AGRICULTURE

OSUTAPS TESTING AG PERFORMANCE SOLUTIONS

2021

Irrigated Corn Farm Management Competition Report

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Introduction

The Testing Ag Performance Solutions (TAPS) program hosts farm management competitions that promote profitability and efficiency through peer-to-peer interaction. The program hosted 15 competitors in the irrigated corn competition at the Oklahoma State University's McCaull Research and Demonstration Farm near Eva, OK. The competitors were assigned "farms" numbered 1-16 with the 16th farm being one managed by the Oklahoma State extension team. Each farm was replicated in three plots imposed with our variable rate irrigation system. The project also included check treatments that received no water and/or no nitrogen which allowed for the calculation of efficiency indexes. The TAPS competition allows growers to compete against each other as well as against University extension specialists within the same field for most profitable, and highest efficiency for water and nitrogen (N) fertilizer.

Approach

The contestants were responsible for six management decisions including; irrigation scheduling, nitrogen fertilizer amounts and application (via pre-plant, and fertigation), hybrid selection, seeding rate, and marketing choices of their grain yields. Each team's decisions were implemented in a single field on three randomized plots within a split plot trial design. Eight rows of each plot was planted to the participants selected hybrid and population; and the other eight rows were planted at a seeding rate of 30,000 seeds/acre for P1366. This standard hybrid and population was selected based on Pioneer seed representative's recommendation. The staff of Oklahoma Panhandle Research Extension Center managed all farm plots. The yields and costs from each farm were amplified to represent 3,000 harvested acres. This amplification provided the opportunity to market an amount of grain that was more representative of a modern-sized farm. Each team had access to a number of new and emerging technologies provided by industry partners, such as sensors, models, and imagery, to aid their decision-making process in real-time.

2021 Results

The 2021 growing season was another challenging year for irrigated crop production in the Oklahoma Panhandle with dry conditions directly prior to planting but well above average rainfall in May to help get the season started. The cumulative rainfall experienced during June-August was near normal fallowed by below average rainfall to finish the season in September. Very high yields relative to our historic yields were achieved due to the below average temperatures experienced in July and August. Figure 1 shows the average long-term temperature and rainfall at the Goodwell OK mesonet and the temperature and rainfall at EVA, OK mesonet in 2021.

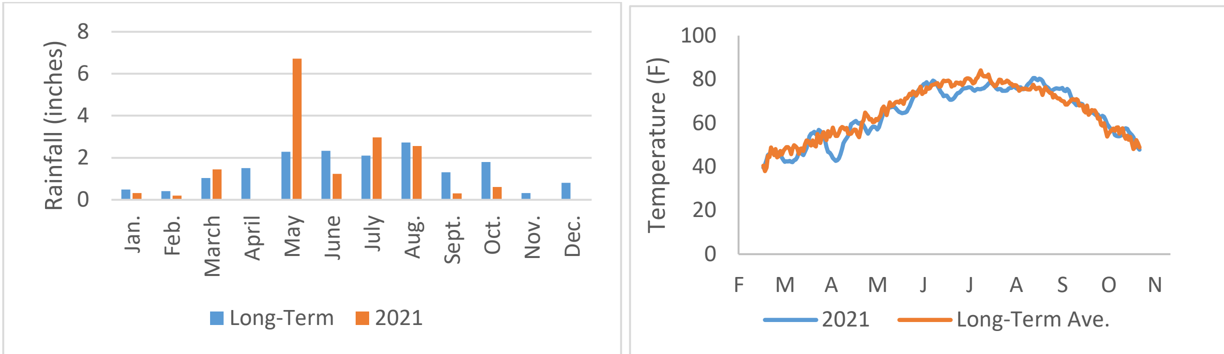

Figure 1: The average long-term temperature and rainfall at goodwell, OK mesonet and the temperature and rainfall at the Eva, OK mesonet in 2021.

