Conducted by:

University of Arkansas Rice Research & Extension Water Management Team

Chris G. Henry, Ph.D. P.E. –Professor & Water Management Engineer

Russ Parker - Irrigation Program Associate

Robert Goodson - Irrigation Program Hourly

Rick Wimberley - Irrigation Program Hourly

Harper Summers- Irrigation Program Associate

Ranjitsinh Mane – Assistant Professor Agricultural and Consumer Economics

Acknowledgments:

University of Arkansas County Extension Agents	
Extension Agents/Supervisors	**County**
Stewart Runsick	Clay
Ben Holcomb	Clay
Kurt Beaty	Chicot
Jenna Martin	Cross
Katrina Owen	Crittenden
Scott Hayes	Drew
Lance Blythe	Greene
Dave Freeze	Greene
Matthew Davis	Jackson
Brady Harmon	Jefferson
Bryce Baldridge	Lawrence
Courtney Sisk	Lawrence
Stan Baker	Lee
Dustin North	Monroe
Alan Beach	Mississippi
Shawn Payne	Phillips
Tucker Vonkanel	Phillips
Mike Andrews	Randolph
Brian Haller	White
Jerrod Haynes	Woodruff

All Grain Merchandisers & Personnel at Contestant Affiliated Elevators

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Executive Summary

The Arkansas Irrigation Yield Contest is a novel approach to promoting the adoption of Irrigation Water Management Practices. While there is a monetary prize for motivation, the peer comparison is believed to be a key feedback mechanism that drives improvement in irrigation acumen. The contest recognizes those that have achieved a highly developed skill to manage water resources. The impact of water management practice technologies are also quantified through this program. Many of the contest producers stated that adoption of the IWM tools such as moisture sensors and surge valves have a cost and time commitment in the first year to establish trust and acceptance, but in the end are beneficial at reducing labor and input costs.

In 2024, there were 47 producers from 20 counties throughout the Arkansas Delta who entered 58 fields in the contest. Six of the growers entered multiple crops and/or fields. The contest is an opportunity for farmers to explore their individual aptitude to reduce energy, water use, labor, and improve profitability. There are three categories available: Corn, Soybean, and Rice, with subcategories for Levee Rice, Furrow Rice, and for the second year, Zero Grade Rice. Each producer (except for flooded rice entries) used at least one irrigation management tool (e.g., computerized hole-selection; multiple-inlet rice irrigation; soil moisture sensors; surge irrigation).

In the soybean category, the average water use efficiency for 2024 was 2.9 bushels /inch. In 2023, the average was 3.46 bushels/inch WUE, versus 3.16 in 2022. In 2021, the average was 3.53, while in 2020, the average was 3.48. 2019's average was 2.94, and 2018's was 2.86.

The corn category achieved average water use efficiency in 2024 was 9.98 bushels/inch. In 2023, the average was 9.98 versus 7.19 in 2022. In 2021, the average was 10.53, while in 2020, the average was 8.07. 2019's average was 8.06, and 2018's was 9.36.

In the rice category, the average water use efficiency for 2024 was 6.40 bushels/inch, the highest in recorded contest history for rice. The 2023 average was 5.96 bushels/inch while the 2022 results were 5.44 bushels per inch. 2021 through 2018 results were 5.46 bushels /inch, 4.62 bushels /inch, 4.70 bushels /inch, and 5.17 bushels /inch respectively.

Rules specific to the irrigation contest were developed and posted on a website along with the necessary entry and harvest forms. The contest was adapted from traditional yield contests (Arkansas Soybean Association, 2014; National Corn Growers Association, 2015; National

Wheat Foundation, 2018; University of California Cooperative Extension, 2018). Unlike traditional yield contests, the Arkansas Irrigation Contest winners are selected based on the highest Water Use Efficiency (WUE), where WUE is defined as the yield estimate divided by the total water received by the field. Total water includes rain plus irrigation. Rain was estimated from meteorological computer models, and irrigation water was measured with a portable propeller-style flow meter that was installed in a tamper-proof fashion. As in traditional yield contests, the yield estimate at harvest was supervised and witnessed by impartial observers (Extension and or NRCS workers). Of the categories, twelve winners were selected and awarded prizes totaling $128,552 value.

Lawrence County producer Frank Binkley was awarded first place in the soybean division with a WUE of 3.83 bushels/inch. Jackson County producer Ty Graham was second with a WUE of 3.69 bushels/inch. Danny Gipson was third with a WUE of 3.39 bushels/inch.

Clay County producer Jeremy Wiedeman placed first in the corn division with a WUE of 13.51 bushels/inch. Clay County producer Matt Ahrent was second place with a WUE of 12.50 bushels/inch, while Kelby Wright of Cross County placed third with a WUE of 11.66.

Cross County producer Kelby Wright was awarded first place in the flooded rice division, with a WUE of 5.68 bushels/inch. Monroe County producer Jon Carroll placed second, achieving a WUE of 5.48 bushels/inch. Clay County producer Blake Ahrent placed third achieving a WUE of 5.28 bushels/inch.

Mississippi County producer Cody Fincher was first in the furrow rice division. He achieved a WUE of 8.66 bushels/inch. Rieves Wallace of Crittenden County was second with a WUE of 7.52 bushels/inch. Jackson County producer Ty Grahan was third achieving a WUE of 6.37 bushels/inch.

First place in zero grade rice was Chad Render of Jefferson County with a WUE of 13.6 bushels/inch, the highest WUE ever recorded in rice. Second place is Mark Felker of Crittenden County with a WUE of 9.22 bushels/inch, while Crittenden County producer Rieves Wallace placed third with a WUE of 8.32 bushels/inch

Awards were sponsored by Ricetec, the Arkansas Corn and Grain Sorghum Promotion Board, the Arkansas Soybean Promotion board, Seametrics, Delta Plastics, Irrometer, FarmLogs, Agsense, and Crop X.

Each participant receives an individualized report card, providing feedback on their WUE and yield performance compared to the aggregated results from all the entries. The contest is strongly supported by the volunteer efforts and in-kind efforts of NRCS field offices and Extension agents who serve as supervisors for the contest. The irrigation industry and commodity boards also supported the contest through product and cash donations. *The effort and support of these persons and organizations is greatly acknowledged and appreciated.*

Introduction

The overall objectives of the irrigation contest are,

- Educate producers on the benefits of using Irrigation Water Management Practices to improve profitability, sustainability, and reduce labor requirements for irrigation.
- Document the highest achievable Water Use Efficiency by crop type under irrigated row crop production in Arkansas.
- Reward and recognize producers who achieve a high level of irrigation water management acumen among their peers.
- Transfer knowledge of good irrigation water management practices from contestants to irrigation peers and to those that advise irrigators.
- Provide a platform for demonstrating Irrigation Water Management Practices at county and local levels.
- Provide a feedback mechanism for irrigators to benchmark their irrigation management skills.

