

## 2017 Farm Management Competition Banquet Report



*"I've really learned a lot by participating in the UNL-TAPS competition. There were a lot of really cool tools at our disposal and we have had the opportunity to see if they can add value to our operation without risk," said Jon Walz*

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**Mission Statement:** "To fully engage agriculturalist, scientist, educators and industry in an innovative endeavor, to TAP into the University of Nebraska's potential to create the environment for all to work together in finding solutions through innovation, entrepreneurialism, technological adoption, improved techniques and methodologies for Nebraska's farm's, farm businesses and farm families to maintain profitability and sustainability and productivity.

## EXECUTIVE SUMMARY

The TAPS education and solutions program was created out of the need to incorporate and engage agricultural research, agricultural technology, industry, and producers in an interactive real world way to increase productivity, sustainability, and profitability. TAPS is an acronym that stands for Testing Ag Performance Solutions. With the many challenges related and faced by agricultural production there is a need for a deeper level of engagement among all the stakeholders. Not surprisingly many entities have contributed in many different ways, to the programs development. The University of Nebraska-Lincoln Research and Extension personnel and facilities act as the common ground and hosts the program. This structure provides the needed oversight and neutrality needed to maintain a healthy objective environment for producers, researchers, and industry suppliers to innovate, test, adopt, learn about and develop new technologies, try new management practices and techniques and make the needed adjustments in the efficient and profitable production of corn.

This is the TAPS inaugural year and as such has been more successful than could have been hoped. The TAPS program is based on a competitive model where participants (individuals and/or groups) compete in the production and marketing of corn. Each team or farm competes for three possible awards, the most prestigious being the most profitable farm, followed by an efficiency for nitrogen and water use award, and finally an award for productivity (highest yield). Competitors make many input and management choices which include, crop insurance selection, planting choices of both population and hybrid, all marketing decisions, irrigation scheduling and quantity, fertilizer timing, amount, and method. Unlike a simple yield contest the management objectives of the contest relate directly to the management and relationship of resource allocation to profitability and sustainability. Competitor's choices are made in an environment where real time information regarding field conditions are available using new and emerging technologies. Opportunities for stakeholders to meet and discuss outcomes, challenges, and to share their experiences are a large part of the contest. Communication, learning, and innovation are enhanced by continuous communication and direct yearlong interaction of all those involved in the program as well as the publication and sharing of the project results and take home lessons which are shared year round.

This program's design has many benefits including; 1) University researchers and extension professionals are in direct completion with farmers under real world conditions, 2) Farmers are able to use new and emerging methods and tools creating innovative opportunities and serve as role models and teachers, and 3) The industry people become observers of technology application and its many interactions leading to further development of technology making all three groups an active part of the innovative and problem solving team.

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*

# PARTICIPANTS

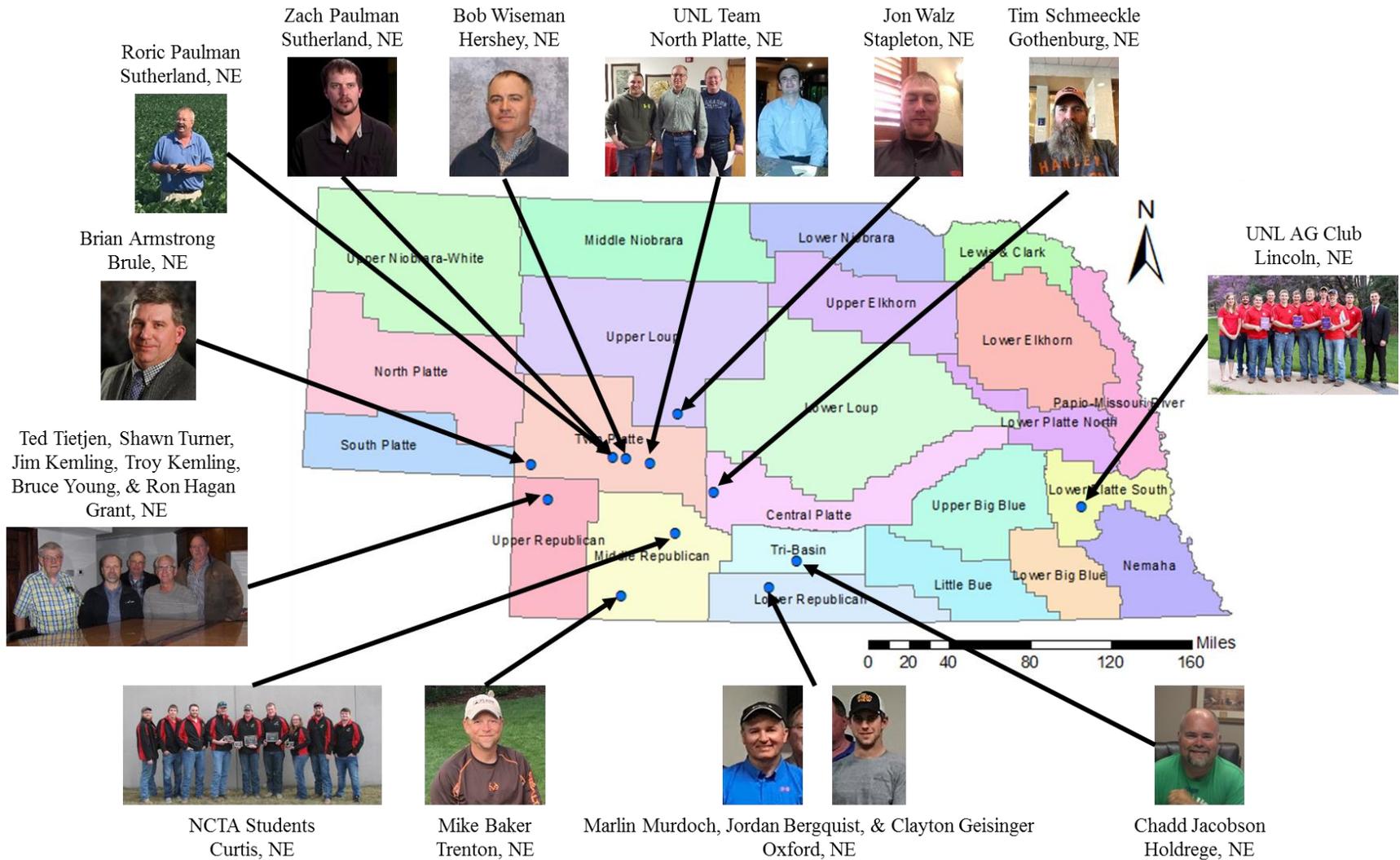


Figure 1. Location of the 2017 UNL TAPS farm management competition contestants, along with their respective Natural Resource District.

