2019 Annual Arkansas Irrigation Yield Contest

"Most Crop Per Drop"

U of A
DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Conducted by:
University of Arkansas Rice Research & Extension Water Management Team

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Acknowledgments:

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Extension Agents/Supervisors	County
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Allison Howell	Clay
Rick Wimberley	Cross
Dave Freeze	Greene
Kurt Beaty	Jefferson
Bryce Baldridge	Lawrence
Stan Baker	Lee
Steven Stone	Lincoln
Keith Perkins	Lonoke
Shawn Lancaster	Mississippi
Shawn Payne	Phillips
Robert Goodson	Phillips
Craig Allen	Poinsett
Jeffrey Works	Poinsett
Brent Griffin	Prairie
Mike Andrews	Randolph
Jan Yingling	White
Brett Gordon	Woodruff

Arkansas Natural Resource Conservation Service	
Supervisors	County
Daniel Baldwyn	Clay
Austin Frames	Cross
Adam Eades	Greene
Scott Crabb	Lincoln/Jefferson

All Grain Merchandisers & Personnel at Contestant Affiliated Elevators

Executive Summary

The Arkansas Irrigation Yield Contest, “Most Crop per Drop”, is a research and Extension program that promotes the adoption of irrigation water management practices. Over 30 producers from fifteen counties throughout the Arkansas Delta region participated in the contest. This was an opportunity for farmers to explore their individual aptitude to reduce energy, water use, labor, and improve profitability. The contest produced notable data results for each grain crop category (corn, rice and soybeans) and water use efficiency (bushels/acre-inch/acre), yield (bushels/acre), and total water use (acre-inches/acre). The winner from each crop category was determined by the contestant with the highest water use efficiency. Each producer used at least one irrigation management tool (computerized hole-selection, multiple inlet rice irrigation, soil moisture sensors or surge irrigation).

Rules specific to an irrigation contest were developed and a website was created to host information and entry and harvest forms. The contest was adapted from traditional yield contests [2,7,8,10]. Unlike traditional yield contests, the Arkansas Irrigation Contest is awarded to the contestant with 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 is measured with portable propeller-style flow meter that are 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). There were three contest categories which included corn, rice, and soybeans and total prizes awarded to eight winners totaling $62,809.

Cross County producer, Karl Garner, was first in the corn division with a yield of 222 bushels per acre and WUE of 11.4 bushels per acre-inch. Greene County producers, Terry and Clay Smith were second in the corn division with a yield of 253 bushels per acre and a WUE of 10.4 bushels per acre-inch. Randolph County producer, Greg Baltz, was third in the corn division with a yield of 260 bushels per acre with a WUE of 8.9 bushels per acre-inch.

Poinsett County producer, James Wray, was first in the soybean division. Wray achieved a yield of 112 bushels per acre with a WUE of 4.3 bushels per acre-inch. Mississippi County producer, Becton Bell, was second for the soybean division with a yield of 88 bushels per acre and a WUE of 3.8 bushels per acre-inch. Cross County producer, Clint Boles, was third in the soybean division with a yield of 73 bushels per acre and a WUE of 3.5 bushels per acre-inch.

Lincoln County producer, John Allen McGraw, was first in the rice division. McGraw achieved a yield of 208 bushels per acre and WUE of 7.8 bushels per acre-inch. Greene County producer, Joey Massey, was second in the rice division with yield of 210 bushels per acre and WUE of 4.9 bushels per acre-inch.

Awards for the winners were sponsored by Ricetec, the Arkansas Corn and Grain Sorghum Promotion Board, the Arkansas Soybean Promotion board, the Mars Corporation, McCrometer, Seametrics, Delta Plastics, Irrometer, Trellis, and Agsense,

Each participant receives an individualized report card, providing feedback on their WUE and

yield performance on their farm compared to the aggregated results from all the entries. The contest is strongly supported by the volunteer 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.

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 nearly fully 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 demonstration of IWM practices at the county and local level.
- Provide a feedback mechanism for irrigators to benchmark their irrigation management skills.

Figure 1 shows the geographic distribution of the contestants. Participation in the contest is entirely voluntary. Generally, the distribution of the contestants was well distributed by crop type. For the 2019 growing season, there has been a new expansion of contestant fields south of Arkansas County. The winners were well distributed, in that no county or location seemed to have an advantage over another. Soil type is known to play a role in soil water storage. Most contestants (Figure 2) were located on silt loam soils (16), However, there were several clay or silty clay soil sites represented (8). Only 1-2 locations were classified as a fine sandy loam. Figure 3 gives a visual illustration of critical water declines in the Arkansas Delta over a ten – year period. The ten-year period was from 2008 to 2018. Groundwater declines are highest in the Northeast Counties such as St. Francis, Cross and Poinsett.