Participation in the contest is entirely voluntary. Generally, the distribution of the contestants and contest winners are well distributed across the delta.

Materials and Methods

Rules were drafted in the spring of 2018 then refined each year. The contest rules are inspired by long-standing yield contests (Arkansas Soybean Association, 2014; National Corn Growers Association, 2015; National Wheat Foundation, 2018; University of California Cooperative Extension, 2018). Close attention was given to make the competition as unobtrusive to normal planting and harvest operations as possible while preserving the ability to produce accurate data and maintain a fair competition. In 2020 a change to how the growing season was determined was done for soybeans for more consistency. Harvest yield estimates are similar to or adapted from the California Rice Yield Contest, National Corn Growers Association Yield Contest, National Wheat Yield Contest, and the Arkansas "Go for the Green" Contest. Contestants harvest a minimum of three acres, harvested from the top of the field to the bottom, skipping two harvest machine widths between paths. A supervisor and a flowmeter are required to participate in the contest. UADA staff facilitate the contest, however a panel of impartial irrigation experts serve as judges to review methods and confirm the results.

Water Use Efficiency

Water use efficiency (WUE) is defined as the amount of yield produced per unit of water input. Irmak et al. (2011) defines Crop Water Use Efficiency as:

$$\mathbf{WUE_b = Y_i \,/\, (P_e + IR + \Delta\ SW)} \qquad \textit{Equation 1}$$

where WUE_b = benchmark water use efficiency, Y_i = yield of irrigated crop (bu/ac), P_e = effective rainfall (in), IR = Irrigation applied (in), and Δ SW = change in soil water content in the root zone during the growing season (in). For the irrigation contest, this same equation is used, without consideration of Δ SW. Given the high rainfall amounts experienced in Arkansas, the soil water content is relatively high during the first month of emergence, so it is assumed that contestants begin the season with a full or nearly full profile. Also, estimating this parameter adds unnecessary complexity to determining the results of the contest.

A challenge in determining WUE is the difficulty in estimating effective precipitation. Effective precipitation is defined as the amount of rainfall that is stored by the soil after the excess leaves the field as runoff. The precipitation events for each contestant were carefully evaluated for magnitude and impact on the results. There are dozens of published methods to estimate effective precipitation, however, they are all untested in this region. Rather than try to select a method to estimate effective precipitation using a published method, effective rainfall is defined as less than 2 inches for thirty days after emergence and 3 inches for the remainder of the season until maturity. Rainfall events over 2 inches in depth are reduced to 2 inches for the first 30 days after emergence. After 30 days from emergence, any rain events that exceed 3 inches are reduced to 3 inches. Most furrow irrigation events are nearly 3 inches; this is the reasoning behind using 3 inches as an effective rainfall depth. With this adjustment, in 2018, 2019 and 2020 there were only a few extreme events and the adjustment did not have any impact on the results. In 2021, a significant rain event occurred south of Interstate 40 over a 6-day period from June 5 through June 10. Total rainfall ranged from 11.9 inches to 6.4 inches, and the adjustments were minimal. This affected approximately 5 growers. No adjustments have been needed in 2022 and 2023.

Equation *2* was used to calculate the water use efficiency for each contestant. It is defined as the harvest yield estimate divided by the total water delivered to the field,

$$\mathbf{WUE = Y / (P_e + IRR)} \quad \textit{Equation 2}$$

where WUE = Water Use Efficiency in bushels per inch, Y = Yield estimate from harvest in bushels per acre, P_e = Effective precipitation in inches, and IRR = Irrigation application in ac-inches/ac.

Meter Sealing

Irrigation amounts were totalized using 6 inch, 8 inch, 10 inch, and 12 inch portable propeller meters manufactured by McCrometer. Each meter was sealed using the following process.

Figure 1. Example of Universal Hydrant Sealing

- Meters were sealed to the universal hydrant by using circle lock clamps or horseshoe clamps
- Serialized cable ties are used to secure the clamps and fittings. These cables can only be removed by cutting the cable.
- The fitting connections are wrapped with poly pipe

tape.

- A unique identifying stamp is used across the tape.

Universal hydrants are secured to the alfalfa valve and from the alfalfa valve to the meter using the same procedure. Any additional fittings, if needed, are also secured using this procedure to ensure that no other irrigation water source can contribute to the field. Figure 1 shows a typical meter sealing configuration. All other possible sources of irrigation water to that field were sealed to prevent non-measured irrigation sources from being used in the contest field (Figure 2).

Figure 2. Example of an alfalfa valve sealing done to exclude other sources.

Only mechanical propeller meters are used in the contest. For the winning entries, all meters are checked against a reference meter and must test within 5% of the reference meter, or else the water use is adjusted according to the reference meter and the contest results adjusted accordingly.

Assigning Days to Measure Rainfall

Part of the rainfall measurement is the decision concerning exactly which days to measure rainfall for each field. The intent is to measure rainfall from emergence to physiological maturity. For every crop field entered in the contest the planting date is the basis for emergence date which is recorded on every entry form. Seven days after the planting date is the assumed emergence date and rainfall contributions are accumulated from then until maturity. Corn is the most straightforward crop to assign the date of physiological maturity. Seed companies publish their maturity information in sales literature. Published days to maturity are used to determine the time after emergence. Emergence is assumed as 7 days after planting. This defines the period for which rainfall contributions are accumulated.

For rice, the University of Arkansas Division of Agriculture DD50 models are used (Hardke, 2020). Such models can be used to plan fertilizer, pesticide, and scouting decisions.

The UA DD50 program (dd50.uaex.edu) requires the variety, location, and emergence date, then returns dates of growth stage management events. The predicted drain date for the planted variety for each contestant is used as the last day to measure rainfall on that contest field. Emergence date is assumed as 7 days after planting. The rainfall between these periods is accumulated for the precipitation contribution for each contestant field.