The limited rainfall in March and April suggested a significant need to pre water this field prior to planting. However, mechanical issues with the pivot and wells limited our ability to apply pre water and therefore none was applied. Fortunately, 0.47 inches of rainfall occurred on May 3, allowing us to plant into good surface moisture on May 6th. On May 10-11 another 0.73 inches of rainfall was received followed by an rainfall event providing 2 inches on May 15-17. On May 27 0.75 inches of irrigation was applied to incorporated herbicides which was followed by 3.34 inches of rainfall on May 30. These rainfall events were a blessing and provided for recharge of our profile before the onset of the irrigation season. Soil moisture sensors were installed during the first 2 weeks of June and participants were given the option to select irrigation depths on June 16 and every 5 days as the pivot turned at a 5 day interval supplying an opportunity to apply 1.25 inches every revolution.
The farms were irrigated with 3-5 inches of irrigation during June, 4-8 inches during July, 0-8 inches during August, and 0-3 inches during September. It is noteworthy that farm 3 terminated irrigation early, this was in part due an error on my part in placing the moisture probe in the wrong. Location. After realizing that the corn was very short on water the participant decided to let it ride and achieved a yield of 167 bu/acre.

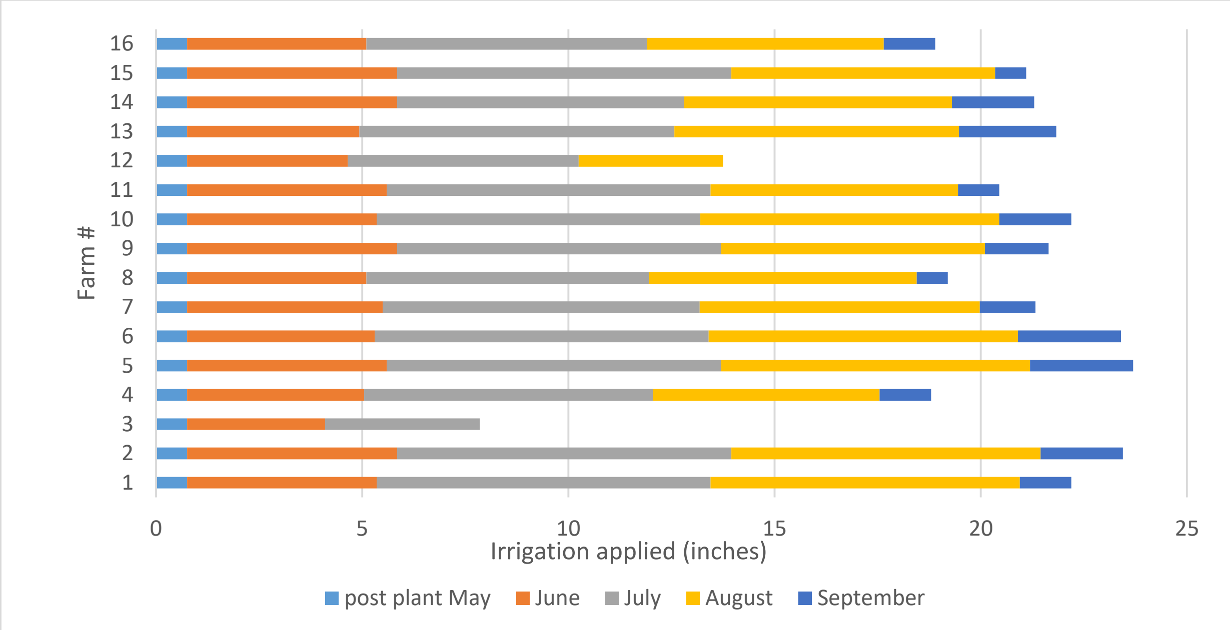

Figure 2: Irrigation water applied for each corn farm during the irrigation season, which started on May 27 and ended on Sept 8. OSU Extension managed farm 16. The total length of bar represents total irrigation applied.