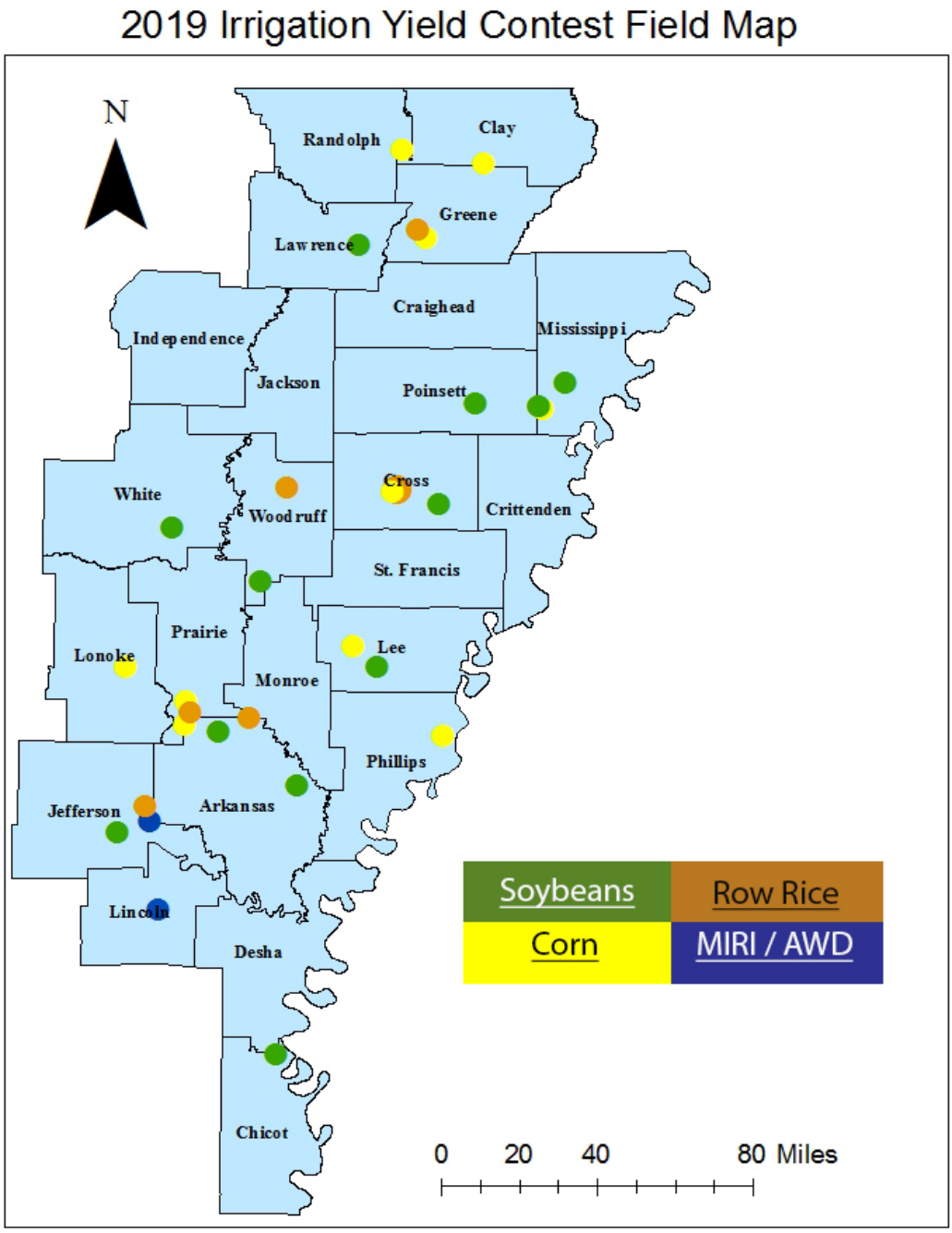


Figure 1. Contestant Field Locations

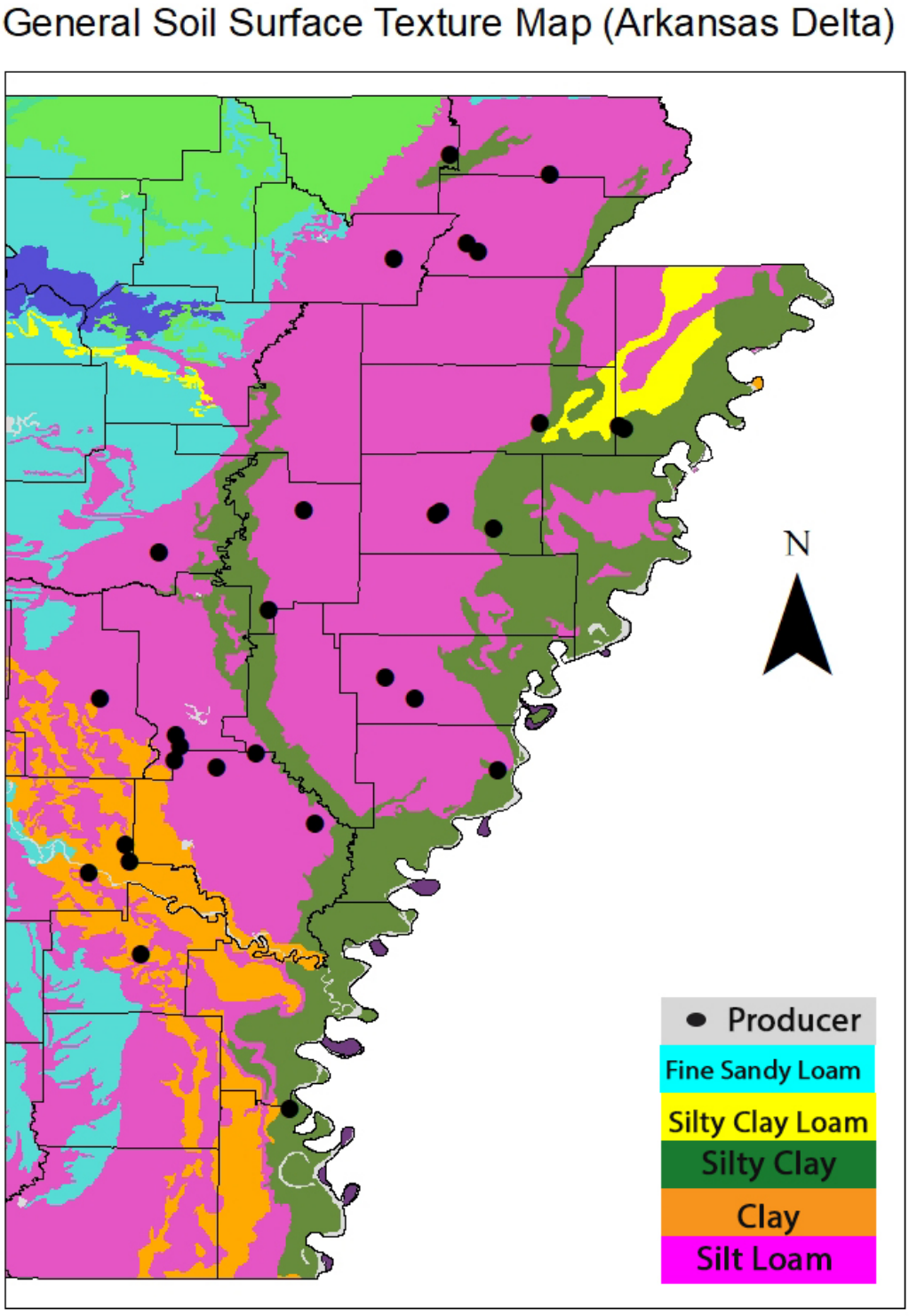


Figure 2 Contestant Soil Texture Map

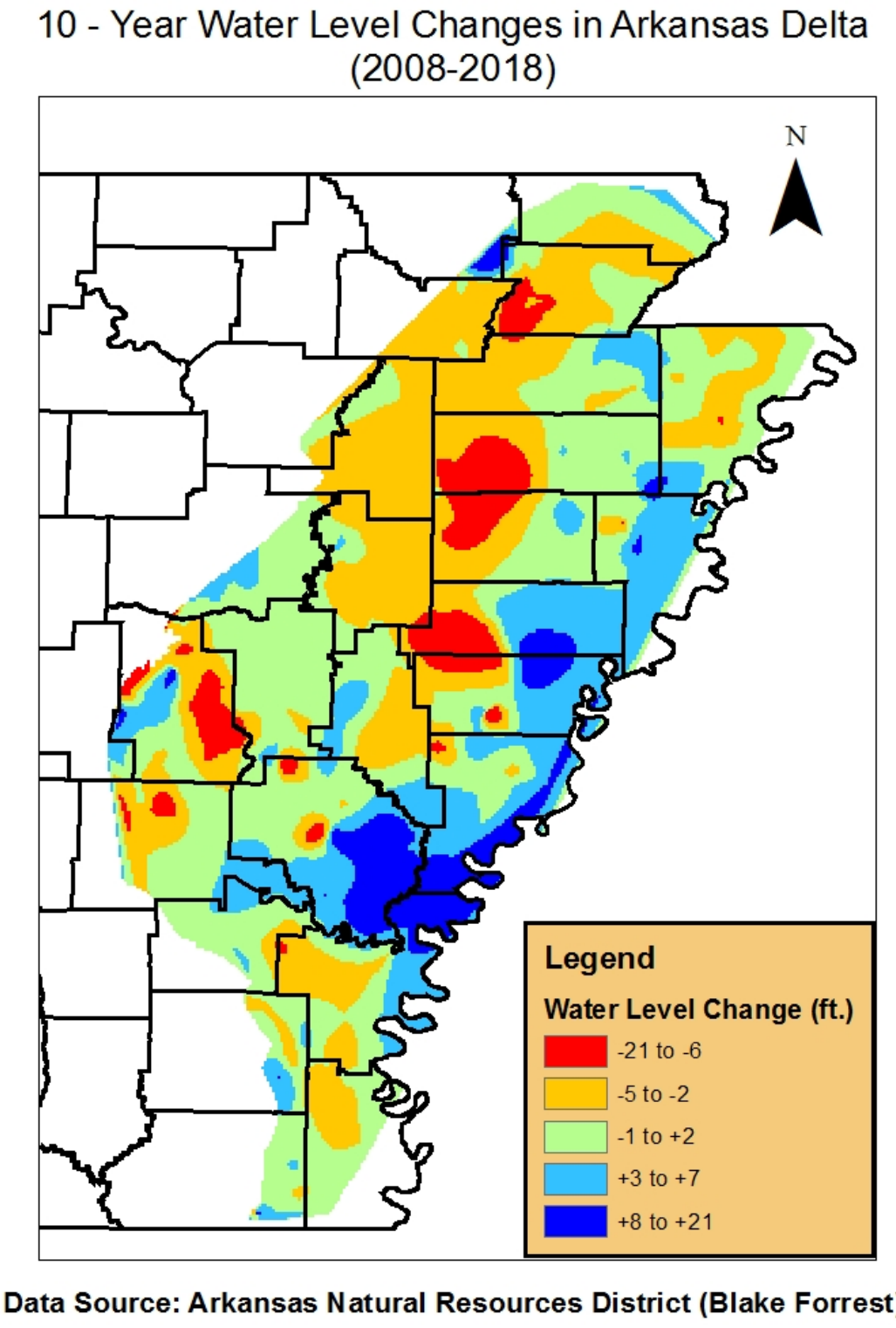


Figure 3. 10-Year Water Level Changes in Arkansas Delta

Materials and Methods

Rules were drafted in the Spring of 2018 then adjusted in the spring of 2019 and were inspired by long-standing yield contests [2,7,8,10]. Harvest yield estimates are similar 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, harvest from the top of the field to the bottom and skip two harvest machine widths between paths. A supervisor and a flowmeter are required to participate in the contest. UADA staff facilitates the contest, however a panel of impartial technical irrigation experts serve as judges to review and confirm the final results and methods.

Water Use Efficiency

Water use efficiency (WUE) is defined as the amount of yield produced for a specified amount of water input. Irmak et al. [6] defines Crop Water Use Efficiency as a benchmark water use efficiency where,

$WUE_b = Y_i / (P_e + IR + \Delta SW)$ (Equation 1)

WUE_b = benchmark water use efficiency
Y_i = yield of irrigated crop (bu/ac)
P_e = effective rainfall (in)
IR = Irrigation applied (in)
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 final 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 final 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, thirty days after emergence and 3 inches for the remainder of the season until maturity. Rainfall events over 2 inches in depth are excluded after 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, and this is the reasoning behind using this as an effective rainfall depth. Even with this adjustment, there were only a few extreme

events, and the adjustment did not have any impact on the final results in 2018 and 2019. In the future more work is needed to develop a regionally specific adjustment for effective rainfall. Thus the equation (Equation 2) used to calculate the water use efficiency for each contestant is defined as the harvest yield estimate divided by the total water delivered to the field,

WUE = Y / (P_e + IRR) where, (Equation 2)
WUE = Water Use Efficiency in bushels per acre-inch
Y = Yield estimate from harvest in bushels per acre
P_e = Effective precipitation in inches.
IRR = Irrigation application in ac-inches/ac.

Meter Sealing

Irrigations were totalized using 8" and 10" portable propeller mechanical meters manufactured by McCrometer. Each meter was sealed using the following process.

Figure 4. 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 lines.

Universal hydrants are secured to the alfalfa valve and from the alfalfa valve to the meter using the same procedure.
Any additional fittings are also secured using this procedure if needed to ensure that no other irrigation water source can contribute to the field.

Figure 5. Example of alfalfa valve sealing done to exclude other sources.

Figure 4 shows a typical meter sealing configuration. All other sources of irrigation to that field were also sealed to prevent non-measured irrigation sources from being used in the contest field (Figure 5).

Only mechanical propeller meters are used in the contest. They are required to have adequate straight run pipe before the impeller but can include vanes and flow straighteners if they meet the manufacture guidelines. For the winning entries, all meters are checked against a reference meter and must test within 5% of the reference
meter, else the water use is adjusted according to the reference meter and the contest results adjusted accordingly.

Rainfall Estimation

Farmlogs™ (Ann Arbor, MI) and Climate Corporations Fieldview™ (San Franciso, CA). 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. Farmlogs™, Climate Corporation Fieldview™ and twelve rain gauges was used throughout the irrigation season to collect rainfall accumulation. The rainfall values were added with total applied irrigation to get the total water use. An analysis was conducted to see if tipping bucket measurements at weather station locations were different from two different commercially available computer model predictions. Figure 6 shows the total rain during the growing seasons the contest has been conducted. As can be seen there was an average nearly 7 inches more rainfall in 2019 than 2018.