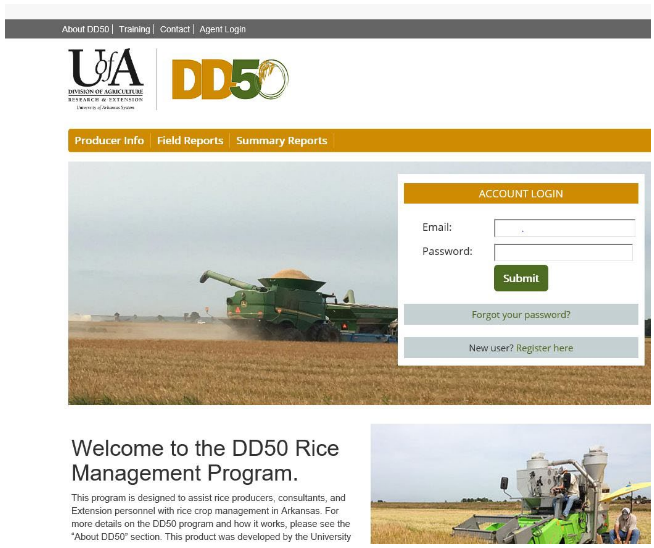


Figure 3. University of Arkansas DD50 Rice Website

For soybeans, the previous method was to use commercially available published data, but in 2020 the following procedure was adopted. A similar process is used to establish the emergence data, 7 days after the planting date reported. The end of rainfall accumulation is assumed to be at R 6.5. This is chosen so that late season rainfalls do not penalize contestants, as it is assumed that R 6.5 would be the latest that rainfall accumulations would affect yield. Next the University of Arkansas soybean crop model SoyStage (http://soystage.uark.edu) is used to model the growth stages. SoyStage (*Figure 4*)was developed using Arkansas research trials (dos Santos et al., 2014; Salmeron et al., 2015; Salmeron et al., 2016; Weeks et al., 2016; Salmeron et al., 2016; Salmeron et al., 2017). The SoyStage model provides R5 and R7 but not R6.5. To determine R6.5 the Mississippi State University Extension, Maturity Date Calculator – SoyPheno (https://webapps.msucares.com/deltasoy/) is used to determine R6 for the maturity group and planting date reported by the contest grower (Mississippi State University, 2020). Then the difference in the dates from R7 from SoyStage and R6 from SoyPheno are used to determine the R6.5 date. Rainfall is accumulated from the assumed emergence date until this estimated R6.5 date.

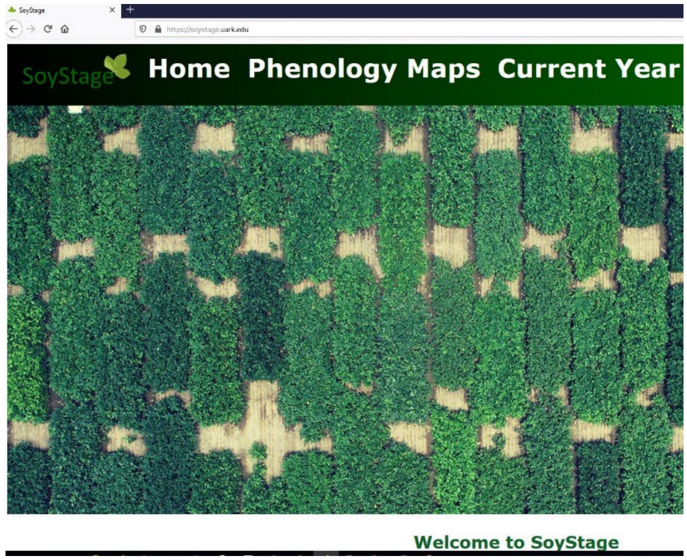


Figure 4. SoyStage website

Rainfall Estimation

Farmlogs™ (Ann Arbor, MI) was used exclusively for 2021. Comparisons between Farmlogs™ and Climate Corporations Fieldview™ (San Francisco, CA) were done in 2020, with similar results. Both programs are computer-based services that provide rainfall estimates for user defined areas, using mobile apps or internet browsers. For the contest, rainfall amounts for each contest site using the data provided on entry forms was used to track rainfall contributions to the fields. The rainfall values were added with total applied irrigation to get the total water use. **Error! Reference source not found.** shows the total rain during the growing seasons the contest has been conducted. The precipitation was assessed for each contest site utilizing the commercial rain prediction service, Farmlogs™. This service uses a computer algorithm to determine rain intensity derived from National Weather Service products. This approach is used instead of rain gages so that tampering of rainfall data is not possible. The rainfall generated data may not be completely accurate against a well-maintained weather station, but it is assumed to be equally unbiased across all contest sites. Between 2018 and 2019 a more detailed analysis comparing actual rainfall from 18 weather stations with the modeled data was conducted and found not significant difference (P=0.95) using this approach results in a good estimate of rainfall compared to a weather station during the growing season. Details of this analysis are discussed in the 2020 contest report. The annual rainfall for each year of the contest is shown in Figure 5