Figure 3 shows the amount of nitrogen applied pre-plant and during four fertigation events. The total applied ranged from as little as 157 lbs applied on farm 12 to as much as 332 lbs on farm 13 which received 242 lbs N/acre pre plant and 90 lbs N/acre as fertigation. In contrast farm 12 received 87 lbs N/acre pre plant and 70 lbs as fertigation. The treatment structure also included a non-fertilized Check that received no nitrogen other than that applied with 100 lbs of MESZ (12_{N}-40_{P2O5}-0_{K2O}-10_{S}-1_{Zn}). It should be noted that this 0 N rate produced 221 bu/acre. Therefore, this field was considered to be marginally responsive to N fertilizer in 2020. This is likely due to exceptional rooting depth of the crop which provided for utilization of subsoil residual.

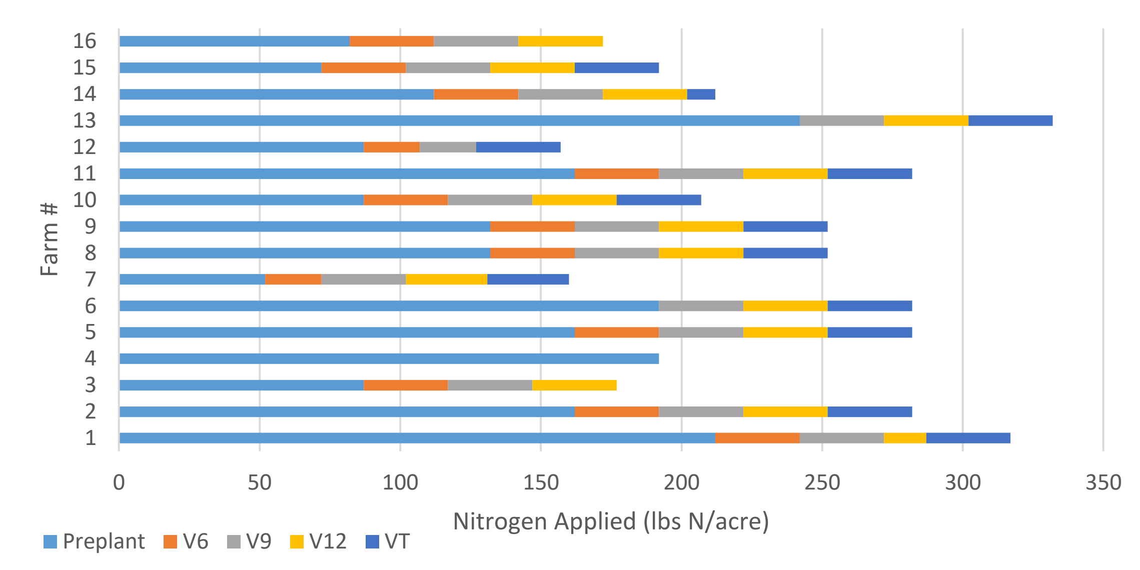

Figure 3: Nitrogen amount and method for each corn farm at Eva, OK. OSU Extension managed farm 16. The total length of bar represents total N applied.

Figure 4 shows grain yield for the participant selected hybrids and the standard hybrid on each farm. The P1366 produced yields that were similar to the participant selected hybrids on most of the farms. A notable exception is farm 13 which used DK 66-17. This suggests that the high N rate supplied to this farm was very well suited for the DK 66-17 which was the highest yielding farm at 309 bu/acre. However, the P1366 appears to have been negatively impacted by this high rate of N, as it performed well in other treatments receiving similar irrigation to that provided by farm 13 with less N. It should be noted that the P1366 still produced 241 bu/acre in farm 13. In contrast it achieved 295 bu/acre on farm 6 while the participant hybrid DK70-27 produced 307 bu/acre. Farm 6 utilized 282 total lbs of N/acre with 23.4 inches of irrigation.