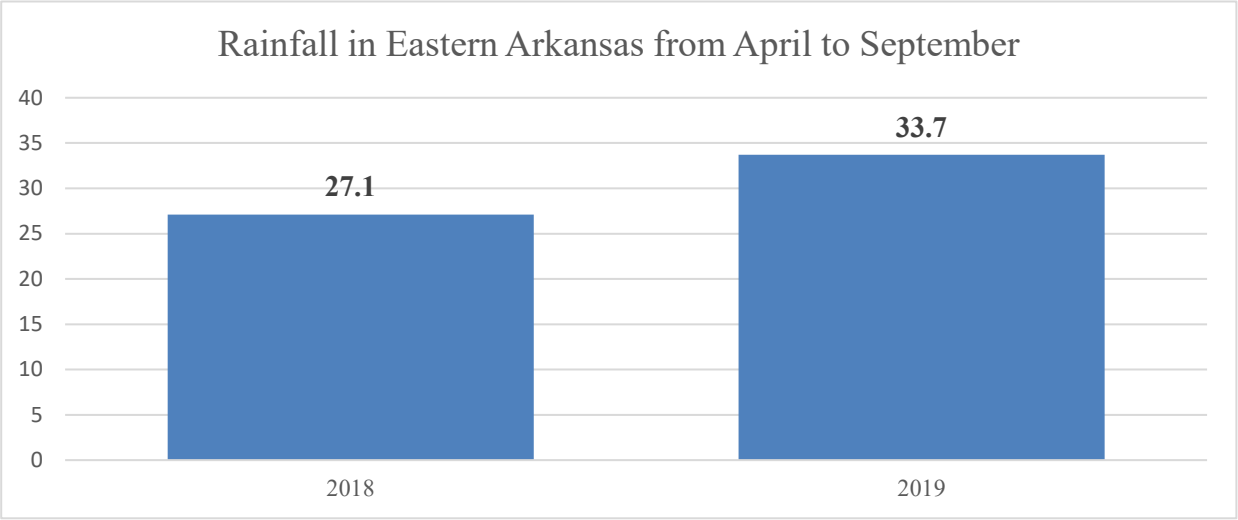


Figure 6. Total Rainfall from contest locations.

The precipitation was assessed for each contest site utilizing two commercial rain prediction services, Farmlogs™ and Fieldview™. These services use 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 is assumed to be equally bias across all contest sites.

Table 1. Rainfall from April 1 to September 30, 2019 for 3 methods

	Rain bucket	Farmlogs	Climate Corp Fieldview
Mcgehee	30.0	32.7	33.1
Gould	40.1	34.2	31.9
Stuttgart	28.5	35.0	30.4
Carlisle	35.7	37.2	34.8
Keiser	26.2	26.4	26.7
Delaplaine	26.9	28.7	29.0
Mean	31.2	32.4	31.0

In 2019, data from six weather stations was compared to the rainfall prediction generated from Farmlogs and Fieldview during the growing season. Using an Analysis of Variance (ANOVA) no difference was found in the difference (p=0.502) in annual rainfall from the weather station measured data to the computer predictions.

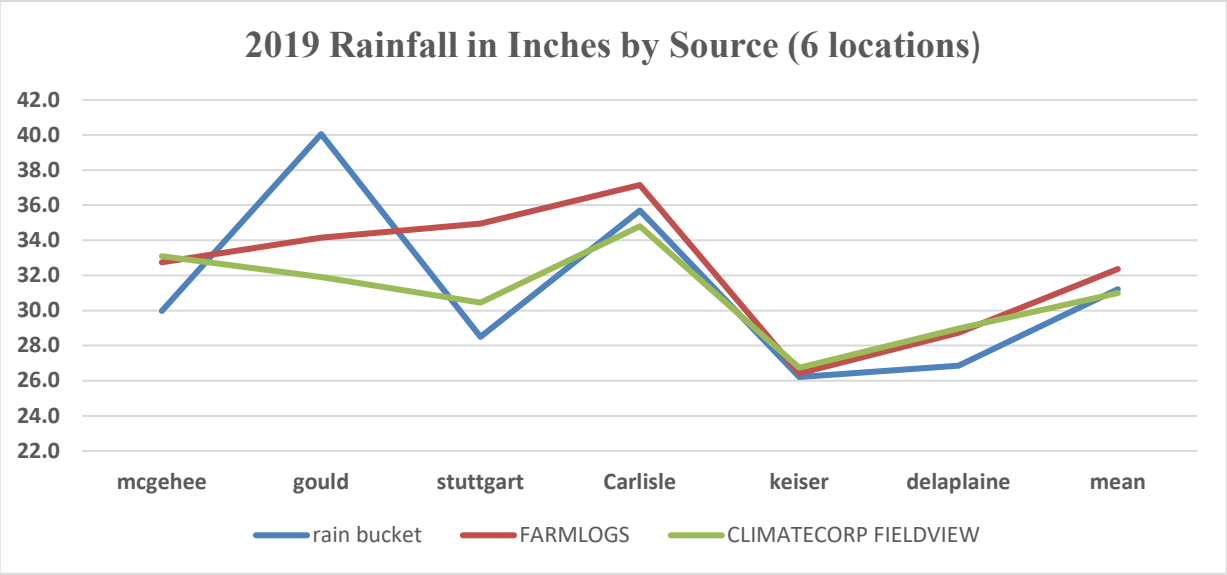


Figure 7. Rainfall from 6 weather station sources for 2019

For 2019, six locations, identified and monitored during the growing season to have well maintained rain buckets. From April 1 to September 30, 2019, rainfall data was collected to provide a comparable data point for each location and data source (Figure 7). A 2-year comparison was later analyzed as well with 18 locations from June 5 to August 31 have no

significant difference between rain buckets, Farmlogs, and Climate Corp Fieldview (Figure 8).

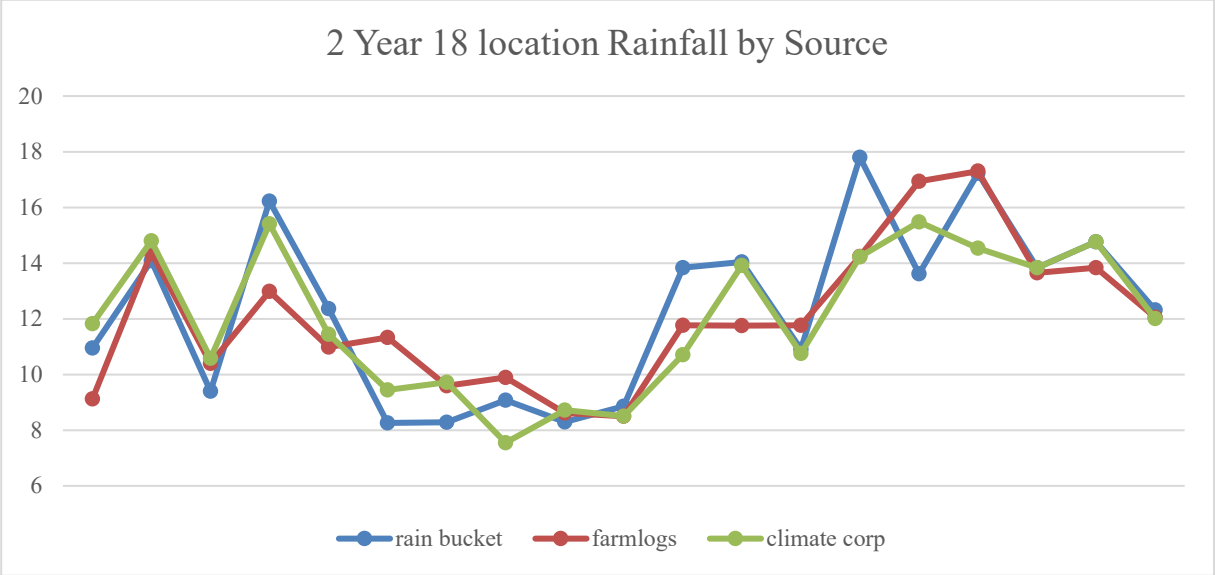


Figure 8. Two-year 18 location rainfall

Farmlogs ™ and Fieldview™ produced similar results when compared to rain gauges. An absolute match was not necessary in terms of data accuracy because it was more important to collect rain information for every location from one method, but these two programs were used to check against each other for consistency. Also, for the contest, accumulated seasonal rainfall was considered more important than single event accuracy. Rainfall is reported for each contest field from emergence to maturity. Information from the contest entry forms about the planting date gave us an emergence date and genotype/cultivar/hybrid grown provided crop maturity.

The first source was the National Weather Service (NWS) but their data was more difficult to obtain because it is part of an estimation product that required some interfacing. Farmlogs™ was easier to use because rain data was provided in tabular form. Farmlogs™ utilizes raw weather data from the NWS then establishes a proprietary model to estimate precipitation for a given location. Climate Corp Fieldview™ application was found to be dependable as well for rain data collection. Retrieving data from Fieldview™ was more difficult and time consuming than Farmlogs™. A difference between the programs was that Fieldview™ reported more events but less rain per event, where Farmlogs™ reported fewer events but larger ones. For example, Fieldview™ reported several small events but the total would be near to one reported event by Farmlogs™. However, the difference in the total rainfall depth reported was not significantly different. Because of the ease in reporting, Farmlogs™ was used for the contest. Rainfall estimation seems to under report heavy rainfall events compared rain bucket data. However, Farmlogs™ seems to report high rainfall more often than Fieldview™. Table 2 shows the mean rain data comparing locations where tipping bucket rain stations are located and where predictions for Farmlogs™ rainfall to Fieldview™ rainfall estimates were compared.

The 2018 and 2019 18 locations of raw data was compared to the rain prediction services, Farmlogs™ and Fieldview™. A one- way Analysis of Variance (ANOVA) was done to test if

there were numerical differences between rain gage data and the estimates generated from Farmlogs™ and Fieldviews™. The differences between the groups was not significantly different (p=0.95), and the data was found to have equal variances and normality. The lack of difference suggests that using the computer rainfall prediction method is a reliable way to determine rainfall contributions to contest fields. Additional data will be collected in future years to confirm the reliability and accuracy of this approach to rainfall estimation for the contest. At this time it appears the current approach of using Farmlogs™ to estimate season long rainfall is appropriate.

Table 2 shows the irrigation system type, maturity, planting date and season long rainfall for each of the contest categories, corn, rice and soybeans. Most of the contestants use furrow irrigation and similar maturities for the contest.