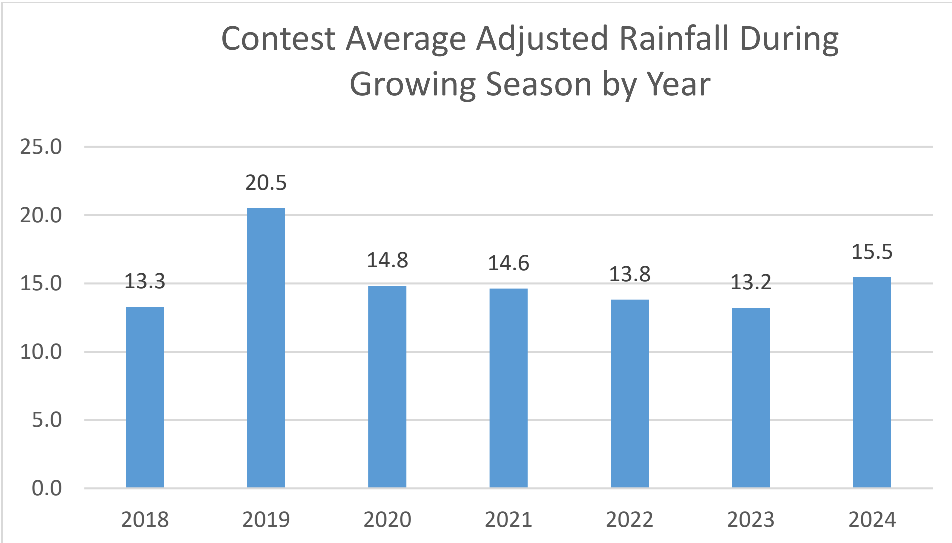


Figure 5. Contest Average Adjusted Rainfall During Growing Season by Year

Table 1. Rainfall Data for 2024 Contest Fields

Location	Crop	Irrigation Type	Variety	Planting Date	Maturity Date	Rainfall Inches (unadj)	Rainfall (Adj)
Lawrence	soybean	Furrow	Asgrow 47xf2	4/1/24	8/8/24	13.3	13.3
Jackson	soybean	C Pivot	Delta Soy 577	6/3/24	9/10/24	10.0	9.57
Mississippi	soybean	Furrow	Becks 4991	4/3/24	8/7/24	17.6	17.6
Jackson	soybean	Furrow	GoSoy 451E23	3/30/24	8/1/24	14.9	14.4
White	soybean	Furrow	Pioneer 46A90	3/23/24	7/24/24	21.3	20.8
Greene	soybean	Furrow	Gateway 477E	5/2/24	8/21/24	10.8	10.8
Mississippi	soybean	Furrow	Becks 4777	4/16/24	8/9/24	16.8	16.8
Cross	soybean	Furrow	asgrow46X6	4/3/24	8/3/24	16.7	16.7
Lee	soybean	Furrow	NK49-C2XFS	4/13/24	8/4/24	13.1	13.1
Lee	soybean	Furrow	NK42-T5XF	4/13/24	8/1/24	13.5	13.5

Clay	soybean	Furrow	Pioneer 47A64X	4/2/24	8/7/24	17.3	17.3
Clay	soybean	Furrow	AG47XF2	4/22/24	8/16/24	18.2	18.2
Monroe	soybean	Furrow	Asgrow 48xf3	5/1/24	8/18/24	11.7	9.9
Greene	soybean	Furrow	Gateway 473xf	4/30/24	8/20/24	12.2	12.2
Phillips	soybean	Furrow	Pioneer 46A20LX	4/2/24	8/1/24	15.7	15.7
Phillips	Soybean	Furrow	Asgrow 49XF4	5/9/24	8/21/24	12.4	12.4
Arkansas	Soybean	Furrow	Asgrow 48XF3	4/23/24	8/19/24	11.7	11.7
Randolph	Soybean	Furrow	Invictus 4859XF	4/18/24	8/10/24	12.0	12.0
Clay	corn	Furrow	Pioneer 14830 YHR	4/4/24	7/27/24	17.9	17.9
Clay	corn	Furrow	Pioneer 14830	3/30/24	7/22/24	20.2	20.2
Cross	corn	Furrow	DeKalb 68-35	3/29/24	7/25/24	16.7	16.7
Jackson	Corn	Furrow	DeKalb 68-35	3/29/24	7/25/24	16.5	15.3
Greene	corn	Furrow	DeKalb 66-06	4/3/24	7/28/24	13.5	13.5
Mississippi	corn	Furrow	Becks 6803	4/5/24	8/1/24	18.0	18.0
Phillips	corn	Furrow	Pioneer 1500	4/1/24	7/25/24	16.4	16.4
Lee	corn	Furrow	NK1677-3110	4/24/24	8/18/24	13.8	13.8
Lee	corn	Furrow	Revere 1289	4/17/24	8/7/24	11.6	11.6
Jefferson	Rice	Zero Gr	RT7331MA	5/1/24	8/15/24	10.2	10.2
Crittenden	Rice	Zero Gr	RT7421FP	4/21/24	8/14/24	15.8	15.8
Mississippi	Rice	Furrow	RT7521	4/16/24	8/9/24	17.7	17.7
Crittenden	Rice	Zero Gr	RT7521	5/12/24	8/31/24	12.1	12.1
Crittenden	Rice	Furrow	RT7302	4/5/24	8/5/24	16.5	16.5
Jackson	Rice	Furrow	RT7421FP	4/1/24	8/5/24	15.0	14.2
Lonoke	Rice	Zero GR	RT7323FP	3/30/24	7/29/24	24.8	19.2
Cross	Rice	MIRI	RT7321	3/28/24	7/27/24	17.3	17.3
Monroe	Rice	MIRI	RT753	4/15/24	7/31/24	16.5	16.5
Drew	Rice	Furrow	RT7521	4/1/24	7/28/24	23.5	22.5
Clay	Rice	Cascade	RT7421FP	4/7/24	8/6/24	18.0	18.0
Jefferson	Rice	Cascade	Ozark	4/3/24	7/29/24	14.3	14.3
Chicot	Rice	Furrow	CLL118	5/20/24	8/31/24	6.1	6.1
Jackson	Rice	MIRI	RT7421FP	4/22/24	8/15/24	14.0	13.1
Crittenden	Rice	MIRI	RT7521FP	4/18/24	8/11/24	15.7	15.7
Lee	Rice	Furrow	RT7521	4/10/24	8/6/24	17.1	17.1

Harvest Yield Estimate

In 2019, a minimum yield requirement was added to account for deficit irrigation and reasonable commercially acceptable yields. It is well known by irrigation scientists that high Water Use Efficiency (WUE) can be achieved through deficit irrigation. For 2021, minimum yield was set at 200 BPA for corn, 180 BPA for rice and 60 BPA for soybean. Those minimum yields were continued for 2024. Thus, the contestants must achieve a commercially acceptable yield and a high WUE to win. As the contest develops the judge panel can use past results to further justify a fair minimum yield.

2024

Contest Participants & Field Requirements

The 2024 Arkansas Irrigation Yield Contest was conducted on 58 commercial fields that were 30 acres or larger from across the Arkansas Delta. Seventeen counties participated in the program: Clay, Chicot, Cross, Crittenden, Drew, Greene, Jackson, Jefferson, Lawrence, Lee, Lonoke, Monroe, Mississippi, Phillips, Randolph, Woodruff, and White counties totaling 2,428 acres. If there is more than one water source for the field, each source is fitted with a flow meter (multiple pumps may supply the field through a single hydrant). Entries are for zero grade rice, levee rice, furrow rice, soybeans, and corn. A contestant may enter the competition with more than one crop but may not win for more than one crop per year. First-place winners may never win or enter the same crop irrigation category again, but are allowed to enter other crops in subsequent years. Unlike other yield contests that have multiple categories and production systems represented, the irrigation contest is limited: This limitation is meant to recognize as many irrigators as possible given the limited resources available. Contestants must be 18 years old at the time of entry, and promotion board members (and their spouses) who support the contest are not allowed to enter in the respective commodity category contest.

