.90	190	169.0	0.098	6
3	4.10	180	172.6	0.108	4
4	3.45	155	179.1	0.139	2
5	2.75	190	163.6	0.094	7
6	3.50	180	182.4	0.131	3
7	5.25	200	175.0	0.099	5
8	2.50	72	155.2	0.141	1

Table 2. Seasonal irrigation (inches), nitrogen fertilizer (lb/acre), grain yield (bu/acre) adjusted to 14% moisture content, Water × Nitrogen Intensification Performance Index (WNIPI), and final efficiency ranking for the individual sorghum farms.

### Highest Input Use Efficiency

The WNIPI values (and their ranking) for the individual sorghum farms are presented in Table 2, along with seasonal irrigation, nitrogen fertilizer, and grain yield. The WNIPI values relative to grain yield, irrigation, and nitrogen fertilizer are illustrated in Figure 21. The most efficient team, Farm 8, and the UNL extension educator team, Farm 7, are highlighted in Figure 21. The sorghum WNIPI values ranged from 0.094 (Farm 5) to 0.141 (Farm 8) with an average value of 0.101. The most efficiency in sorghum award goes to Tracy Zink, Farm 8. Tracy went with a low input produc-

tion approach by applying a seasonal total of 2.5 inches of irrigation, 72 lb/acre of nitrogen fertilizer, and planting Fontanelle G6192 at a seeding rate of 76,500. Although Tracy had a lower yield, her efficiency was greatest of the competing teams due to the increase in yield above the control farm, relative to the inputs applied. Another noteworthy team was Farm 4, which had the second highest efficiency with a WNIPI value of 0.139. Farm 4 had higher inputs with 3.45 inches of irrigation, 155 lb/acre of nitrogen, and 81,000 seeds per acre; however, it had a similar percent increase in grain yield above the control farm, relative to

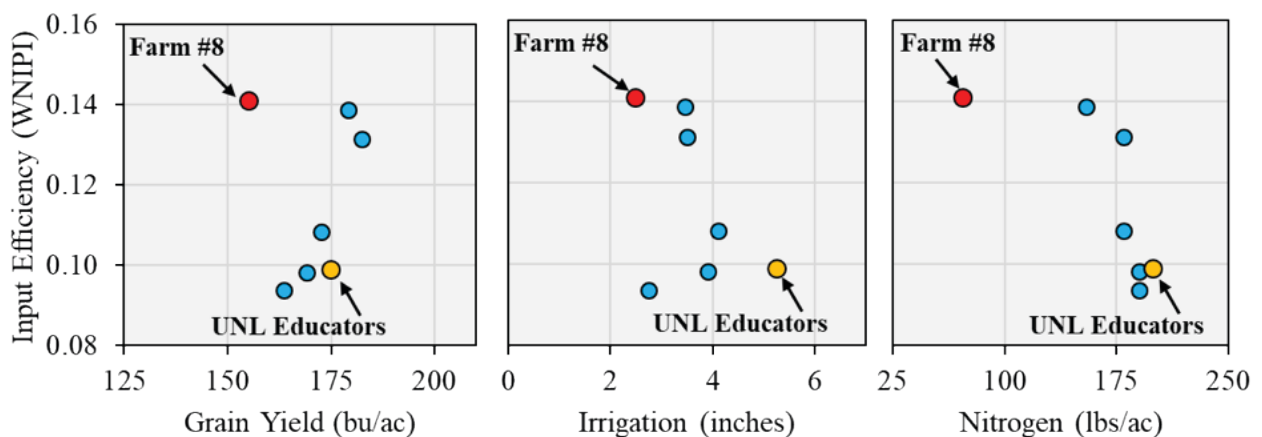


Figure 21. Input use efficiency (Water × Nitrogen Intensification Performance Index) of the sorghum farms compared against grain yield (bu/acre), irrigation (inches), and nitrogen fertilizer (lb/acre). The most efficient farm (Farm 8) is highlighted in red and the UNL extension educator team (Farm 7) is highlighted in yellow.

the increase in inputs. One contributor to this increase was that the Pioneer 84G62 hybrid had a higher yield response to irrigation than the Fontanelle G6192 hybrid. Congratulations Tracy Zink!