Table 2. 2019 Contest Site Rainfall Amounts

		IRR		Relative Maturity	Planting Date	Rainfall Inches
Location	**Crop**	**type**	**Variety**	**Or GDD**		
Wynne	corn	furrow	DK6744	117	5/10/2019	18.04
Helena	corn	furrow	DK6772	117	4/14/2019	22
Walcott	corn	furrow	DK6744	117	4/22/2019	19.42
Pocahontas	corn	furrow	DK6432	114	3/26/2019	23.64
Carlisle	corn	furrow	DKC6744	117	5/16/2019	21.27
Moro	corn	furrow	P1870YHR	118	3/26/2019	30.2
Slovak	corn	furrow	DKC6744	117	4/1/2019	25.85
Whitton	corn	furrow	DK6744	117	4/1/2019	26.29
Knob	corn	furrow	DKC7027	120	4/1/2019	24.49
Slovak	corn	furrow	Agrigold 6544	115	4/23/2019	32.58
Star City	rice	AWD	RT Gemini 214	early	5/3/2019	15.39
Pine Bluff	rice	MIRI	Diamond	med early	4/1/2019	27.11
Slovak	rice	furrow	753	early	5/7/2019	19.59
Altheimer	rice	furrow	CLXL745	very early	6/1/2019	14.91
Walcott	rice	furrow	RT7311	early	4/10/2019	18.65
Mccrory	rice	furrow	RT7311	early	5/17/2019	15.05
Stuttgart	rice	furrow	753	early	5/24/2019	18.13
Altheimer	rice	furrow	CLXL745	very early	6/1/2019	14.91
Wynne	rice	furrow	RT7311	early	4/3/2019	25.05
Payneway	soybeans	furrow	P48A60X	4.8	4/12/2019	19.58
Dyess	soybeans	furrow	Progeny4620	4.6	4/28/2019	19.2
Parkin	soybeans	furrow	Stine 47LF32	4.7	5/17/2019	17.17
Hoxie	soybeans	furrow	P47T89	4.7	5/17/2019	15.33
St Charles	soybeans	furrow	A45X8	4.5	4/24/2019	20.88
Aubrey	soybeans	furrow	Dynagro43SX27	4.3	4/30/2019	20.15

Cotton Plant	soybeans	furrow	GO SOY 48C17	4.8	5/25/2019	15.14
St Charles	soybeans	furrow	A45X8	4.5	4/24/2019	20.88
Halley	soybeans	furrow	Credenz 45-50	4.5	5/5/2019	16.14
Whitton	soybeans	furrow	A47X6	4.7	5/10/2019	16.32
Griffithville	soybeans	furrow	AG46X6	4.6	3/26/2019	30.42
Gould	soybeans	furrow	P48A32	4.8	4/3/2019	26.28
Stuttgart	soybeans	furrow	Mission 4637	4.6	5/5/2019	21.64
Mean						**21.0**

Harvest Yield Estimate

The yield estimate for the contest is determined by harvesting part of the field with a neutral party observer or supervisor. The yield estimate is determined by harvesting a three-acre sample of the contest field. Every yield contest was witnessed or supervised by a third party. Supervisors must not have a financial interest in the contest field. In most cases extension agents and or NRCS personnel are contest supervisors.

Supervisors are encouraged to help with the decision making of irrigation decisions and can be involved during the season. Harvest operations were witnessed by supervisors or University of Arkansas Division of Agriculture (UADA) staff designated on the entry form. Before the selected harvest, the combine grain hopper, grain cart, and truck hoppers are inspected and confirmed to be empty. A minimum of three acres is harvested using certified scale weights from a public grain buyer. The supervisor witnesses the full and tare weighing of the harvest truck.

Yields are adjusted to 12% moisture for rice, 13.5% for soybeans and 15% for corn. Foreign matter in excess of 1% is deducted from the yield. The winning entrants provided a yield map of the entire field entered to confirm that the entire field was irrigated the same as the harvest yield check. Area must be measured and certified by a supervisor. The corn and soybeans harvest were generally accomplished by measuring row lengths and width of cut.

Fields were measured using a digital rangefinder or measuring wheel. At least three acres of the 30 acres was required to be harvested. Passes from the top to bottom of the field were required after turn row removal. Up to 3 harvest width passes are allowed on the turn row to facilitate harvesting the yield check.

For 2019, a minimum yield requirement was used 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. Arbitrary minimum yields were 200 BPA for corn and rice and 60 BPA for soybeans. 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.

2019 Contest Participants & Field Requirements

The 2019 Arkansas Irrigation Yield Contest was conducted on 30 commercial fields across the state. Fifteen counties participated in the program: Arkansas, Chicot, Clay, Cross, Greene, Jefferson, Lawrence, Lee, Lincoln, Lonoke, Mississippi, Poinsett, Phillips, Prairie, Randolph, Woodruff, and White counties totaling 1,668 acres. The field may have only one irrigation water source or riser to the field (multiple pumps may supply the field through a single hydrant). Tables 8, 9 and 10 below display the field characteristics and planting information for each of the 30 entries. Entries are for rice, soybeans, and corn irrigated fields. A copy of the FSA Form 578, including farm summary were submitted with the contest entry form which confirms irrigation and production history. A contestant may enter for more than one crop but may not win for more than one crop per year. Winning contestants may not enter for the same crop, once a person wins first place for a crop, they cannot win for that crop again. Unlike other yield contests, that have multiple categories and production systems represented, the irrigation contest is limited, thus 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 spouses) who support the contest are not allowed to enter in the respective commodity category contest.

Contest results are shown in Table 3 for corn, Table 4 for soybeans and Table 5 for rice.

Table 3. Contest Corn Field Characteristics

Producer	previous crop	planting population	energy source	water source	gpm flow	row spacing	genotype	acres
1	soybeans	35,000	electric	well	800	30	DK6744	37.4
2	corn	37,000	electric	well	900	38	DK6772	31
3	corn	33,500	diesel	well	1,100	30	DK6744	35
4	peanuts	34,000	diesel	well	1,350	30	DK6432	67.3
5	soybeans	34,500	electric	surface water	900	30	DKC6744	38.9
6	soybeans	34,000	electric	well	800	38	P1870YHR	32.6
7	soybeans	32,000	electric	surface water	900	30	DKC6744	90.7
8	soybeans	34,000	diesel	well	1,800	38	DK6744	67.1
9	soybeans	34,000	diesel	well	1,500	30	DKC7027	33.5
10	soybeans	34,000	diesel	surface water	1,000	30	Agrigold 6544	75.7

Table 4. Rice Contest Field Characteristics

Producer	Irrigation Method	Previous Crop	Planting Population	Energy Source	Water Source	Flow Rate (GPM)	Row Spacing	Acres
1	furrow	soybeans	400,000	electric	surface water	1000	7.5 in	66.5
2	flood	soybeans	480,000	electric	well	1234	7.5 in	36.6
4	furrow	soybeans	460,000	diesel	surface water	1800	7.5 in	92.67
5	furrow	soybeans	480,000	diesel	well	1500	7.5 in	35.6
6	furrow	soybeans	420,000	diesel	well	600	7.5 in	31.6
7	furrow	rice	500,000	electric	well	1000	7.5 in	30.8
9	furrow	soybeans	500,000	diesel	well	900	7.5 in	31.1
10	flood	soybeans	500,000	diesel	surface water	1000	7.5 in	44.2

Table 5. Contest Soybean Field Characteristics

Producer	Previous Crop	Planting Population	Energy Source	Water Source	Flow Rate (GPM)	Row Spacing	Variety or Hybrid	Acres
1	corn	125,000	diesel	well	1,500	38	P48A60X	32
2	soybeans	137,000	electric	well	800	38	Progeny4620	32.8
3	soybeans	155,000	diesel	well	1,800	38	Stine 47LF32	31
4	rice	152,000	diesel	well	1,300	38	P47T89	70.6
5	corn	16,0000	electric	surface water	1,510	30	A45X8	74.8
6	cotton	140,000	diesel	well	1,000	38	Dynagro43SX27	64.5
7	corn	140,000	electric	well	800	38	GO SOY 48C17	79.8
8	rice	140,000	diesel	well	1,200	38	Credenz 45-50	35
9	soybeans	152,000	diesel	well	1,200	38	A47X6	45.8
10	corn	170,000	diesel	surface water	1,250	30	AG46X6	41.8
11	soybeans	145,000	diesel	well	1,300	38	P48A32	47.6
12	rice	140,000	electric	well	1,000	30	Mission 4637	35.3

Description of Awards

Participants were awarded for highest water use efficiency in each crop category (Corn, Soybean, & Rice). is given to each of the eight winners that contain various cash prizes and products from the sponsors who generously contributed to the contest. Table 7 highlights the prizes for the winners. Additional support for the program has been provided by McCrometer, through a discount program to provide meters for the contest in addition to providing 10" flowmeters to the winners. In total over $62,809 in cash and products are distributed to the winners of the contest.