Description of Awards

Participants were awarded for highest water use efficiency in each crop category (Corn, Soybean, Flooded Rice and Furrow Rice) is given to each of the Twelve winners that contain various cash prizes and or products from the sponsors who generously contributed to the contest. Table 2 highlights the prizes for the winners. In total over $128,552 in cash and products are distributed to the winners of the contest.

Table 2. Prizes Awarded

Rice Division 1 each Flood, Furrow, and Zero Grade	Corn Division	Soybean Division
$12,000 seed tote credit sponsored by RiceTec	**$6,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board	**$6,000** cash sponsored by the Arkansas Soybean Promotion Board
$7,260 of RiceTec seed	**$3,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board	**$3,000** cash sponsored by the Arkansas Soybean Promotion Board
$3,740 of RiceTec seed	**$1,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board	**$1,000** cash sponsored by the Arkansas Soybean Promotion Board
$3,000 in cash from Delta Plastics		

For First Place Winners of the Corn, Rice (overall) and Soybean Division Prizes	
	Irrometer Telemetry reader and three watermark sensors $825 in product retail value $2,475 in total

	Aquatrac AgSense Soil Moisture Monitoring Unit $1,200 retail value $3,600 in total
	10" Seametrics AG 90 Insertion Magmeter (Flowmeter) $1,507 in product retail value $4,521 in total
	CropX Soil Moisture Monitoring Unit $1,500 retail value $4,500 in total
FarmLogs POWERED BY BUSHEL	One Year Subscription to Farm Logs $228 retail value $684 in total

Irrigation Water Management Tools

Contestants were asked about the Irrigation Water Management (IWM) tools they would utilize on the contest field when they enter the contest. All but two of the contestants used Computerized Hole Selection (Pipe Planner or PHAUCET or the Rice Irrigation app) during the 2020 growing season in their contest fields. Table 3 shows mixed use of sensors in the contest field. However, it is common, when sensors are used, to see them be used for decision making in several adjacent fields. Considering this, it is possible sensors are being used by contestants at a rate higher than these numbers indicate. The data from entry forms is incomplete, but shows positive change in computerized hole selection use. Furrow Irrigated Rice (FIR) continues to be a popular practice to use and increased from previous years.

Table 3. Percentages of Contestants Using Irrigation Technologies in Contest Field (%)

	Soil Moisture Sensors	*Pipe Planner*	*Furrow Irrigated Rice*	*Surge Valves*
2024	87	78	38	10
2023	85	100	54	22
2022	81	79	64	12
2021	87	97	80	35
2020	42	100	73	16
2019	40	43	38	28
2018	50	73	50	44

Contest 7 Year Data

The Arkansas Irrigation Yield Contest's primary goal is to encourage the use of irrigation water management tools by farmers. As an added benefit, data from 149 fields have been recorded across the delta region. Most importantly the WUE of each field was determined. Though WUE data from production fields can be found intermittently from various sources such as the Arkansas verification fields, a large data set of WUE from a number of locations across multiple years is not readily available. The data set from the competition, in addition to WUE, also provides the yield, applied irrigation, adjusted rainfall, and total water applied.

An effort was made to compare data from the seven years the contest was conducted, but it is difficult to infer trends in WUE over the years due to the variation among contestants' results. A wide range of management styles and field conditions are represented. Figure 6 shows the distribution of WUE over the seven years.

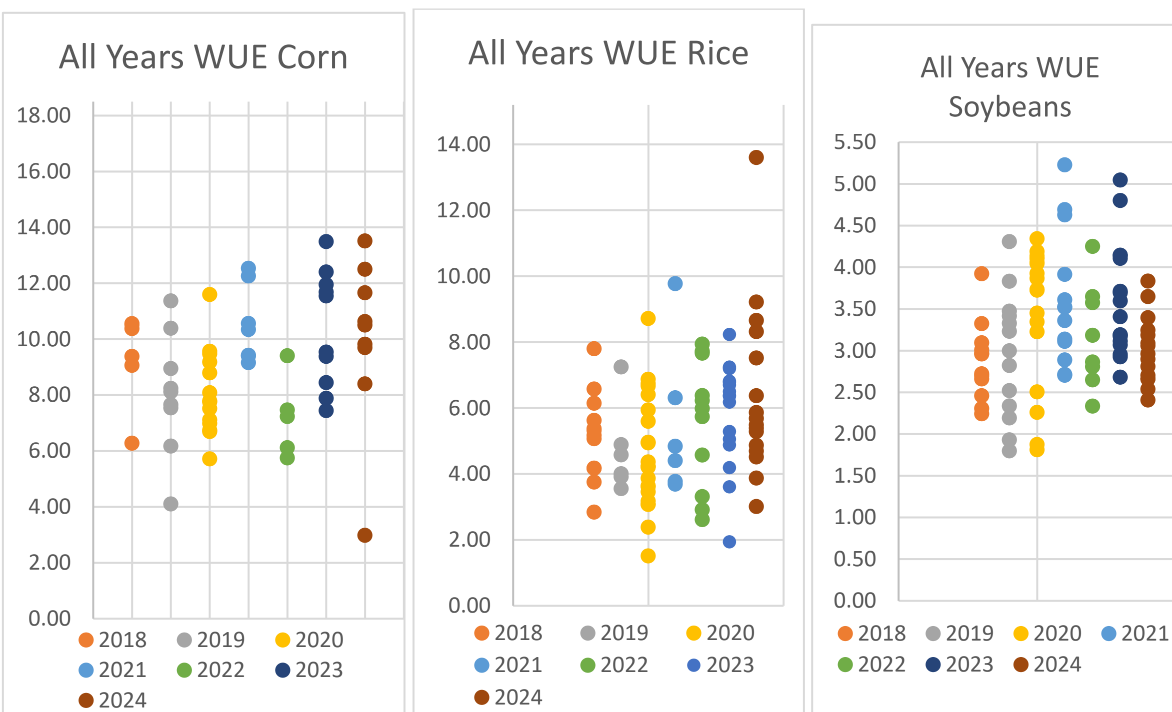
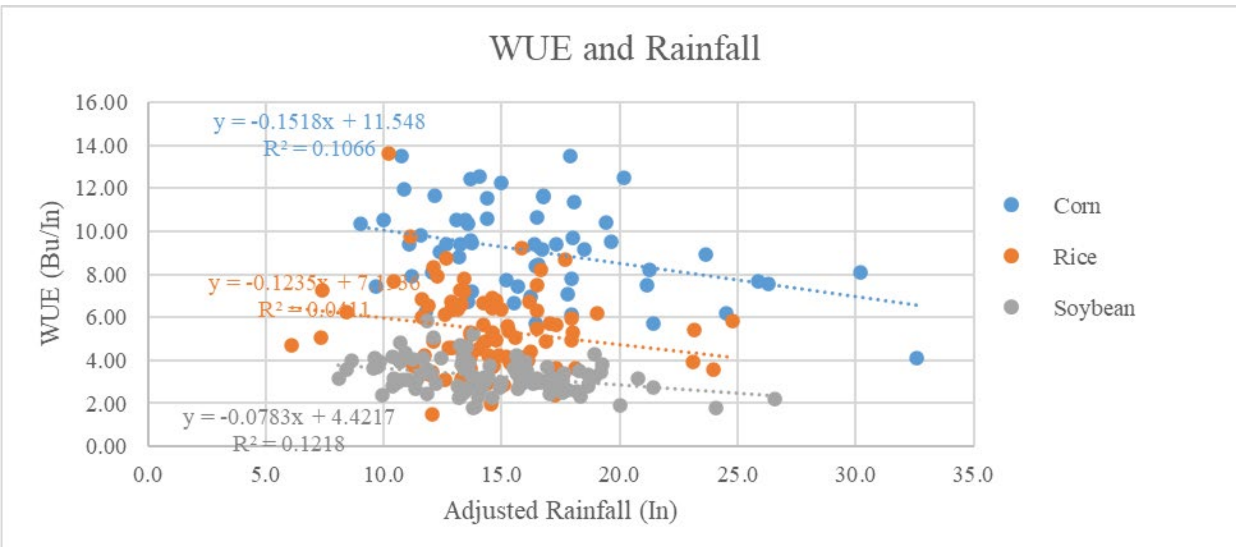