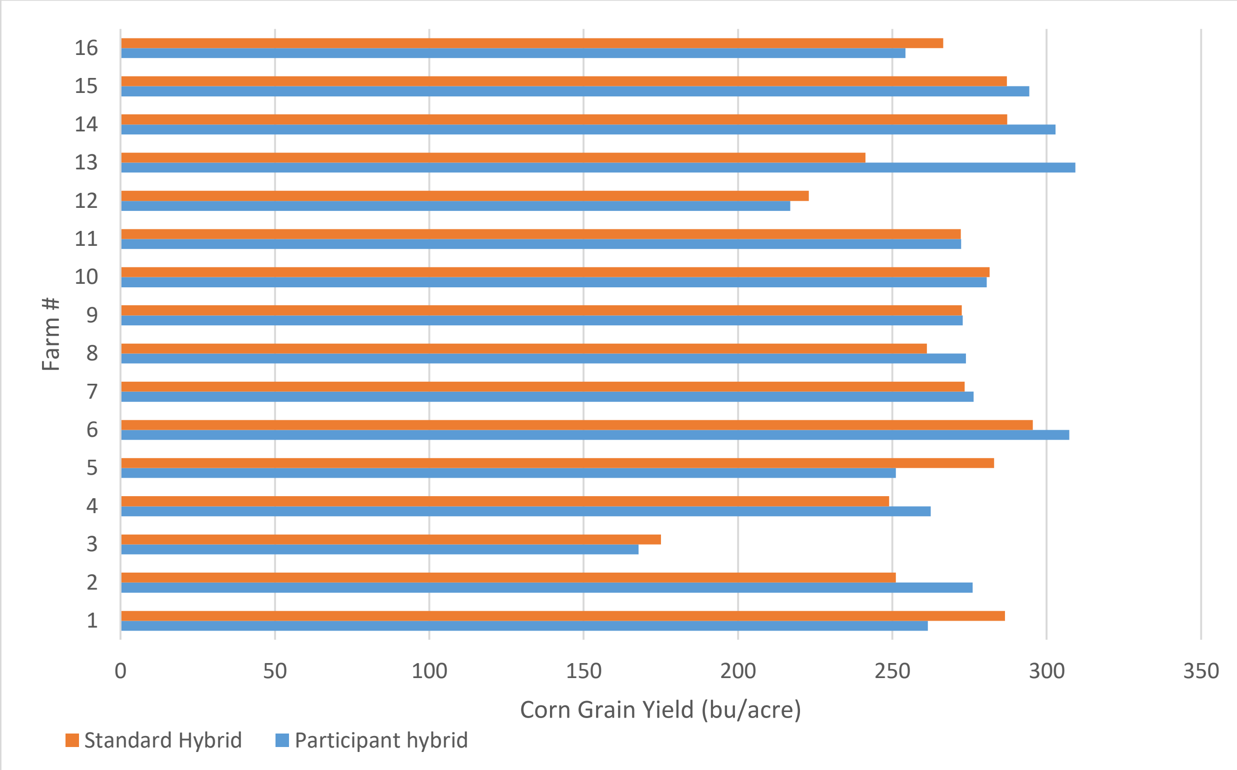

Figure 4: Grain Yield for the participant hybrid and the standard hybrid produced on each farm at Eva, OK. OSU Extension managed farm 16.

Table 1: Participant selected hybrid and Seeding rate and the standard hybrid and Seeding rate.

Farm #	Hybrid	Seeding rate
1	Channel 217-41	30000
2	P1108Q	32000
3	D55VC80 VT double pro	26000
4	P1359AM	32000
5	LG 66c32	25000
6	DK70-27	34500
7	Pioneer 1108Q	35783.5
8	P1366AM	30,000
9	DK70-27	29000
10	P1366AM	34000
11	Channel 214-22 Stax	33000
12	AgriGold A6544	32,000
13	DK66-17	30000

14	DK70-27	32500
15	P1847AML	30000
16	P1366AM	30000
Standard	P1366AM	30000

Figure 5 shows the net return to land and management for each farm given the yield and the sale prices achieved by each participant's hybrid and marketing selections. The figure also shows the net return to land and management for each farm given the yield of the standard hybrid and the cash price of corn on Dec. 15 at Elkhart Kansas ($6.43/bushel, storage and transport costs were subtracted for a net price of $6.26). Due to the combination of the second highest yield and the fact that Farm 6 marketed all of its corn for an average net price of $6.50, farm 6 generated the highest net revenue of $1240/acre with the second highest revenue generated by farm 13 which generated the highest yields and a revenue of $1198/acre.