Table 6. Prizes Awarded

Rice Division	Corn Division	Soybean Division
$11,000 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
$6,000 or a trip sponsored by Mars Corporation.	**$3,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board	**$3,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board
	$1,000 cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board	**$1,000** cash sponsored by the Arkansas Corn and Grain Sorghum Promotion Board
$2,000 in cash from Delta Plastics		

For First Place Winners of the Corn, Rice and Soybean Division Prizes	
	Irrometer manual reader and three watermark sensors $325 in product retail value plus $500 cash $2,475 in Total

	10” Mccrometer portable flow meter with a FS-100 Flow Straightener $2,271 in product retail value $6813 in total
	Trellis Base and Sensor Station $1,000 in product retail value $3,000 in total
	10” Seametrics AG 90 Insertion Magmeter (Flowmeter) $1,507 in product retail value $4,521 in total

	Aquatrac AgSense Soil Moisture Monitoring Unit $1,200 I retail value $3,600 in total

Awards were presented to the winners at the Arkansas Soil and Water Conversation Conference on January 29, 2020 in Jonesboro Arkansas. Award presentations were also held at the Cotton & Rice Conference in Memphis, TN on January 30 & 31, 2020. Pictures were taken with the sponsors during the conference and shared through social media

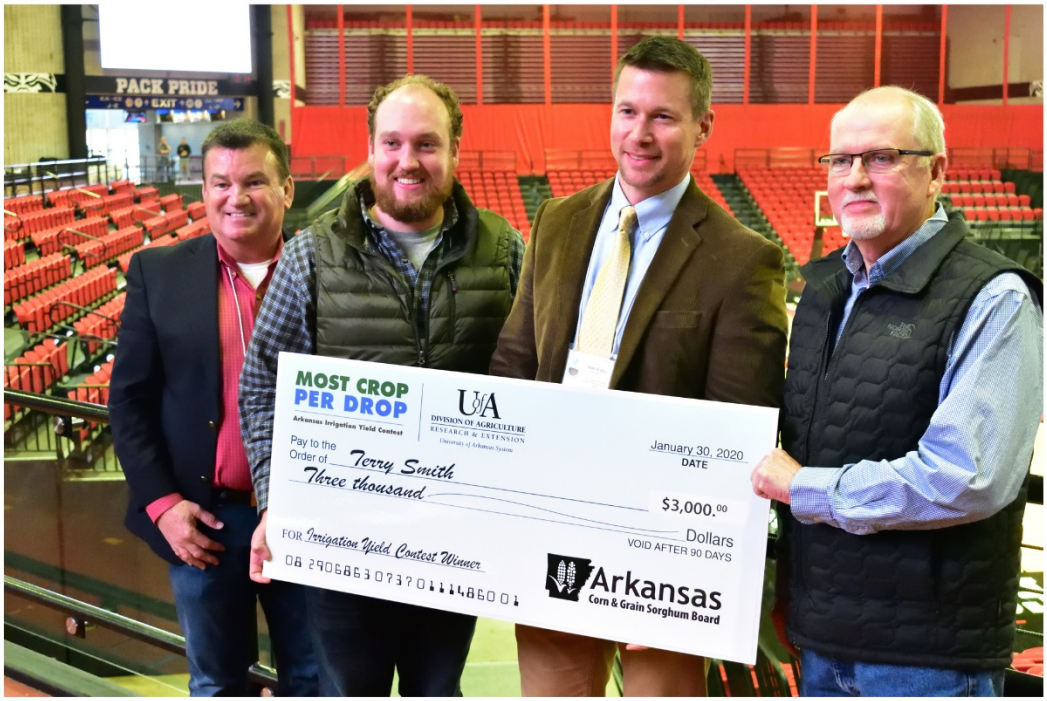
Photo Gallery of the Contest Winners
Jonesboro, Arkansas Water & Soil Conference
January 29, 2020

Arkansas Corn & Grain Sorghum Board

Arkansas Corn and Sorghum Board Cash Award Presentation

Tommy Young & Greg Baltz

Tommy Young & Karl Garner



Tommy Young, Clay Smith, Adam Eades & Terry Smith

AGSENSE
A valmont COMPANY

Ag Sense Aquatrac Presentation

Karl Garner, Chris Henry, John Allen McGraw & James Wray

McCROMETER

McCrometer Portable Meter Presentation

Hugh Ivey, Karl Garner, John Allen McGraw, James Wray & Chris Henry

Delta Plastics

PRESERVING OUR FARMLAND

Delta Plastics Presentation

Matt Lindsey & James Wray

Karl Garner & Matt Lindsey

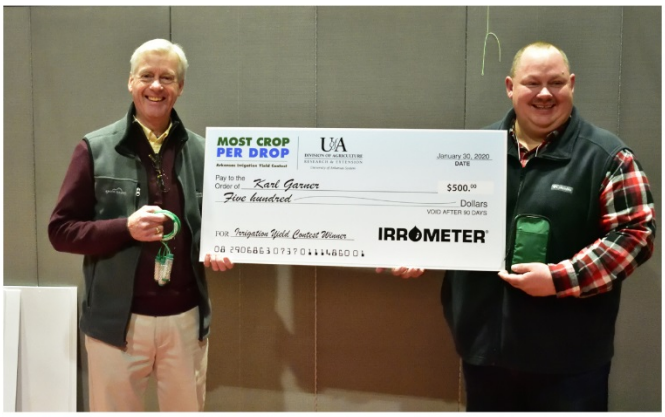
John Allen McGraw & Matt Lindsey

IRROMETER

Irrometer Presentation

John Allen McGraw & Steve Perkins

Steve Perkins & James Wray



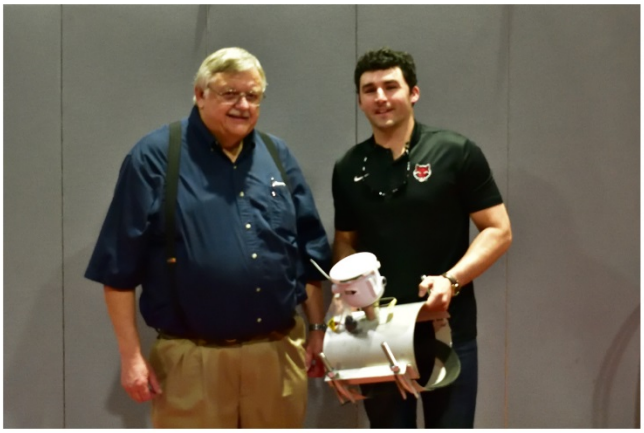
Steve Perkins & Karl Garner

Seametrics

Seametrics Flowmeter Presentation

Karl Garner & Lonnie Nunnenkamp

Lonnie Nunnenkamp & John Allen McGraw



Lonnie Nunnenkamp & James Wray

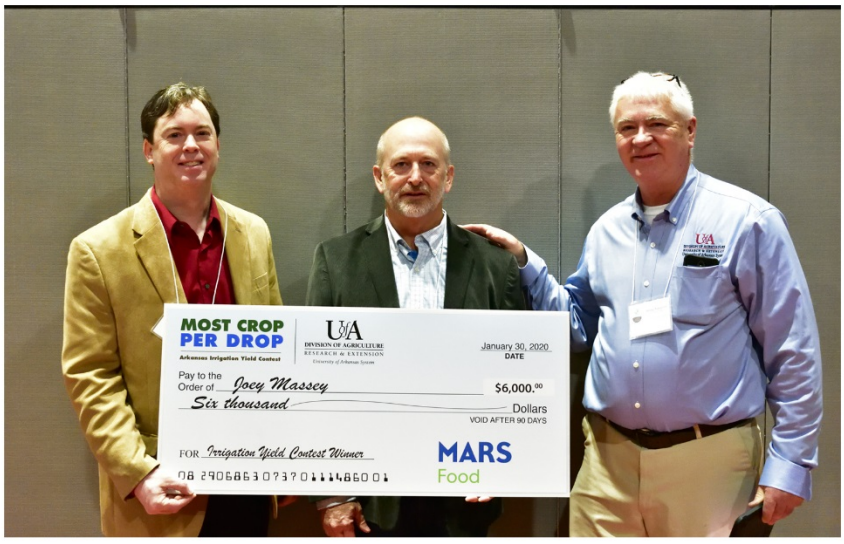
TRELLIS
grow more, use less.

Trellis Base and Soil Moisture Sensor Presentation

Elizabeth Buchen, John Allen McGraw, Karl Garner, James Wray & Pete Knezevich

MARS

MARS Cash Prize Presentation



Chris Henry, Joey Massey & Greg Simpson

Arkansas Soybean Board Cash Award Presentation

Greg Simpson, Josh Cureton, Karen Moore, Clint Boles & Chris Henry

*Second Place Soybean Winner, Becton Bell, was not present for the award presentation.

Irrigation Water Management Tools

Contestants are asked about the Irrigation Water Management (IWM) tools they utilize on the contest field when they enter the contest. All of the contestants used Computerized Hole Selection (Pipe Planner or PHAUCET or the Rice Irrigation app) during the 2019 growing season in their contest fields (Figure 9). Thirty percent of the contestants used surge irrigation and 94% used soil moisture sensors in their contest fields. Twelve percent of the contestants used Unmanned Aerial Vehicles (UAV) to assist in irrigation management.

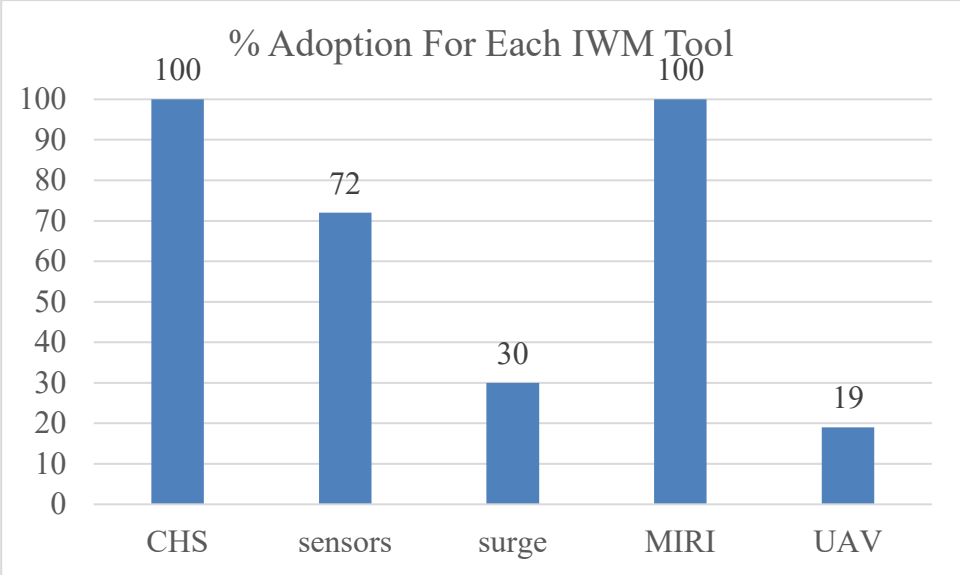


Figure 9. Contest Use of Irrigation Water Management BMPs

Figure 10 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 total water from rainfall and irrigation. Soybeans averaged 2.99 bushels per acre-inch per acre, the rice category averaged 5.38 bushels per acre-in per acre and corn averaged 8.83 bushels per acre-inch per acre of total water.