Figure 6. 7 Year Scatterplot for Rice, Corn, and Soybean Water Use Efficiency

Error! Reference source not found. The average WUE over the 7-year period for soybean was 3.22 Bu/In, the average for corn was 9.03 Bu/In, and the average for rice was 5.45 Bu/In.

In the WUE calculation, the amount of rainfall that the field receives can be a large component in the total water. More rain does not always translate to less irrigation water needed, but WUE is determined by both rain and irrigation water. By plotting rainfall against WUE using all seven years, linear regression and goodness of fit was determined. Across all three crop types, no linear relationship was found between rainfall and WUE Figure 7. Adjusted rainfall is used in this calculation as it was used to determine the WUE. However, fewer than ten of the 149 data points have an adjusted rainfall value that differs from the recorded rainfall. Thus, the amount of rainfall received is not considered a factor in the WUE results.

Figure 7. WUE vs. Rainfall for All Years and Crops



By plotting the yield against the WUE, linear regression was performed to determine the goodness of fit between WUE and yield as shown in Figure 8. Across all three crop types there is no significant relationship between yield and WUE. While it may appear that there is relationship between lower yields and lower WUE, in most instances the fields that are on the lower ends were irrigated as if they would yield higher but may have had confounding issues. This causes a normal amount of water to be used with a below normal yield resulting in a lower WUE. Thus, it is believed that the yield obtained is not a significant factor in the WUE for a contest entry.

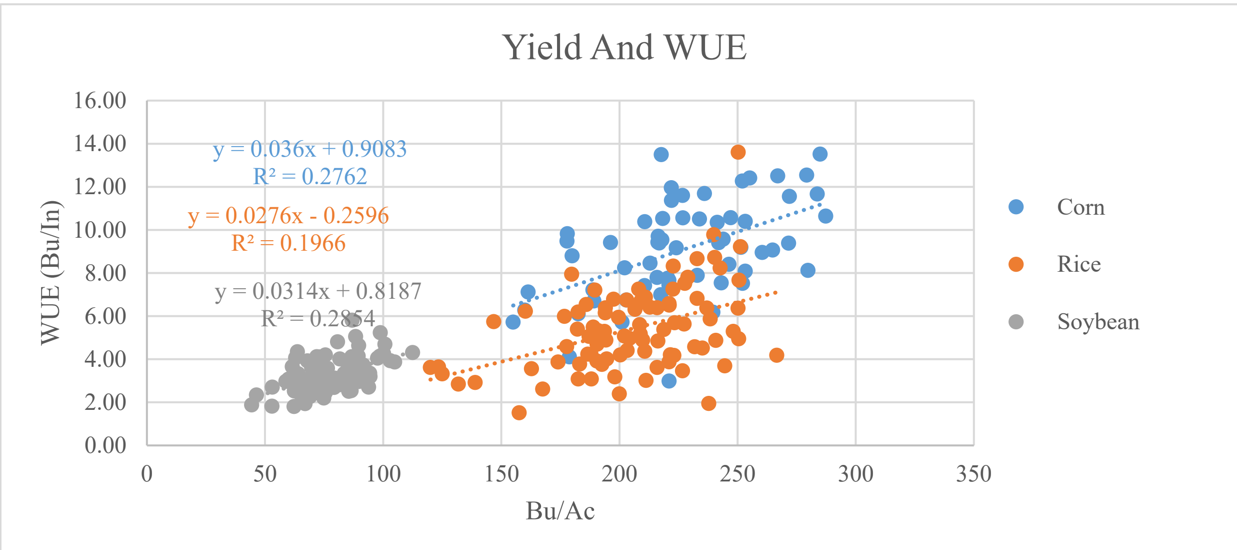
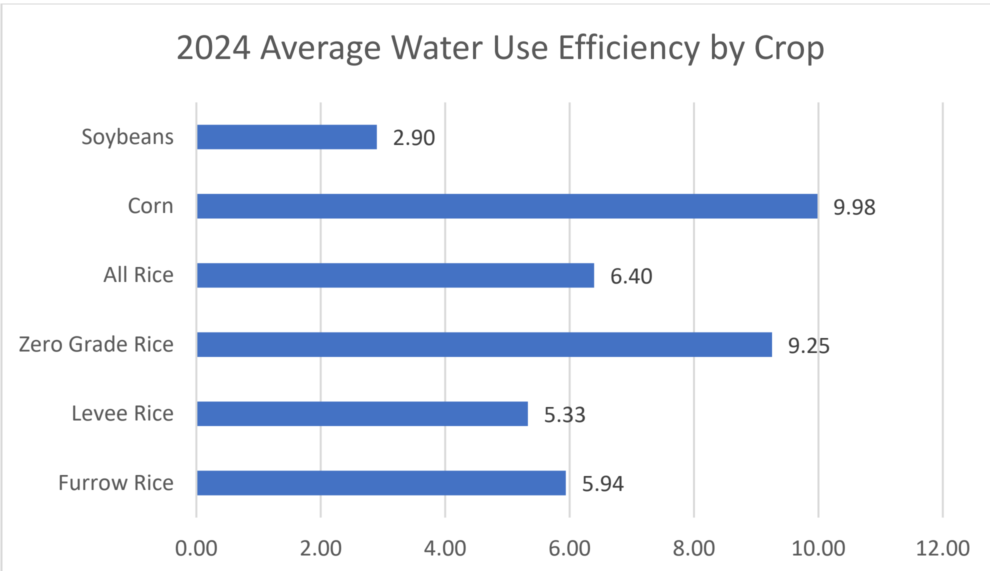