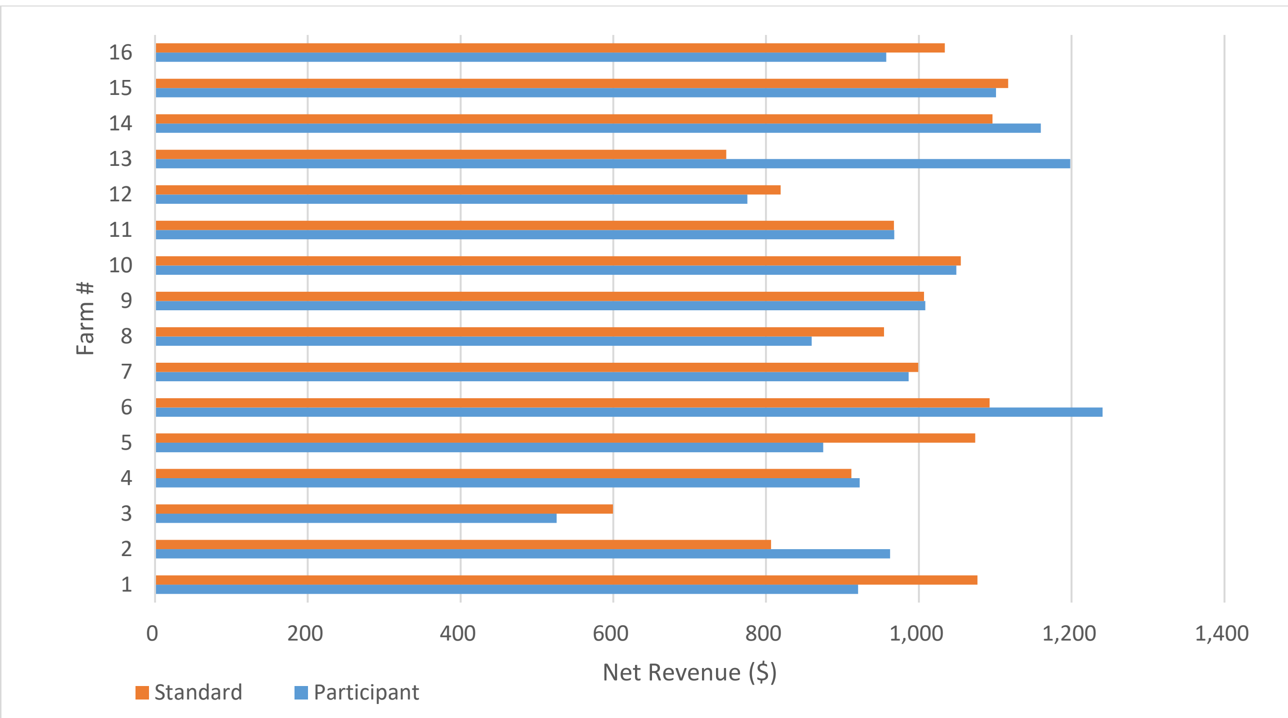

Figure 5: Net return to land and labor for each farm based on the participant's hybrid yield and grain marketing, and the standard hybrid yield and grain price on Dec. 15. OSU Extension managed farm 16.

Figures 6 and 7 show the impact of irrigation applied and N rate on net revenue. Figure 6 shows very clearly that from 8-19 inches of irrigation the net return is very much driven by irrigation applied. However, above 19 inches, net revenue is less impacted by irrigation applied. It is certainly true that the highest revenues were achieved with irrigation rates above 19 inches of irrigation but there were also revenues that were not increased by irrigation above this threshold. The lack of yield response for some farms could result from the timing of irrigation, hybrid selection or less than optimum marketing.