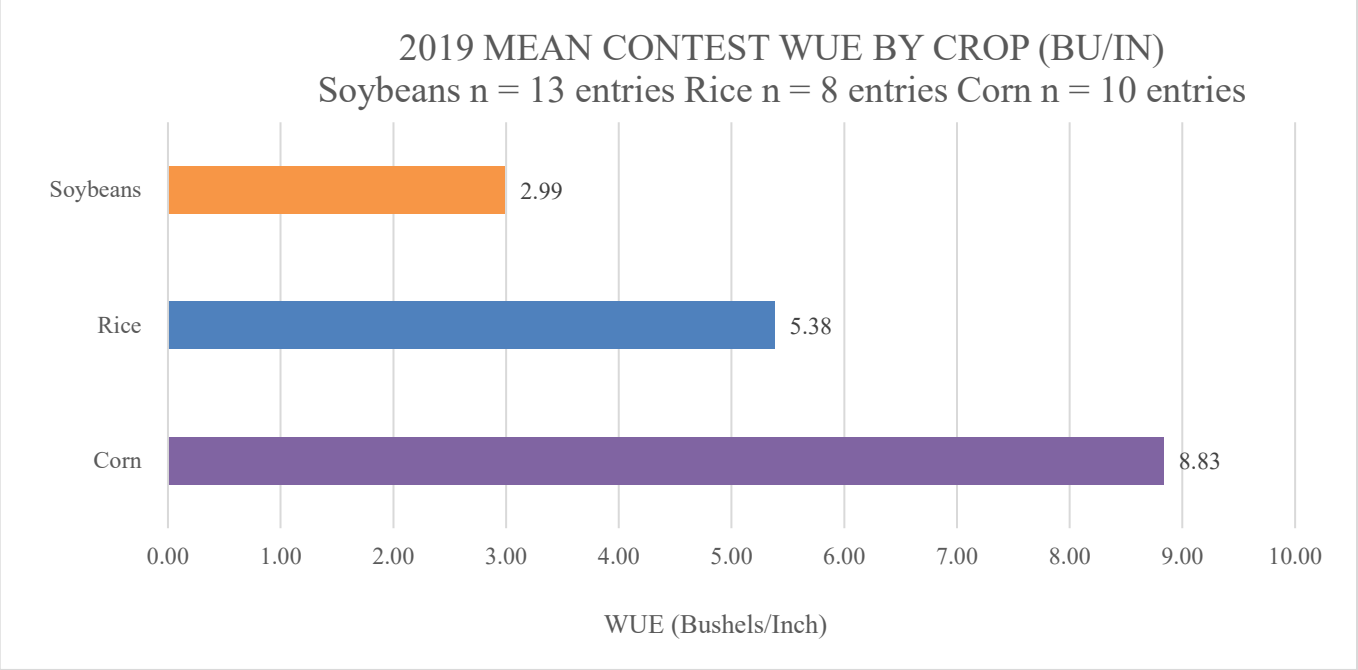


Figure 10. Water Use Efficiency by Crop Type

Contest Results

Contest 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 made the final decision on the winners.

At the time of each individual harvest, at least one supervisor was on field site where each of the equipment was inspected. Yield was determined by harvesting at least 3 acres of the field from top to bottom. Grain yields were taken from the total weights harvested from the contest areas. These weights were measured on certified scales at commercial grain buyers. Samples from harvested area were graded by commercial graders and deductions were made from those samples. Moisture was corrected back to normalized moisture values for each crop. Grain yields were adjusted to account for moisture weight. Water use was calculated by metered irrigation and rainfall during crop growth.

The wet season likely played a large role in the water use in 2019. Reference to the irrigation water use and yields in Arkansas Verification Programs is only done for reference to other measured water use and yield estimates for commodity crops and should only be interpreted as an average water use one may expect from these crops under average recent history conditions.

Corn Contest Results

Table 7.Corn Irrigation Contest Result

	Variety Selection	Yield (Bushels per Acre)	Irrigation (acre - inches applied)	Rain (inches) (unadjusted)	Rain (inches) (adjusted)	Total Water Use (inches)	Water Use Efficiency (Bushels per Inch)
Grower 1	DK 6744	222	1.5	18.0	18.0	19.5	11.4
Grower 2	DK 6744	253	5.0	19.4	19.4	24.4	10.4
Grower 3	DK 6432	260	5.5	23.6	23.6	29.1	8.9
Grower 4	DKC 6744	202	3.3	21.3	21.3	24.6	8.2
Grower 5	P1870 YHR	280	4.3	30.9	30.2	34.5	8.1
Grower 6	DKC 6744	221	3.0	27.3	25.9	28.9	7.7
Grower 8	DK 6744	243	6.0	26.3	26.3	32.3	7.5
Grower 9	DKC 7027	240	14.3	24.7	24.5	38.8	6.2
Grower 10	Agrigold 6544	179	11.1	34.8	32.6	43.6	4.1
Grower 11	DK 6772	247	0	22	22.0	22.0	11.2 ***
Mean		235	6.0	25.1	24.4	29.8	8.1

*** Removed from contest.

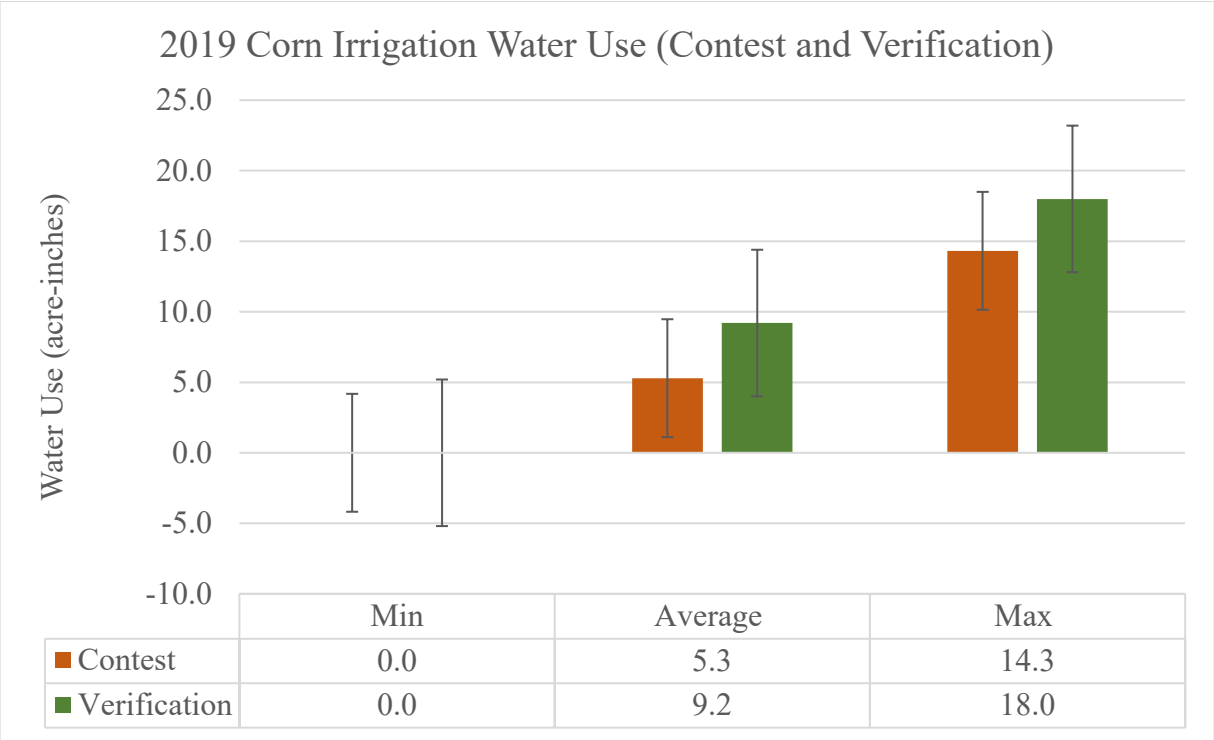


Figure 11. Contest Average Water Use and Verification Water Use

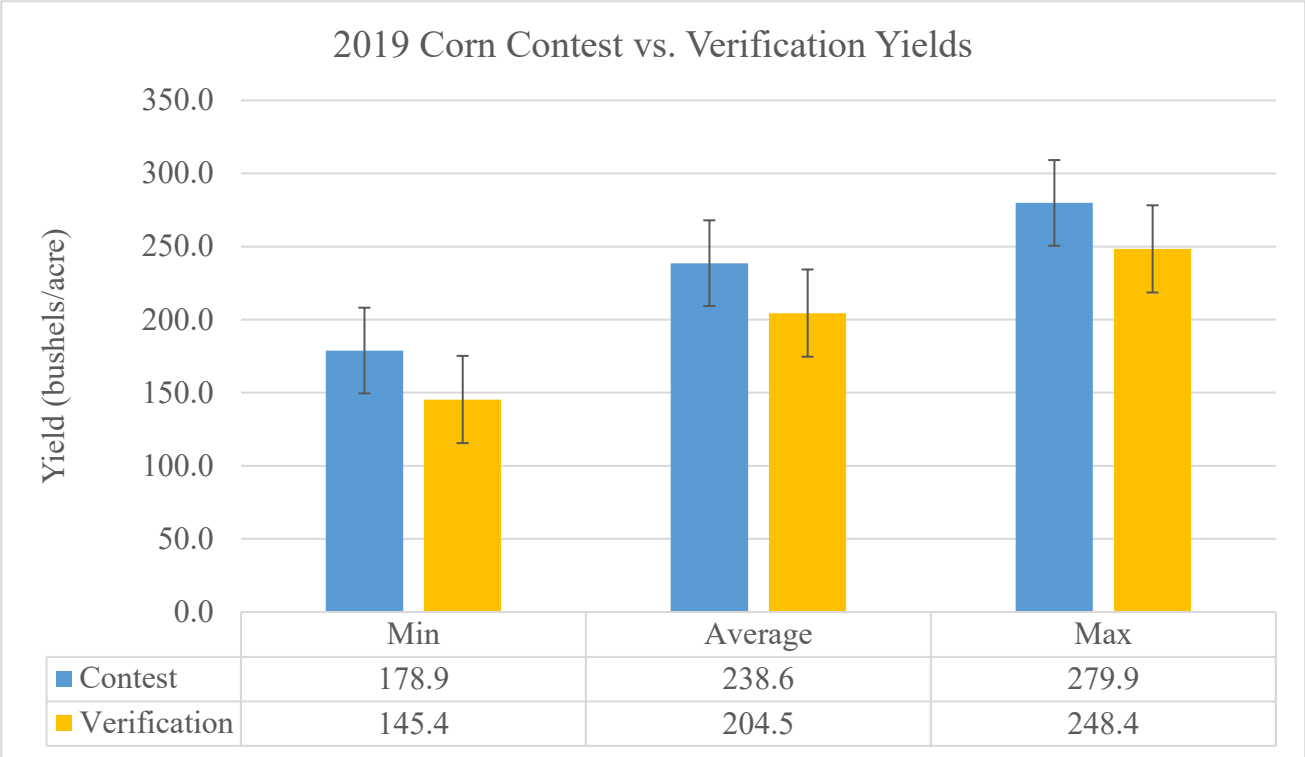


Figure 12. Corn Yield of the Contest vs Corn Verification Average Yield under 5-year span

Overall, ten corn fields were entered the contest. The irrigation water use (Figure 11) and yields (Figure 12) were similar to the University of Arkansas Corn and Grain Sorghum verification program results [11]. The average yield of corn grown for the contest was 219 BPA and the average water use efficiency of corn grown for the contest was 9.98 bushels per acre-inch.