## PROGRAM OVERVIEW

The first annual farm management competition was established under a variable rate center pivot at the West Central Research and Extension Center (WCREC) in North Platte, Nebraska. The competition included 15 total teams for 2017. WCREC specialist/educators also competed; however, they were not eligible to win the cash awards. Each “Farm” on paper included 3,000 harvested acres for the purposes of making decisions. The “Farm” decisions made by each team were imposed on 3 randomized plots and the average of the three plots was used for collecting yield data. Participants had control over six parameters:

1. Irrigation management – Amount and timing of application
2. Nitrogen management – Application method (pre-plant, sidedress, & fertigation) and amount
3. Hybrid selection – Provided seed or used default hybrid
4. Seeding rate – Seeds planted per acre
5. Grain marketing – Used various marketing tools to price grain from March-November
6. Crop insurance – Selected yield and/or price protection as well as hail and wind insurance

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 and risk. However, no additional inputs, such as fertilizers, additives, etc. were allowed to be applied to the individual plots.

## DESCRIPTION OF AWARDS

The participants competed for three awards, 1) Most Profitable Farm, 2) Highest Input Use Efficiency, and 3) Greatest Grain Yield. Description of each award is presented below.

1. Most Profitable Farm (\$2,000) – included average yield from the plots, marketing decisions, and cost of production based on the management decisions.
2. Highest Input Use Efficiency (\$1,000)

$$\text{Input Use Efficiency} = \text{Rank} \left[ \frac{(ET_{\text{Farm}} - ET_{\text{C}})}{\text{Irrigation}_{\text{Farm}}} \right] + \text{Rank} \left[ \frac{(GNU_{\text{Farm}} - GNU_{\text{C}})}{\text{Nitrogen Applied}_{\text{Farm}}} \right] + \text{Rank} \left[ \frac{\text{Yield}_{\text{Farm}}}{\text{Yield}_{\text{C}}} \right]$$

where, “C” is a control farm managed by UNL that receives no irrigation or nitrogen fertilizer (except for 10-34-0 at planting), “ET” is evapotranspiration for the individual and control farms, and “GNU” is nitrogen taken up in the grain. With disparity in the range of values observed across the three efficiency components a composite ranking was performed. Each term was ranked from highest to lowest where the highest value received 1 point and the lowest value received 14 points. The final score was comprised by summing up the points for each farm, where the lowest number was deemed the winner.

3. Greatest Grain Yield Award (\$500) – adjusted by the winner’s percent of total possible profit. Total possible profit is the range of difference between the most and least profitable farms.

## TIMELINE

The competition started with a kick-off meeting on March 20<sup>th</sup> at WCREC in North Platte, NE, where the rules and regulations of the competition were described. Field operations began on May 5<sup>th</sup> when pre-plant nitrogen fertilizer was applied using a double coulter nitrogen applicator and concluded with combine harvest on November 2<sup>nd</sup>. Several workshop and field tours were conducted throughout the growing season, including a field tour and industry workshop on June 27<sup>th</sup> and a grower's panel and field tour on August 24<sup>th</sup>. The field events provided an opportunity for growers to interact with each other as well as UNL faculty and industry personnel. The competition officially ended on November 22<sup>nd</sup>, which was the final day for the participants to market their grain. Results and awards were presented at a banquet on December 12<sup>th</sup>.