The data in figure 7 is even more surprising as it shows that N rate had no relationship with net revenue. Even if we were to take out the two farms that utilized less than 19 inches of irrigation we would find no impact of N rate on net revenue. This is due in large part to the fact that this pivot showed little response to N fertilizer, as demonstrated by the 221 bu/acre yield achieved in the Zero N treatment (data not shown).

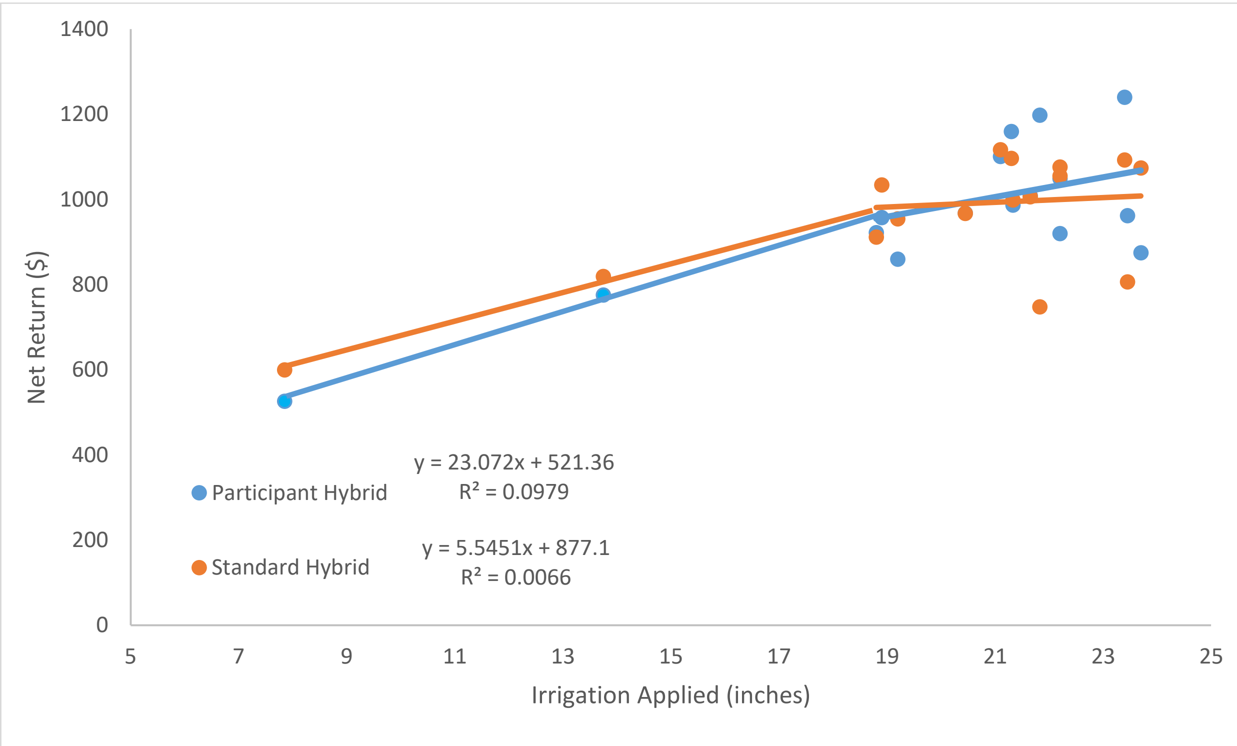

Figure 6: Net return to land and labor as a function of irrigation applied to each farm based on the participant's hybrid yield and grain marketing, and the standard hybrid yield and grain price on Dec. 15.