This average yield was 12% higher than the state average for 2019 of 181 BPA [15]. Corn yield was corrected to 15.5% moisture for every field. None of the fields had a Foreign Matter (FM) grade above 1 percent to require dockage/adjustment.

The highest yielding corn field was in Poinsett County with a yield of 279 BPA. The water use efficiency ranged from a high of 11.4 bushels per acre-inch to a low of 4.1 bushels per acre-inch. The average irrigation water added to corn contest fields was 5.3 inches. The highest irrigation water added to a corn contest field was 11.1 inches and the lowest irrigation water added was the winner (Karl Garner) with 1.5 acre-inches.

Figure 13. Karl Garner

Garner (Figure 13) explained how it took time to develop trust in what the watermark sensors read. "Trust the sensors! If you trust the sensors and the data, we have you will save water, money, and will increase you ROI [Return of Investment]. The sensors will talk to you, if you listen, they will take the guess work out of when to irrigate."

Garner credits the use of soil water moisture sensors, computerized-hole selection (Pipe Planner) and P & R surge valves to steer toward great irrigation scheduling. His field has two soil types Calloway silt loam and Calhoun silt loam.

Garner planted later than any of the other contestants, and received the least amount of rainfall, likely because of the late planting date. He also applied the least amount of irrigation. While his yield was not the highest, Garner achieved the highest water use efficiency. 2019 was an excessively wet year with frequent heavy rainfalls and it is considered to have played a significant role in the results.

Figure 14. Greene County Producers Clay & Terry Smith with Adam Eades (NRCS)

The father and son duo (Terry & Clay Smith) of Greene County made a successful run with their corn contest crop achieving a WUE of 10.12 bushels/acre-inch (Figure 14). The Smith duo advocate for cover crops and minimum/no-till as it was implemented on their contest field this past summer. A set of watermark sensors was used as well for optimum irrigation scheduling.


Figure 15. Randolph County Producer Greg Baltz

Greg Baltz (Figure 15) placed third in the corn division with a WUE of 9.16 bushels/acre-inch. Baltz utilized several irrigation water management tools that contributed to the successful results. The tools

were surge valves for his sandy soil with long furrow lengths and watermark sensors for timely irrigation scheduling. Baltz also credits variety selection as a key factor.

Rice Contest Results

The Rice Irrigation Contest produced a broad range of results in terms water use between the producers. In 2019 among all rice fields in the contest, two of the rice fields practiced multiple inlet/alternate wetting & drying irrigation that produced an average yield of 186 BPA. Six of the rice fields practiced furrow irrigation that produced an average yield of 191 BPA. All rice contest fields planted RiceTec hybrids seed as except for one which was planted to Diamond.

Tabular results from the rice contest are shown in Table 8**.** Two entries did not meet the minimum yield.

Two fields were planted with RT XP753, three fields were planted with RT 7311 Clearfield and one field was planted with Diamond, one field was planted with Gemini 214C, and one field was planted with RT CLXL745.

The winning rice field was grown in Lincoln County by John Allen McGraw who produced a strong yield of 208 BPA with a water use efficiency of 7.80 bushels per acre-inch. The average rice yield in the rice contest was 190 BPA and the average rice water use efficiency being 3.6 bushels per acre inch. The yield average for the rice contest was 20% higher than the state average rice yield for 2019 (167 BPA) from the USDA National Agricultural Statistics Service [16].

Table 8. 2019 Rice Yield and Water Use Efficiency for Contest Fields

Grower	Irrigation Method	Variety Selection	Yield (Bushels per Acre)	Irrigation Applied(acre – inches/ac)	Rain (inches) (unadjusted)	Rain (inches) (adjusted)	Total Water Use (inches)	Water Use Efficiency (Bushels per inch)
1	**AWD**	Gemini 214	208.2	13.4	16.0	15.4	28.7	7.2
2	**furrow**	RT 7311	209.9	24.3	18.7	18.7	43.0	4.9
3	**furrow**	RT 7311	177.7	23.8	15.1	15.1	38.8	4.6
4	**furrow**	RT 753	194.6	30.5	18.3	18.1	48.6	4.0
5	**furrow**	RT 7311	190.5	23.7	25.1	25.1	48.7	3.9
6	**MIRI**	Diamond	162.8	18.7	27.4	27.1	45.8	3.6
7	**furrow**	CL XL 745	200.1	22.6	15.64	14.9	37.5	5.3 **
8	**furrow**	RT 753	173.4	2.62	21.84	19.6	22.21	7.9 **
mean			189.6	22.4	20.1	19.2	42.3	4.7

** Did not meet the minimum yield based or other contest irrigation or harvest rules.

The average dry bushels for all rice fields were corrected to 12% moisture. Yields in the rice contest ranged from a high of 210 BPA (furrow rice) to a low of 163 BPA (flooded rice). The average irrigation water added for all contest rice fields was 20 acre-inches. The highest irrigation water applied to a contest rice field was 31 acre-inches and the lowest amount of irrigation water added to a contest rice field was 3 acre-inches.

The average dry bushels for all rice fields were corrected to 12% moisture. Yields in the rice contest ranged from a high of 210 BPA (furrow rice) to a low of 163 BPA (flooded rice). The average irrigation water added for all contest rice fields was 20 acre-inches. The highest irrigation water applied to a contest rice field was 31 acre-inches and the lowest amount of irrigation water added to a contest rice field was 3 acre-inches. The average WUE was 4.7 bu/in.

The results from the contest were compared to the published report for the University of Arkansas Verification Report for 2019 to compare the irrigation water use and average yields from the program to the contest [12]. The average irrigation water was 27 ac-in/ac for the verification program fields and 19.9 ac-in/ac for contest fields (Figure 16). Average yields in the verification program fields was 183.4 bushels per acre and 189.7 bushels per acre for the contest fields (Figure 17). Using this data, the minimum yield requirement will be changed to 180 bushels per acre for 2020 contest fields.