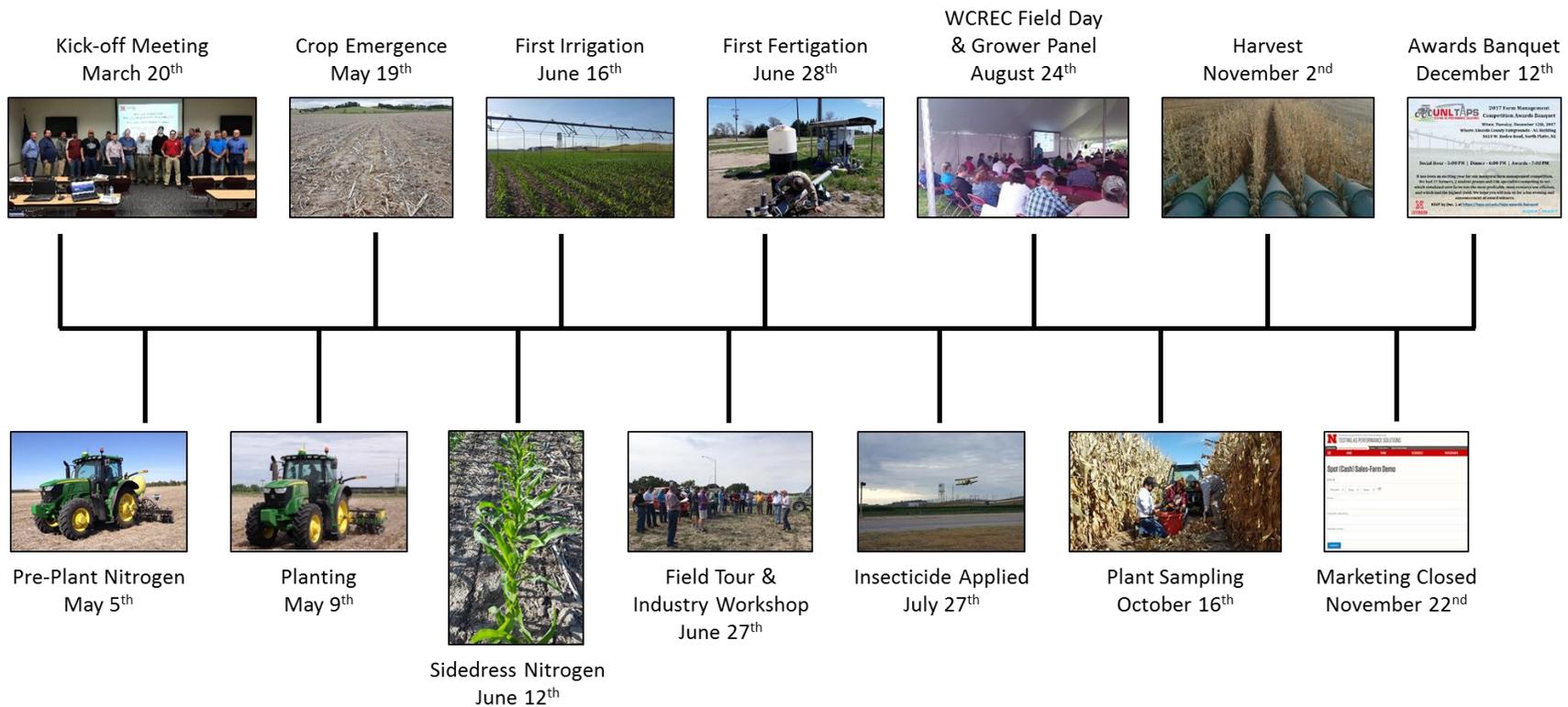
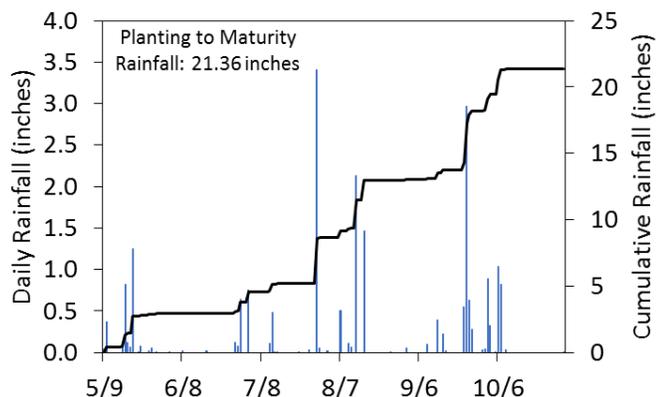


Figure 2. Timeline of events for the 2017 UNL TAPS farm management competition.

## MANAGEMENT DECISIONS

### *Weather Conditions*

The WCREC received ample rainfall in late July/early August and again during late September, but had two extended dry periods with minimal rainfall from May 21 to June 27 and from August 17 to September 22 (Figure 3). The seasonal rainfall from planting to physiological maturity (May 9 to Oct. 10) was 21.36 inches, which exceeded the long-term (1960-2010) average rainfall of 13.3 inches for the same time period (National Weather Service's Cooperative Observer Program (COOP) accessed through the High Plains

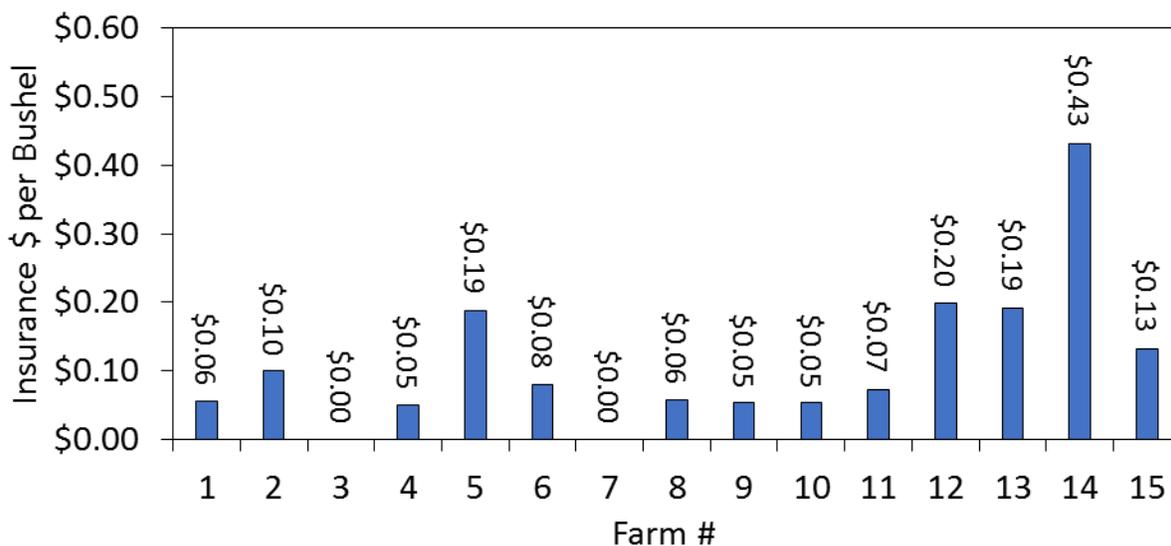


**Figure 3. Daily and cumulative rainfall (inches) from planting (5/9/17) to physiological maturity (10/10/17).**

Regional Climate Center (HPRCC) archive at [www.hprcc.unl.edu](http://www.hprcc.unl.edu)). However, three dates (July 29, August 13, and Sept. 24) had rainfall that exceeded 2 inches per day with a cumulative total of 8.5 inches.

### *Crop Insurance*

Participants were able to choose a revenue or yield insurance plan with either enterprise or optional units with a level of coverage from 65 to 85%. They were also able to select one of fifteen hail plans and its level of coverage as well as wind insurance. To determine indemnity payments we used the report of crop insurance claims for Lincoln County from the Risk Management Agency for 2017. From the reports it was determined that about 1.7% of the corn acres in Lincoln County were hailed at 100% loss. Indemnity payments were calculated accordingly for each farm, and therefore, 35 of the 3,000 acres were indemnified. Figure 4 shows the net cost per bushel of insurance including the value of indemnity. The insurance cost per bushel ranged from 0.00 to 0.43 dollars with an average of 0.11 dollars.