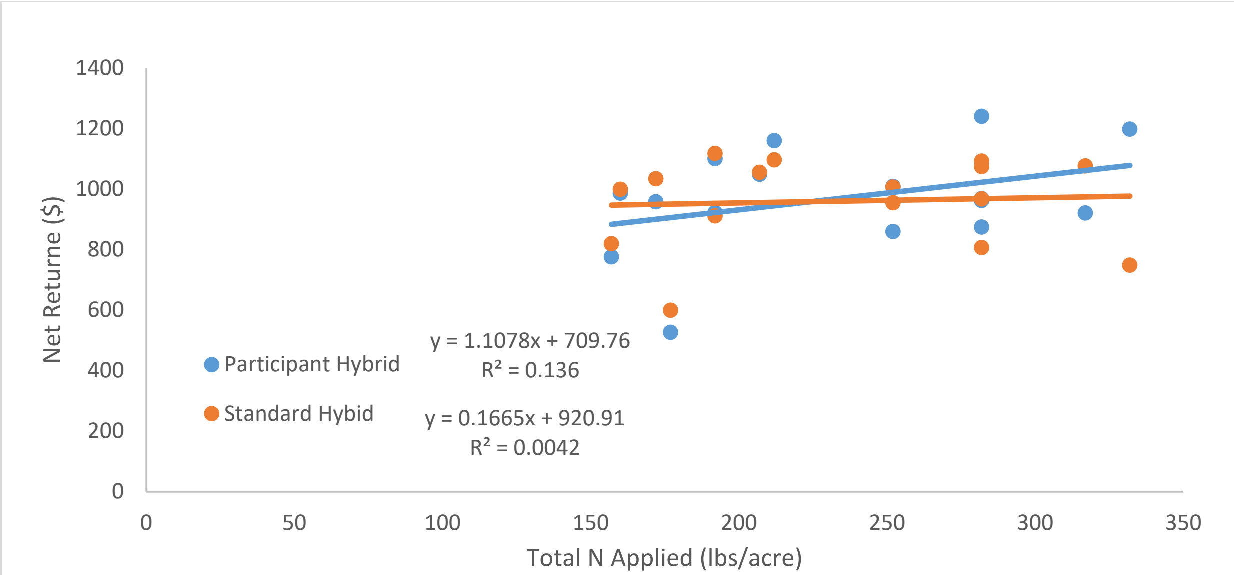

Figure 7: Net return to land and labor as a function of total N applied to each farm based on the participant's hybrid yield and grain marketing, and the standard hybrid yield and grain price on Dec. 15.

Figure 7 shows the water-Nitrogen efficiency intensity index calculated as:

$$\text{OSU WNIPI} = \frac{((Y_{Farm} - Y_{Control})/\,Y_{Control})}{((ET_{Control} + I_{Farm})/ET_{Control}) \times ((Y_{0N} + Y_{Farm})/Y_{0N})}$$

Where Y_{farm} is the yield for the farm $Y_{control}$ is the yield of the treatment that received no irrigation, $ET_{Control}$ is the mesonet estimated ET, I_{farm} is the irrigation applied to the farm, Y_{0N} is the yield of the treatment that received adequate irrigation and zero nitrogen. This efficiency index is modified from the index used in the University of Nebraska Lincoln (UNL) irrigated corn TAPS program. The UNL equation uses the above ground biomass N instead of the grain yield as used in our equation.

Farm 15 shows the highest efficiency index 1.808 when the participant hybrid is used for the analysis. This farm applied irrigation at 21.1 inches which was very close to the optimum irrigation and applied a moderate N rate of 192 lbs/acre while producing a yield of 294 bu/acre which was the fourth highest yield. Its apparent that the P1847 used in this farm was well suited to provide high yields under the conditions provided by Farm 15. The standard hybrid P1366 also performed well producing 287 bu/acre.

Farm 7 deserves an honorable mention for its efficiency index score of 1.806. This farm produced 276 bu/acre with 21.3 inches of irrigation and 160 lbs N/acre. This was achieved with P1108Q planted at 35,784 seeds per acre.

The extension team farm 16 fell short this year with an efficiency score of 1.659 which was the 4th highest efficiency. Despite having the 3rd lowest N rate and 3rd lowest amount of water applied our efficiency score was reduced do to our yield of 254 bu/acre falling short of those achieved by the most efficient farms.