Figure 8. Yield vs. WUE for Six Years and All Crops

Contest Results

Results were calculated for each contestant. First the effective precipitation was determined, and meter readings were calculated and verified. The yield estimates were then taken from the verified harvest forms and the WUE was determined. Contestants were ranked from high to low. The winning meters were checked against a reference meter to confirm accuracy within five percent. The contest results were presented to a panel of three judges, who are experts in the field of irrigation, to review the technical methods used to determine the rankings. The judge panel reviewed the rankings and confirmed the results.

The following chart reports the average Water Use Efficiency for each crop category in the contest for comparison to the winners WUE. Water use efficiency is reported in bushels of grain per volume of irrigation water and precipitation depth. Soybeans averaged 3.00 bushels per inch, the rice category averaged 6.49 bushels per inch, and corn averaged 9.98 bushels per inch.



Corn Contest Results

Overall, 12 corn fields were entered into the contest. The average yield of corn grown for the contest was 255.12 BPA and the average water use efficiency of corn grown for the contest was 10.68 (Table 4). The 2024 winner achieved the highest Water Use Efficiency to date in the contest. The average yield was 42.5% higher than the state average for 2018 of 181 BPA (USDA National Agricultural Statistics Service, 2018). Corn yield was corrected to 15.5% moisture for every field. The highest yielding corn fields were in Clay and Jackson Counties with a yield of 285.1 and 287.4 BPA. The water use efficiency ranged from a high of 13.5 bushels/inch to a low of 3.0 bushels/inch. The average irrigation water added to corn contest fields was 13.78 inches. The highest irrigation water added to a corn contest field was 60.44 inches and the lowest irrigation water added was with 1.13 inches of irrigation. Four fields were withdrawn from the contest prior.

Table 4. Corn Yield and Water Use Efficiency

Grower	Yield (Bushels / Acre)	Irrigation (Acre inches / acre)	Rain (inches) (Unadjusted)	Rain (inches) (Adjusted)	Total Water Use (Inches)	Water Use Efficiency Bushels per Inch
Jeremy Wiedeman	285.12	3.7	17.9	17.9	21.5	13.5
Matt Ahrent	266.94	1.1	20.2	20.2	21.3	12.5
Kelby Wright	283.74	7.6	16.7	16.7	24.3	11.7
Contestant 4	287.37	11.8	16.5	15.3	27.0	10.6
Contestant 5	233.92	8.8	13.5	13.5	22.3	10.5
Contestant 6	216.43	4.3	18	18	22.3	9.7
Contestant 7	246.35	12.9	16.4	16.4	29.3	8.4
Contestant 8	221.05	60.4	13.8	13.8	74.2	3.0

Rice Contest Results

The Rice Irrigation Contest produced a broad range of results in terms of water use between the twenty-four fields entered (4 Zero Grade, 10 furrow, and 10 levee). In 2024, furrow irrigated rice was used in the six contest fields harvested, with an average yield of 214 BPA and an average WUE of 5.94 bushels/inch. Flood irrigation was used on the six fields harvested. The average yield was 225 BPA and average WUE was 5.33 bushels/inch. Zero grade irrigation was used on the 4 fields harvested. The average yield was 241 and the average WUE was 9.25 bushels/inch. Tabular results from the rice contest are shown in Table 5**.** All rice entries that were officially harvested met the minimum yield. In Row Rice, and four entries withdrew prior to harvest. In levee rice, four entries withdrew prior to harvest. In the zero-grade category all fields were harvested. Five fields were planted with RT FP 7521,four fields with 7421, one field with 7321, one each of 7331, 7323, 7302, and 753.There were two fields planted with DG 263, and there was one field of CLM04.

The average rice yield in the contest was 225.13 BPA, and the average rice water use efficiency was 6.4 bushels/inch Table 5. The yield average for the rice contest was 34.7% higher than the state average rice yield of 167 BPA for 2018 (USDA National Agriculture Statistics Service, 2019).

Table 5. 2024 Rice Yield and Water Use Efficiency

Grower	Irrigation Method	Yield (Bushels / Acre)	Irrigation (acre inches / acre)	Rain (inches) (unadjusted)	Rain (inches) (adjusted)	Total Water Use (inches)	Water Use Efficiency (Bushels / Inch)
Kelby Wright	Levee	223	22.9	17.3	17.3	40.2	5.56
Jon Carroll	Levee	189	18.0	16.5	16.5	34.5	5.48
Blake Ahrent	Levee	248	29	18	18.0	47.0	5.28
Contestant 4	Levee	241	35.1	14.3	14.3	49.5	4.87
Contestant 5	Levee	235	39.0	13.1	13.1	52.1	4.51
Contestant 6	Levee	221	41.4	15.7	15.7	57.0	3.87
Cody Fincher	Row	233	9.2	17.7	17.7	26.9	8.66
Rieves Wallace	Row	228	13.8	16.5	16.5	30.3	7.5
Ty Graham	Row	237	23.0	15.0	14.2	37.2	6.4
Contestant 4	Row	182	11.3	23.2	22.5	33.8	5.4
Contestant 5	Row	191	34.5	6.1	6.1	40.6	4.7
Contestant 6	Row	211	53.1	17.1	17.1	70.2	3.0
Chad Render	Zero	250.3	8.2	10.2	10.2	18.4	13.6
Mark Felker	Zero	251.2	11.4	15.8	15.8	27.3	9.2
Rieves Wallace	Zero	222.8	14.7	12.1	12.1	26.8	8.3
Contestant 4	Zero	238.5	21.5	24.8	19.2	40.7	5.7