**Figure 4. The cost of crop insurance minus indemnity payment per bushel produced for individual farms.**

## Hybrid Selection and Seeding Rate

The cost of seed has increased dramatically over the years as new traits and trait packages have been developed and marketed to growers. This year 11 hybrids were selected by the participants, including seed from Dyna-Gro, Pioneer, NuTech, Dekalb, Channel, Renk, Fontanelle, and Golden Harvest. Seed cost per bag (i.e., 80,000 seeds) ranged from \$220 to \$294 with an average of \$253. In addition to hybrid selection, seeding rate is also an important management decision as it affects cost of production and can impact grain yield. The bushels of grain produced for every 1,000 seeds planted are show in Figure 5, along with seeding rate for each farm. If you exclude Farm 7, which was the UNL Control farm, the results ranged from 6.57 to 8.50 bushels per acre for 1,000 seeds planted.

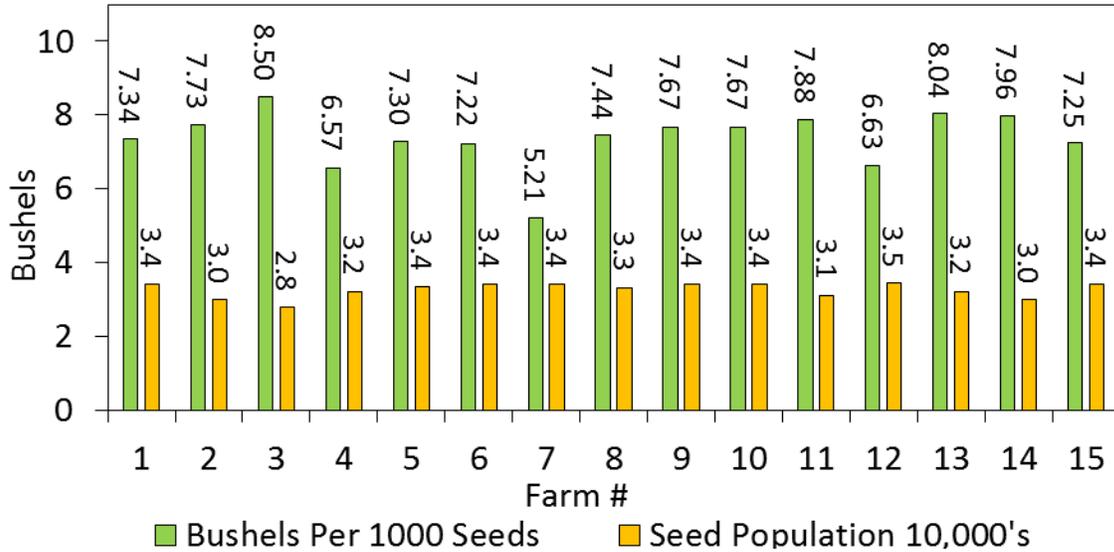


Figure 5. Bushels produced for every 1,000 seeds planted per acre and seeding rate for individual farms.

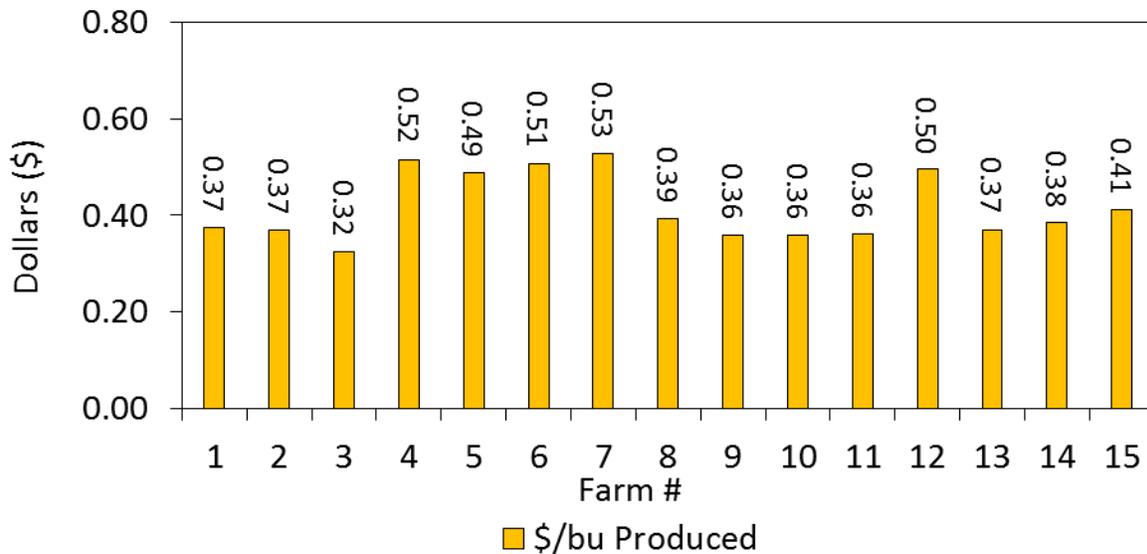
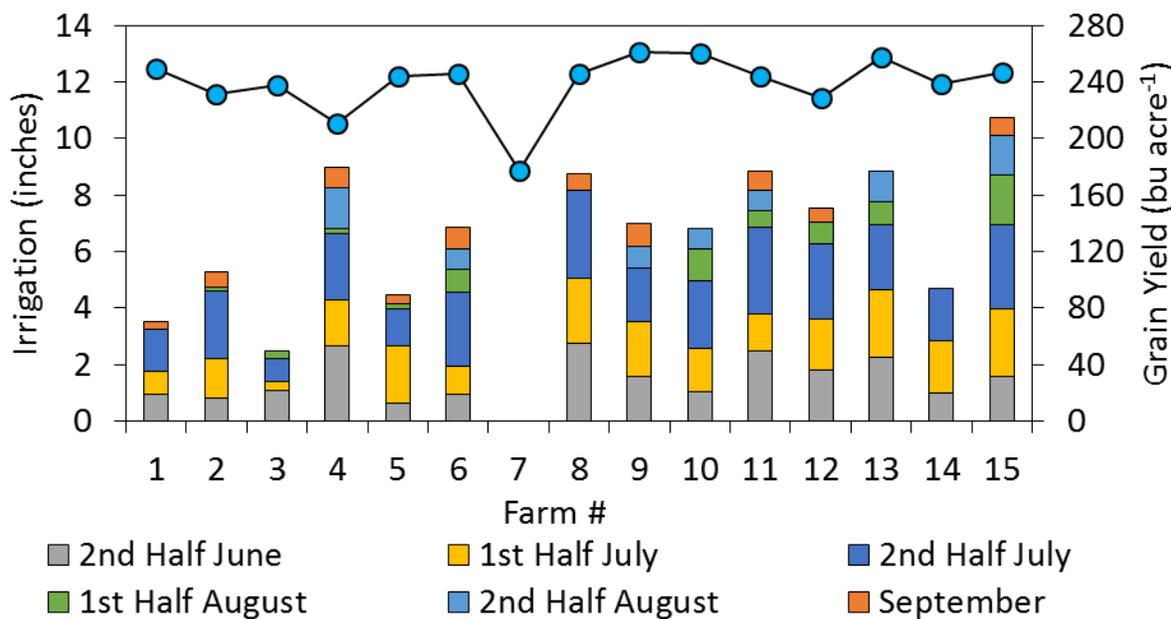