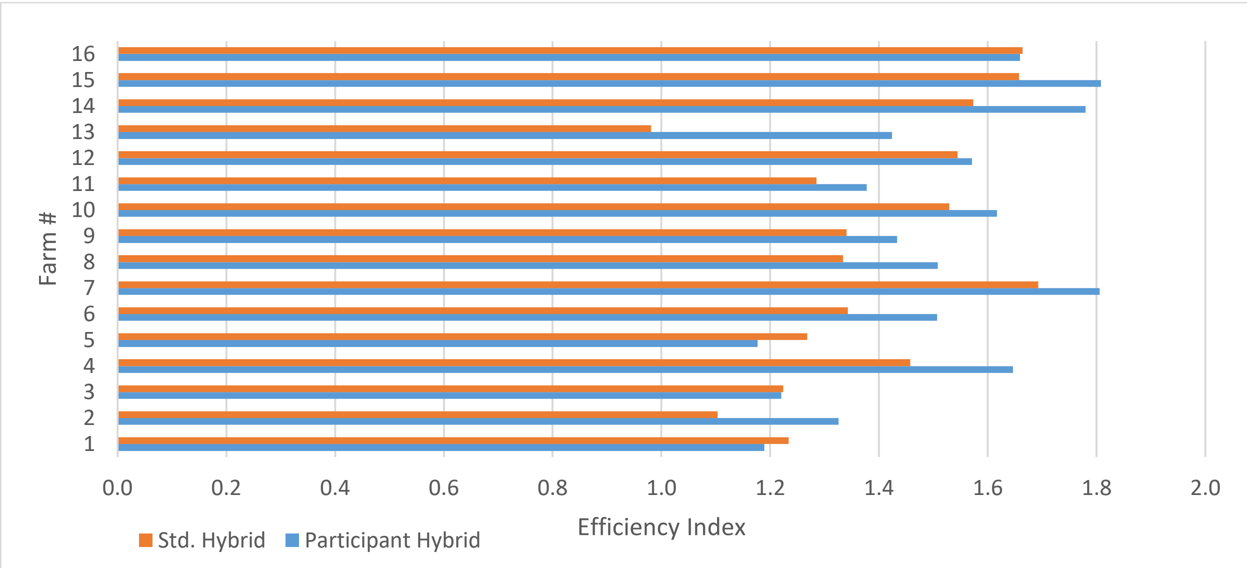

Figure 7 shows the efficiency score as calculated with an adjusted UNL efficiency equation for the standard and participant hybrids. OSU Extension managed farm 16.

Competition Results and Winners:

This year the most profitable farm based on participant hybrid and marketing decision was farm 6. This farm was managed by Matt Steinert, Covington, Oklahoma. His success was achieved by applying 23.4 inches of irrigation, 282 lbs N/acre, and growing 307 bu/acre of DK70-27 planted at 34,000 seeds per acre. His success in being the most profitable was driven by having the second highest yield marketing because he sold all of his corn for $6.81 in Optimum, OK on Nov. 17th.

The most efficient farm based on participant hybid decisions was farm 15. This farm was managed by Marc Voth, a crop consultant who works in the Panhandle region. Marc produced 294 bu/acre with P1847 planted at 30,000 seeds per acre. His crop received 21.1 inches of irrigation and 192 lbs N/acre, with 72 lbs N/acre applied prior to planting.

Congratulations to these two participants and many thanks the following participants who made this 2021 corn TAPS project a very successful project.

Pat Long, Optima, OK; Brent Rendall, Miami, OK; Jason Becker, Turpin, OK; Brett Reiss, Kismet, KS; Roric Paulman, North Platte, NE; Russell Issacs, Turpin, OK; Wes Woolmen, Boise City, OK, Clinton Oyler, Turpin, OK; and Harrison Krey, Rolla, KS, and Jourdan Bell, Amarillo, TX, Jarred McDaniel, Texoma, OK, Darren Buck, Elkhart, KS, Russell Issaacs, Turpin, OK.