### Most Profitable Farm

Farm profitability ranged from a positive \$182.77 to \$117.20 per acre (Figure 22). All eight farms showed a net profit. The magnitude of this number is partly the result of the federal government’s marketing compensation to farmers for the loss in the market due to the current tariff situation. This compensation was set at \$0.46 per bushel, which amounted to \$76.99 per acre for Farm 4. The farm with the greatest compensation was Farm 6 with \$78.41 per acre of compensation. The lowest producing farm, Farm 1, received close to \$50.38 per acre. Farm 4, Brian Ballou, was the most profitable with \$182.77 per acre. The next most profitable competitor, Farm 3, was nearly half as profitable at \$98.69 per acre. This was due to three factors: 1) Lower yields, 2) Lower average market value, and 3) Higher costs. To achieve the same proportional costs of production per bushel Farm 3 would have had to lower costs by more than \$0.27 per bushel, from \$3.04 to \$2.77. Congratulations Brian Ballou!

The most profitable farm was not the highest yielding, but it did have high yield compared to its competitors. Notably, Farm 4 did have the lowest per bushel costs of all the farms, indicating it was the most cost-efficient and effective. However, what really drove profits for the winning team was its superior average marketing price, which exceeded the next best by nearly \$0.28 per bushel. Translated into per acre value, Farm 4 had a \$73.40 per acre advantage in revenue and \$10.68 per acre advantage in reduced costs compared to the next best team, Farm 3.

### Summary

The 2018 TAPS Irrigated Corn and Sorghum Farm Management Competitions provided great insight into various management strategies that can lead to profitable and efficient grain production. In addition, the competitions highlight the challenges associated with accounting for and managing of various inputs. This report serves as a summary of the management decisions made and the resulting outcomes relative to grain yield, input use efficiency of water and nitrogen fertilizer, and farm profitability. Following this report, a more comprehensive report and discussion will be provided about the decisions made along with supporting data generated from technology provided by industry.