Figure 6. Total cost of seed per bushel of grain produced for individual farms.

Cost of seed per bushel produced is presented in Figure 6. This calculation incorporates the cost of seed, seeding rate, and grain yield. Costs per bushel produced ranged from \$0.32 to \$0.53. The observed difference of over \$0.20 per bushel can make the difference between profit and loss. It is extremely important to work with your seed supplier to determine the correct hybrid and the optimum seeding rate for that hybrid, since most hybrids respond positively to increasing populations up to a certain point. Crop variety testing on a small area before hybrid selection for a larger number of acres is one method to reduce risk and assure hybrid performance.

### ***Irrigation Scheduling***

Participants had the opportunity to apply 0 to 1 inches twice a week during the growing season. Irrigation water was also applied during fertigation operations at a maximum rate of 0.30 inches with 30 pounds of nitrogen. The variable cost to pump an acre-inch of water was \$7.80. Total irrigation applied ranged from 2.50 to 10.75 inches for the season. The majority of the participants applied a significant portion of their water during the month of July (Figure 7) due to limited rainfall during that time (Figure 3) as well as to avoid water stress during critical growth stages of tasseling (VT) and silking (R1). Also, most participants applied little irrigation water during September, which corresponded to the late reproductive period which is less susceptible to water stress. Furthermore, allowing the crop to extract more stored soil water late in the growing season may allow for reduced irrigation pumping.



**Figure 7. Cumulative irrigation (inches) for half months and grain yield (bushels per acre) at 15.5% moisture content for individual farms.**

### ***Nitrogen Application***

Participants had the opportunity to apply nitrogen fertilizer in the form of UAN 32% using three application methods, 1) pre-plant, 2) sidedress, and 3) fertigation. The pre-plant and sidedress applications were performed using a double coulter nitrogen applicator and were administered on May 5 and June 12, respectively (Figure 2). Four fertigation applications options of up to 30 lbs per acre per event were made available to the participants targeting the 9 leaf (V9), 12 leaf (V12), tasseling(VT)/silking (R1), and blister

(R2) growth stages. The range in nitrogen applied was 0 to 140 lbs per acre as pre-plant, 0 to 125 lbs per acre as sidedress, and 30 to 120 lbs per acre as fertigation (Figure 8). Every farm opted to apply a portion of their nitrogen fertilizer as fertigation with the intent to be more efficient by applying nitrogen when the crop needed it most. Five farms opted to apply fertigation at all four growth stages (V9, V12, VT/R1, and R2); whereas, two farms (farms 8 and 11) opted to only apply fertigation at a single growth stage (Figure 9). The range in fertigation applied was from 30 (farm 8) to 120 (farm 3) lbs per acre, which represented 17 and 53% of their total applied nitrogen fertilizer. Leaf tissue samples were collected at V14 growth stage and stalk nitrate samples were collected at physiological maturity (R6) to identify nitrogen sufficiency for each farm. Results of the biomass sampling, along with canopy reflectance data will be processed and shared in the final report.