The average yield for all rice fields was corrected to 12% moisture. Yields in the rice contest ranged from a high of 251 BPA (zero grade rice) to a low of 182 BPA (Furrow rice). The average irrigation water added for all contest rice fields was 24.0 inches. The highest irrigation water applied to a contest rice field was 53.1 inches and the lowest amount of irrigation water added to a contest rice field was 8.2 inches (Table 5). The average WUE was 6.40 Bu/in. An unusual situation occurred in zero grade rice, in that up until now the highest WUE was 9.77 Bu/in. Render exceeded this by over 3 Bu/in, which is a large increase from what others have been able to accomplish. It should be noted that this is a significant increase over the highest WUE recorded previously. Render used a new Maxace variety from Ricetec that he attributed to his success in the contest.

Soybean Contest Results

Twenty-two fields were entered in the soybean division. The average yield for all soybean contest fields was 78.7 BPA. The soybean contest average water use efficiency was 2.90 bushels/inch (Table 6). All contest fields were corrected to a 13.5% moisture for the soybean yields.

Table 6. Soybeans Yield and Water Use Efficiency

Grower	Yield (Bushels/Acre)	Irrigation (ac-in/ac)	Rain (inches) (unadjusted)	Rain (inches) (adjusted)	Total Water Use (inches)	Water Use Efficiency (Bushels/ Inch)
Frank Binkley	88.4	9.7	13.3	13.3	23.1	3.83
Ty Graham	61.6	7.1	10	9.6	16.9	3.69
Danny Gipson	86.5	7.9	17.6	17.6	25.5	3.39
Contestant 4	76.3	9.1	14.9	14.4	23.5	3.24
Contestant 5	94.5	8.9	21.3	21.3	29.7	3.18
Contestant 6	68.6	11.4	10.8	10.8	22.2	3.09
Contestant 7	75.7	7.9	16.8	16.8	24.74	3.06
Contestant 8	89.7	13.6	16.7	16.7	30.28	2.96
Contestant 9	68.1	11.3	12.2	12.2	23.5	2.90
Contestant 10	81.7	16	13.1	13.1	29.07	2.81
Contestant 11	93.9	21.3	13.5	13.5	34.75	2.70
Contestant 12	69.5	8.9	17.3	17.3	26.14	2.66
Contestant 13	74.1	12.2	15.7	15.7	27.8	2.66
Contestant 14	86.5	16	18.2	18.2	34.1	2.54
Contestant 15	64.9	17	11.7	9.9	27.0	2.41
Below min yield						
Contestant 16	58.8	6.9	12.4	12.4	19.3	3.05
Contestant 17	53.5	16.9	11.7	11.7	28.6	1.87
Contestant 18	48.7	10	12	12.0	22.0	2.21

The average irrigation water added to a contest soybean field was 11.78 acre-inches per acre added. Table 6 compared to the irrigator reported state average soybean water use of 16.3 acre-inches (Arkansas Water Plan, 2014). The highest irrigation water use by a contested soybean field was 21.26 inches. The lowest irrigation water applied to a contested field was 6.90 inches. Four contestants dropped out of the contest prior to harvest, and three contestants did not meet the minimum yield. The maximum yield in the contest was 94.5 bushels/acre while the contest average was 74.5 BPA Table 6.

Social Media

The contest is promoted primarily on Twitter through the personal accounts of Dr. Chris Henry (@cghenry_ua,) with 609 followers, Robert Goodson (@goodsonretired) with 824 followers, and Russ Parker (@russparker11) with 447 followers. There was a contest twitter account established in 2023, Arkansas Crop Per Drop Contest (@CropPerDropAr) with 40 followers.

Winner History

The highest historical WUE's are presented in Table 11. As the contest has developed, WUE's records are developing. The table shows the top three highest WUE recorded per category in the contest and the year it was achieved.

Table 11. Historical Water Use Efficiencies in Bu/in, name of winner, and year achieved.

Highest Historical WUE Rank	Corn	Levee Rice	Furrow Rice	Zero Grade Rice	Soybeans
1st	13.5 Bu/in Weideman (2024)	8.72 Bu/in Fincher (2020)	9.77 Bu/in Hoskyn (2021)	13.6 Bu/in Render (2024)	5.23 Bu/in Render (2021)
2nd	13.49 Bu/in Arent (2023)	7.80 Bu/in Morris (2018)	8.66 Bu/in Fincher (2024)	8.23 Bu/in Whitaker (2023)	4.34 Bu/in Wiedeman (2020)
3rd	12.53 Bu/in Cain (2021)	7.66 Bu/in Garner (2022)	7.94 Bu/in Render (2022)		4.34 Bu/in Wray (2019)

Conclusions

The Arkansas Irrigation Yield Contest is a novel approach to promoting the adoption of Irrigation Water Management Practices. While there is a monetary prize for motivation, the feedback mechanism that provides data to each contestant on how they compare to their peers provides each participant with a benchmark to improve water management skills and to recognize those that have achieved a highly developed skill to manage water resources. The impact and synergisms of utilizing the many water management practice technologies that are available are also quantified through this program. The 2024 Irrigation Yield Contest results created many success stories. There is a group of contestants who are multi-year participants, with several in the group having won in multiple crop categories. Many of these multi-year contestants continue to improve their water use efficiency year over year, and become comfortable with increasing allowable depletions and comfort with technology. Our observation is that the adoption of moisture sensors, along with use of the Arkansas Watermark Tool app in the case of watermark sensors, we witness more irrigators using these tools to make informed decisions. Another long-term observation has been that management is a large factor in those that perform well in the contest, and that the IWM tools and technologies are aids that help improve their ability to manage irrigation more effectively.

First place soybean entrant Frank Binkley is in his fourth year of the contest, He has used moisture sensors with telemetry, the Arkansas Watermark Tool app, and a surge valve to time irrigations and increase water infiltration.

Records were obtained in the highest WUE for corn and zero grade rice and the average trend is that WUE are improving in Arkansas in corn, soybeans and rice. Arkansas farmers continue to improve their ability to produce more crop per drop.

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