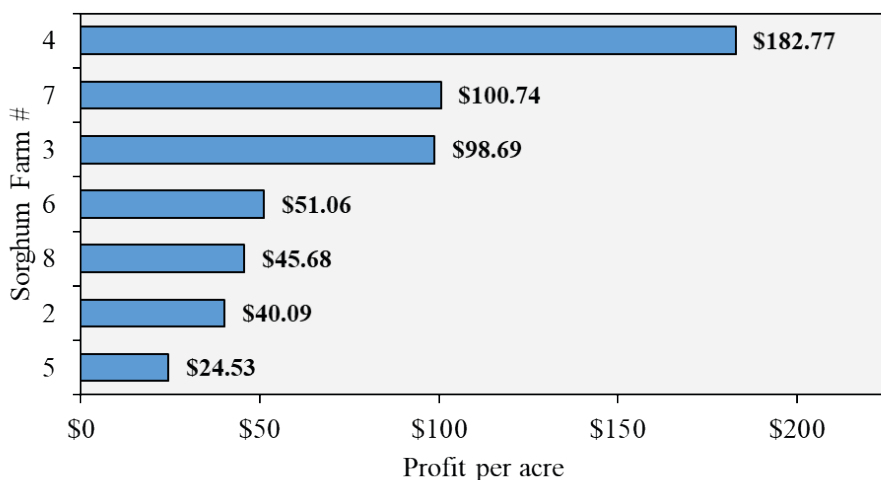
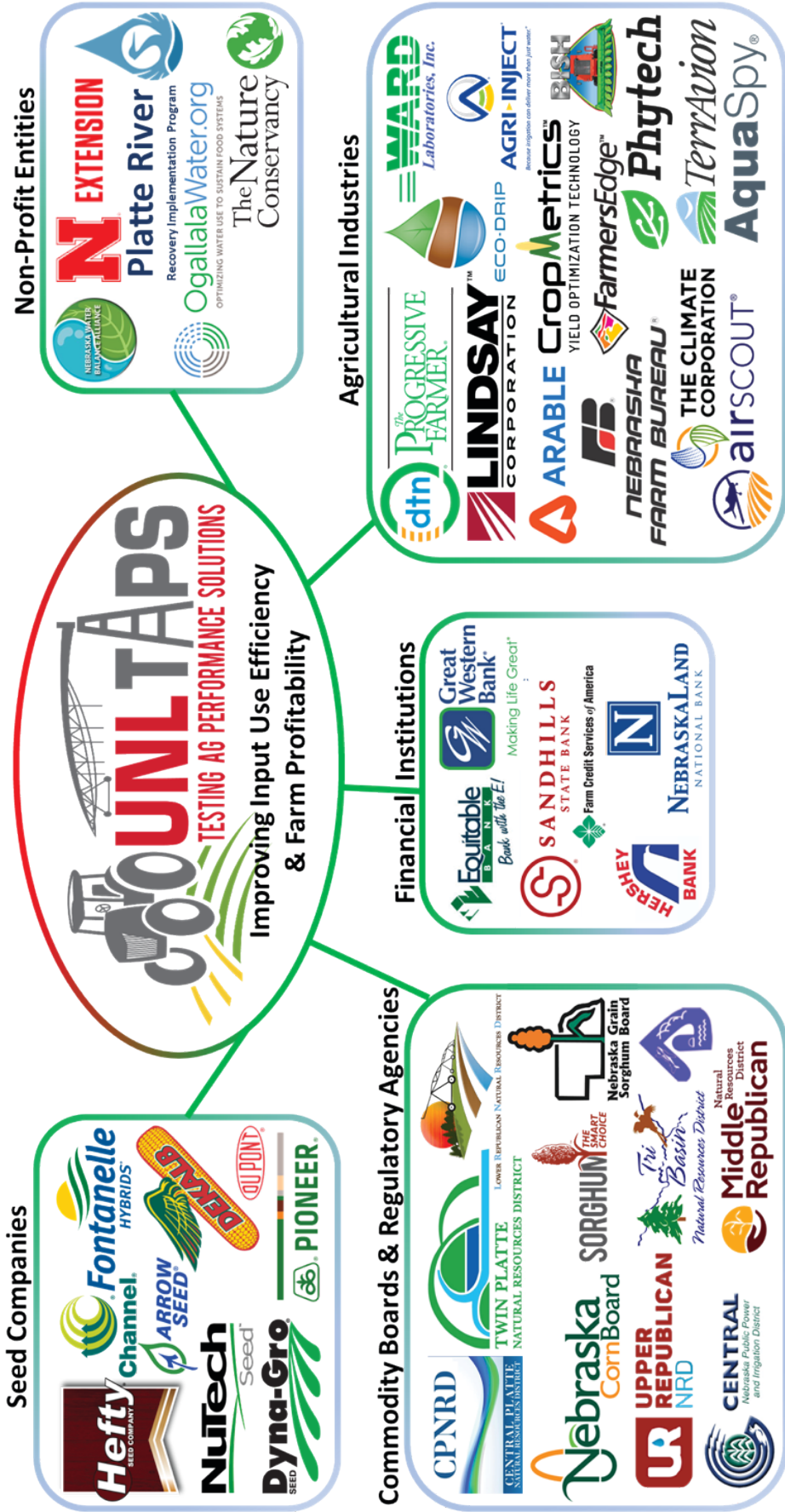


Figure 22. Profitability (\$ per acre) for individual sorghum farms ranked from highest to lowest.

# Thank you 2018 TAPS Partners





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