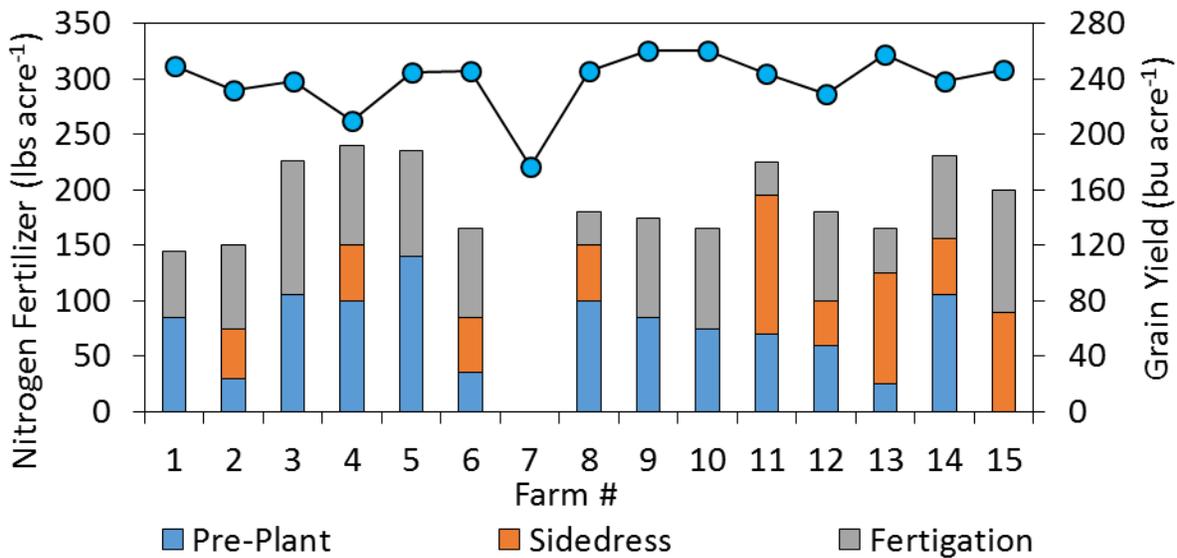


Figure 8. Nitrogen application method and amount (lbs per acre) and grain yield (bushels per acre) at 15.5% moisture content for individual farms.

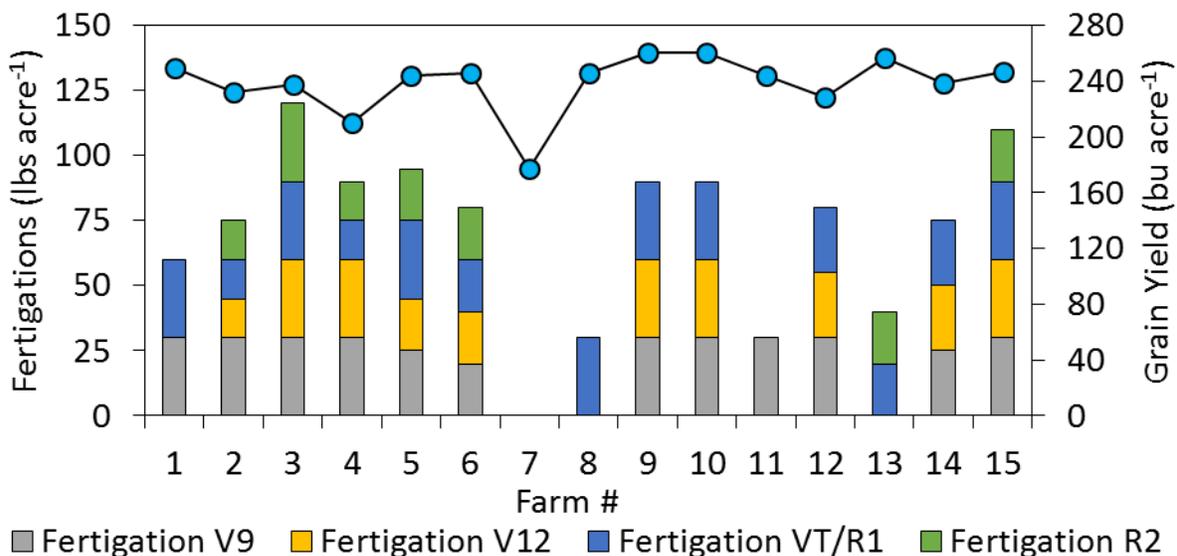
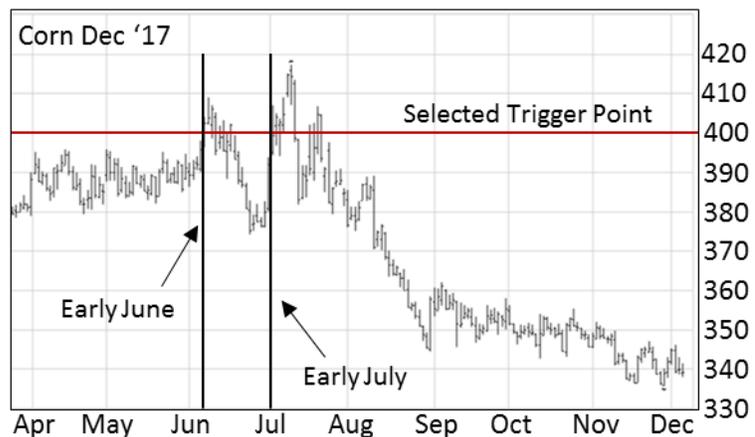


Figure 9. Nitrogen amount (lbs per acre) for individual fertigation applications and grain yield (bushels per acre) at 15.5% moisture content for individual farms.

## Marketing

It was duly noted in our project description last March that grain marketing would likely have the greatest impact on profitability and this was prominently demonstrated this year. For those producers that “delivered” their grain to Ag Valley Coop in North Platte on November 22 received \$3.03 per bushel. Only five farms produced grain at an input cost of less than \$3.03 per bushel. Farms that used the marketing tools of forward contracts, basis contracts, and futures market were able to significantly increase revenue per bushel and ultimately profitability. Figure 10 shows the pricing opportunities that producers had available during 2017. A suggested trigger point of \$4.00 per bushel is highlighted in Figure 10, along with two periods, when the price reached the trigger point.



**Figure 10. 2017 December futures contract for corn with June and July periods when \$4.00 trigger price was reached. Figure adapted from barchart.com.**

## RESULTS AND DISCUSSION

### *Greatest Grain Yield*

The “Greatest Grain Yield” award was granted to Tim Schmeackle, Farm #10, with a yield of 260.7 bushels per acre. Tim selected hybrid Dyna-Gro D53VC55RIB with a seeding rate of 34,000 plants per acre, which is marketed for the western Corn Belt. Tim’s farm ranked 6<sup>th</sup> in “Farm Profitability”, and therefore, he received a cash award of \$320.

### *Highest Input Use Efficiency*

The “Highest Input Use Efficiency” award was comprised of three components: irrigation, nitrogen, and yield response. All three terms of the efficiency calculation was based on a control treatment (Farm 7) that received no irrigation and nitrogen fertilizer. This efficiency index promotes effective irrigation and nitrogen practices without sacrificing production and profitability. The efficiency index penalizes irrigation water and nitrogen fertilizer that is applied to the field but is not taken up by the crop. For example, the irrigation component of the efficiency term decreases if irrigation water does not translate into evapotranspiration (ET), or in other words, if irrigation water is left in the soil profile, percolated below the root zone, and/or runs off the field. It is possible for the irrigation term to exceed 1.0 if the applied irrigation prevents lasting effects of water stress on crop performance allowing for the crop to extract more available water (precipitation and stored water) than the amount of irrigation applied. For example, Farm #1 applied 3.5 inches of irrigation; however, the ET amount exceeded the control treatment by nearly 6 inches due to careful timing of irrigation, which allowed the crop to avoid the lasting effects of water stress experienced by the control treatment.

**Table 1. Input use efficiency components, including evapotranspiration use efficiency (ETUE), grain nitrogen uptake efficiency (GNUE), and yield ratio for the individual farms. Each component was ranked and assigned a number from 1 to 14, where 1 was the highest and 14 was the lowest value. The three rankings were summed to determine a composite score for each farm, where the lowest score was considered the highest input use efficient farm.**

Farm #	ETUE (unitless)	GNUE (unitless)	Yield Ratio	Composite Score
Farm 1	1.70	0.44	1.41	8
Farm 2	0.64	0.22	1.31	36
Farm 3	1.79	0.32	1.35	18
Farm 4	0.77	0.18	1.19	39
Farm 5	1.30	0.21	1.38	24
Farm 6	0.88	0.31	1.39	21
Farm 8	0.64	0.40	1.39	24
Farm 9	1.10	0.44	1.47	7
Farm 10	1.04	0.42	1.47	11
Farm 11	0.80	0.22	1.38	30
Farm 12	1.03	0.21	1.29	33
Farm 13	0.85	0.37	1.45	17
Farm 14	1.40	0.22	1.35	22
Farm 15	0.74	0.29	1.39	25

The values for the irrigation, nitrogen, and yield component terms of the efficiency calculation are presented in Table 1. The irrigation efficiency term ranged from 0.64 to 1.79. In general, irrigation was well managed by the contestants with the average and median efficiency values being 1.05 and 0.95, respectively, which supports that most of the irrigation applied translated into increased consumptive use (i.e., ET). The grain nitrogen uptake efficiency (GNUE) term ranged from 0.18 to 0.44 with an average of 0.30. In general, GNUE decreased with total applied nitrogen fertilizer and increased with grain yield. The yield ratio ranged from 1.19 to 1.47 with an average of 1.37.

The “Highest Input Use Efficiency” award of \$1,000 was granted to Tim Schmeckle, Farm #10, with a composite score of 11. Tim selected hybrid Dyna-Gro D53VC55RIB with a seeding rate of 34,000 plants per acre. His nitrogen management practices consisted of applying 75 lbs per acre (45% of total) as pre-plant and 90 lbs per acre (55% of total) as fertigation administered in three applications of 30 lbs per acre at growth stages: 9 leaf, 12 leaf, and tasseling/silking. His irrigation schedule included applying 15.4, 57.4, and 27.2% of his total irrigation of 6.8 inches in the months of June, July, and August, respectively. As a result, his GNUE value was 0.42 with a ranking of 3 and his ETUE was 1.04 with a ranking of 6. Tim was also awarded the “Greatest Grain Yield” with a yield of 260.7 bushels per acre, which had a yield ratio of 1.47 with a ranking of 2, which demonstrates that efficient use of irrigation and nitrogen fertilizer does not have to come at the expense of yield.

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

Farm profitability ranged from a positive \$146.85 per acre to a negative \$153.29 per acre (Figure 11). Eight farms showed a net profit ranging from \$23.20 to \$146.85 per acre and seven farms showed a net loss ranging from \$27.00 to \$153.29 per acre. Three farms (6, 8, and 10) did not utilize any marketing tools (i.e., sold at market close on November 22 at \$3.03 per bushel), where farms 6 and 8 resulted in a net

loss and farm 10 showed a profit of \$39.09 due to a low cost of production. The two farms with the greatest loss, farms 4 and 14, was primarily attributed to lower yields with relatively high input costs.

The “Most Profitable Farm” was not the highest yielding nor the lowest input cost, but did receive the most revenue per bushel due to an aggressive marketing strategy. This participant forward contracted 30% of their production on April 1, 30% of their production on July 11, 6% of their production on August 28, and the remaining 34% on November 22. The participant also arranged for on farm pickup at a reduced basis and eliminated transportation costs. The “Most Profitable Farm” award of \$2,000 was granted to Roric Paulman, Farm 13.

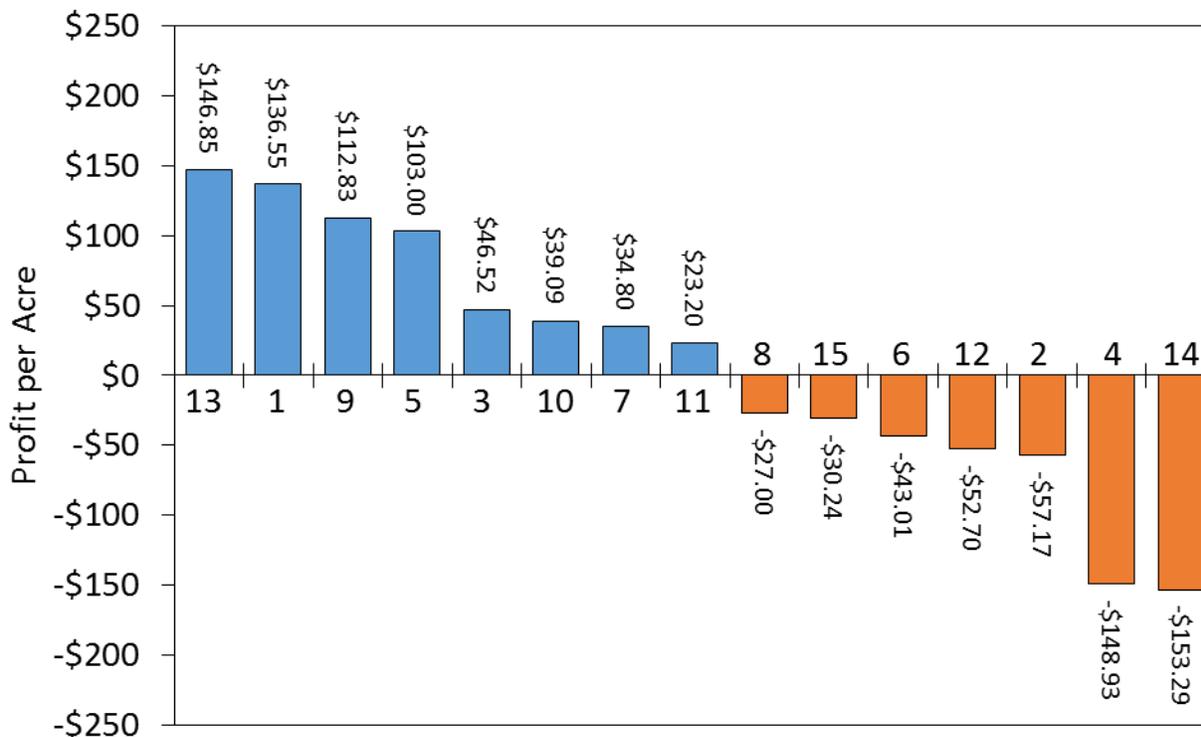
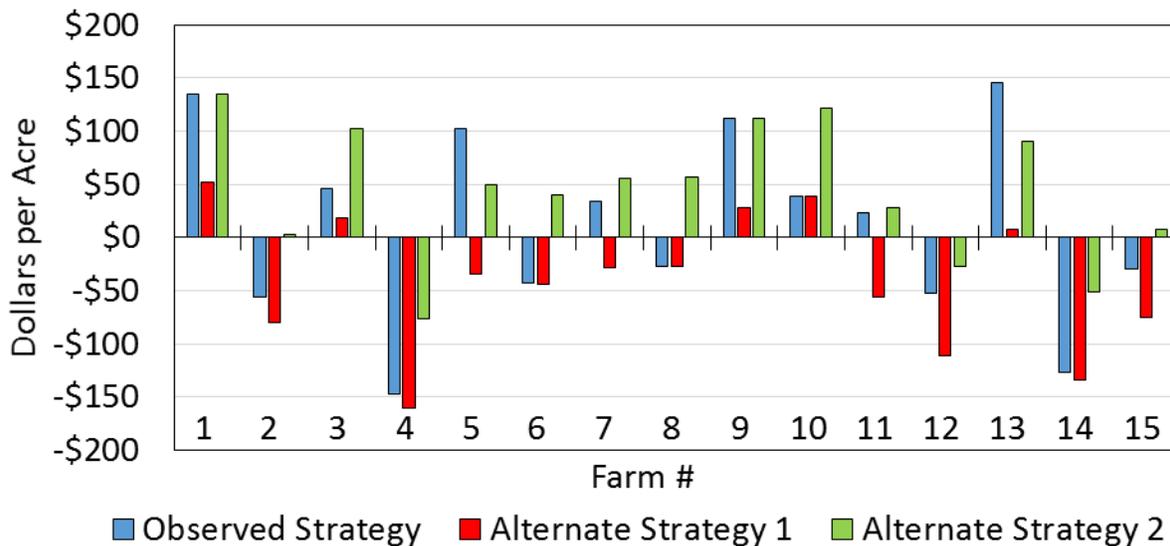


Figure 11. Profitability (\$ per acre) for individual farms ranked from highest to lowest.

### Alternative Scenarios

It is worth noting that this growing season the grain markets gave producers a couple opportunities to market their grain at a profit. In Figure 12, the red bars show profit results if all the crop were marketed at the 3.03/bu level (Strategy 1). The green bars indicate the approximate level of profits that would be expected had 80% of the crops APH (200 bushels per acre) had been marketed at \$3.55 during the month of June (Strategy 2). Strategy 2 adds just under \$250,000 over Strategy 1. The blue bars represent the calculated profit based on each farms individual strategy (Strategy 3 or Observed Strategy). In all instances Strategy 3 and Strategy 2 were better than Strategy 1. Strategy 1 resulted in a total negative profit of over 1.8 million dollars. Strategy 2 resulted in total increase in profits to over 1.9 million dollars. The observed strategy led to a total of nearly 0.5 million dollars of profits. Five of the fifteen farms were profitable if they had used strategy 1. Eight of the fifteen farms were profitable using their Observed Strategies. Eleven of the fifteen farms would have had a positive profit had they applied strategy 2. In two of the fifteen farms, the observed strategies had a higher profit, than strategy 2. Following strategy 2 on average increased the

market value of grain to \$3.39 per bushel versus the ending market value of \$3.03 per bushel on November 22, 2017.



**Figure 12. Comparison of profitability for individual farms between observed and two strategies, 1) crop was marketed for all farms on November 22 at \$3.03 per bushel, and 2) 80% of the crops APH (200 bushels per acre) was marketed at \$3.55 per bushel during the month of June.**

## AG PERFORMANCE SOLUTIONS - TECHNOLOGY

As described through this report, there are considerable differences in producer decisions, ranging from seed selection and population density, to scheduling and prescribing nitrogen and irrigation amounts. A scientific evaluation of these management practices is especially valuable to producers, since it provides a thorough understanding of grower based management practices as they compare against their peers as well as against University recommendations. In addition, this information can be evaluated with economics allowing producers to identify sustainable practices that do not sacrifice profitability. In partnership with industry, extensive data was collected throughout the growing season, including weather conditions, soil properties, soil water content, canopy reflectance and temperature, crop growth and development, leaf and stalk samples, total biomass, grain yield, nitrogen uptake, among others. The results of this in depth analysis will be available in the final 2017 TAPS Report.

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