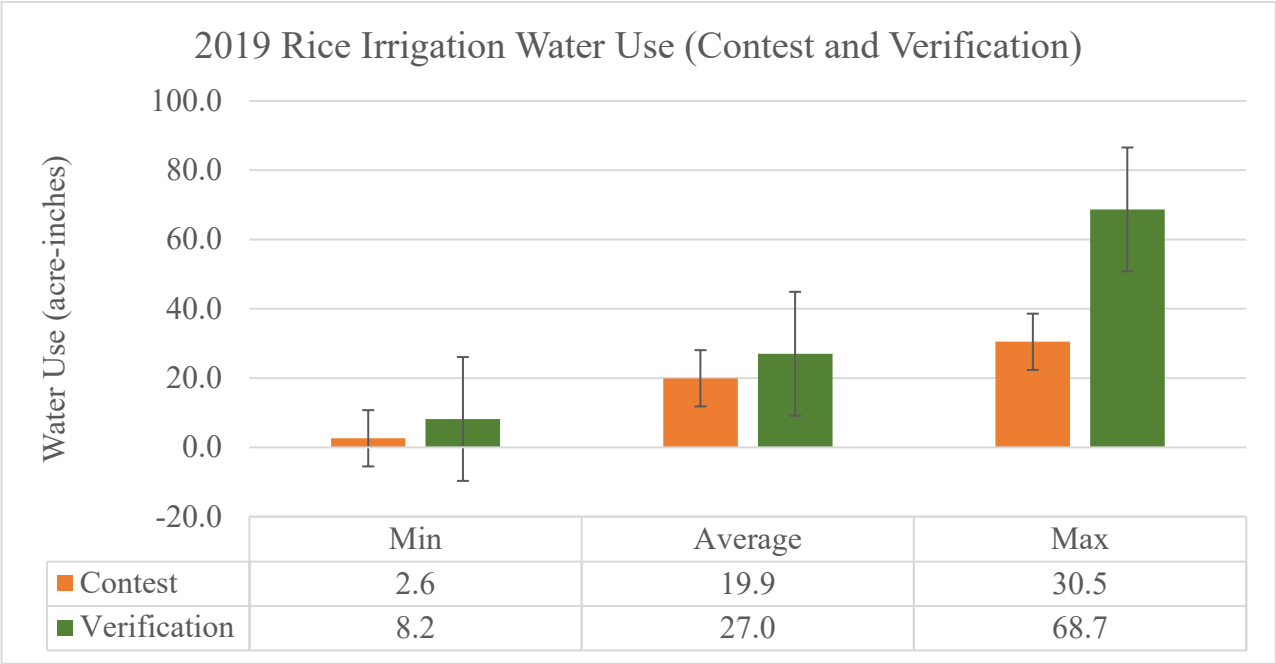


Figure 16. Contest Rice Irrigation Water Use vs Verification Water Use

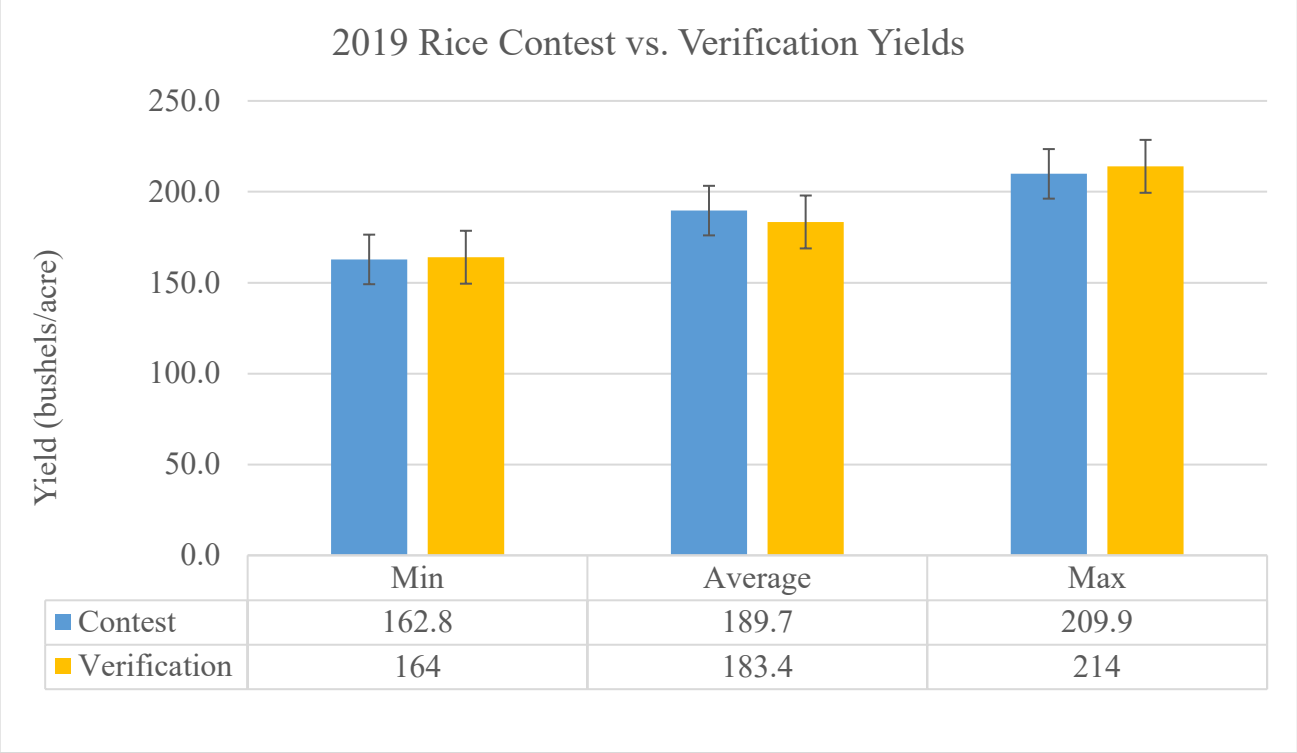


Figure 17. 2019 Contest & Verification Rice Yield

Lincoln County producer, John Allen McGraw placed first in the rice division (Figure 18). The contest field consists of a uniform Perry Clay. The type of irrigation chosen was the alternate wetting & drying method.

Figure 18. John Allen McGraw (far left), Steven Stone, Scott Crabb, Jacob Rix & Jim Camp

“The biggest thing I got out of it was trying AWD for the first real time. I’ve been a little skeptical about it but there is something to it. I held a deep flood on the bottom half of the field and used AWD on the top half and there was little to no difference. I knew AWD would help my chances to win the contest, and without the contest I wouldn’t have tried AWD as soon,” McGraw said.

The second-place winner for the rice division is Joey Massey of Greene County (Figure 19). This is the second consecutive year that Massey participated in the rice division producing row rice. Massey achieved a water use efficiency of 5.1 bushels/inch for 2019 compared to 3.75 bushels per inch in 2018. Figure 26. includes Joey Massey and his brother at the contest harvest.

Figure 19. Massey Brothers

Soybean Contest Results

Twelve fields were entered in the soybean division. Poinsett County producer, James Wray, was the winner of this division with a yield of 113 BPA and water use efficiency of 4.3 bushels per acre-inch (Table 9). The average yield for all soybean contest fields was 74 BPA (26% above the 2018 state average yield of 52.9 BPA) [14] and the soybean contest average water use efficiency was 2.68 bushels per acre-inch. All contest fields were corrected to a 13% moisture for the soybean yields considering harvest conditions. None of the producers in this division received an adjustment or penalized dockage for foreign material.

Table 9. Soybeans yield and Water Use Efficiency

Grower	Variety Selection	Yield (Bushels per Acre)	Irrigation (applied acre-in/ac)	Rain (inches) (unadjusted)	Rain (inches) (adjusted)	Total Water Use (inches)	Water Use Efficiency (Bushels per Inch)
1	P48A60x	112.5	6.5	20.8	19.6	26.1	4.3
2	Progeny 4620	87.9	3.8	19.2	19.2	23.0	3.8
3	Stine 47LF32	72.9	3.8	17.2	17.2	21.0	3.5
4	P47T89	73.3	6.1	15.3	15.3	21.5	3.4
5	A45X8	83.6	4.2	21.2	20.9	25.1	3.3
6	Dynagro 43SX27	71.5	2.0	20.2	20.2	22.1	3.2
7	GO SOY 48C17	63.2	6.0	15.1	15.1	21.1	3.0
8	A45X8	83.6	8.7	21.2	20.9	29.6	2.8
9	Credenz 45-50	62.5	8.7	16.1	16.1	24.8	2.5
10	A47X6	46.4	3.5	16.3	16.3	19.8	2.3
11	AG46X6	74.9	3.7	30.8	30.4	34.2	2.2
12	P48A32	62.3	8.4	26.8	26.3	34.7	1.8
13	Mission 4637	67.0	13.1	22.0	21.6	34.7	1.9
mean		74.0	6.1	20.2	19.9	26.0	2.9

The average irrigation water added to contest soybean fields was 6 acre-inches (Figure 20) compared to the irrigator reported state average soybean water use of 16.3 acre-inches [3]. The highest irrigation water use by a contested soybean field was 13 acre-inches. The lowest irrigation water applied to a contested field was 2 acre-inches/acre to the soybean contest.

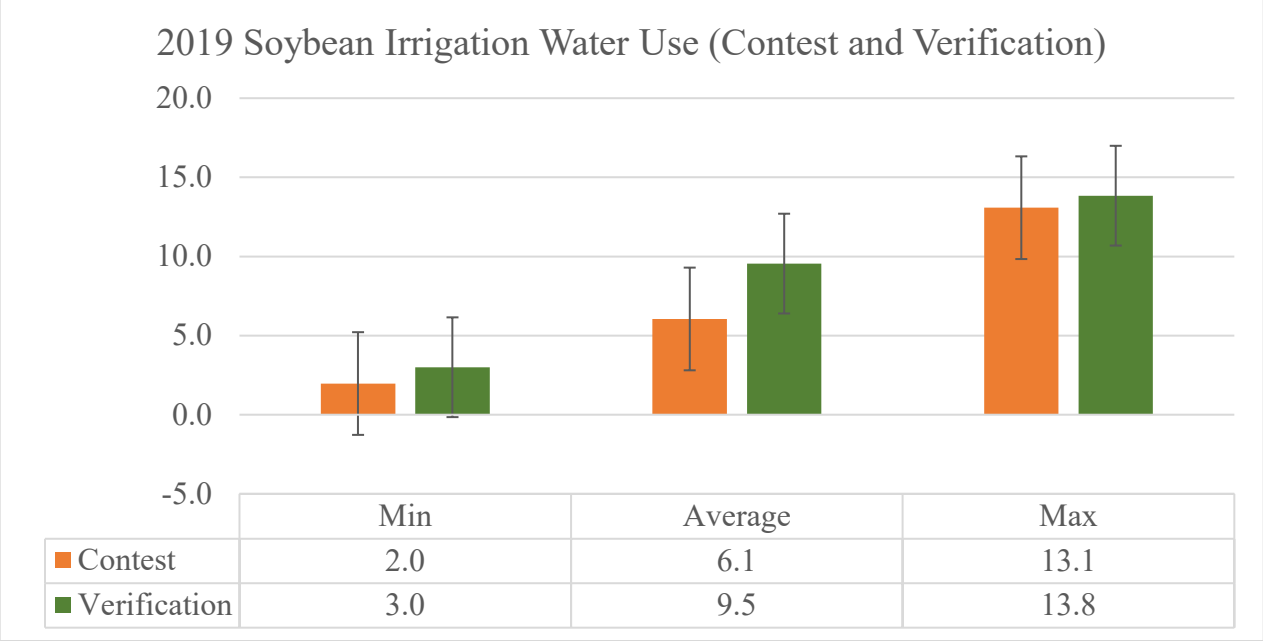


Figure 20. Soybean Water Use (State Average vs. Contest Average)

The maximum yield in the contest was 113 bushels per acre while the contest average was 74 BPA (Figure 28). The lowest yield observed in the contest was 46 BPA was below the NASS state average yield of 52.9 BPA [14]. When comparing the water use and yield between the University of Arkansas Soybean Verification Program [13], the average irrigation water use was 6.1 ac-in/ac for the contest fields and 9.5 ac-in/ac for verification fields (Figure 20). Average yields for the contest were 74 bushels per acre and 55.2 bushels per acre for verification fields (Figure 21). When compared to Go for the Green, the yield contest sponsored by the Arkansas Soybean Association and the Arkansas Soybean Promotion Board, seven producers attained yields over 100 bushels per acre, 120.533, 117.251, 101.007, 100.200, 103.883, 103.702, and 116.636 bushels per acre. Thus the winner of the contest was very near to the top two winners of the yield contest and if the contest field was entered in the Go for the Green, it would have placed third.

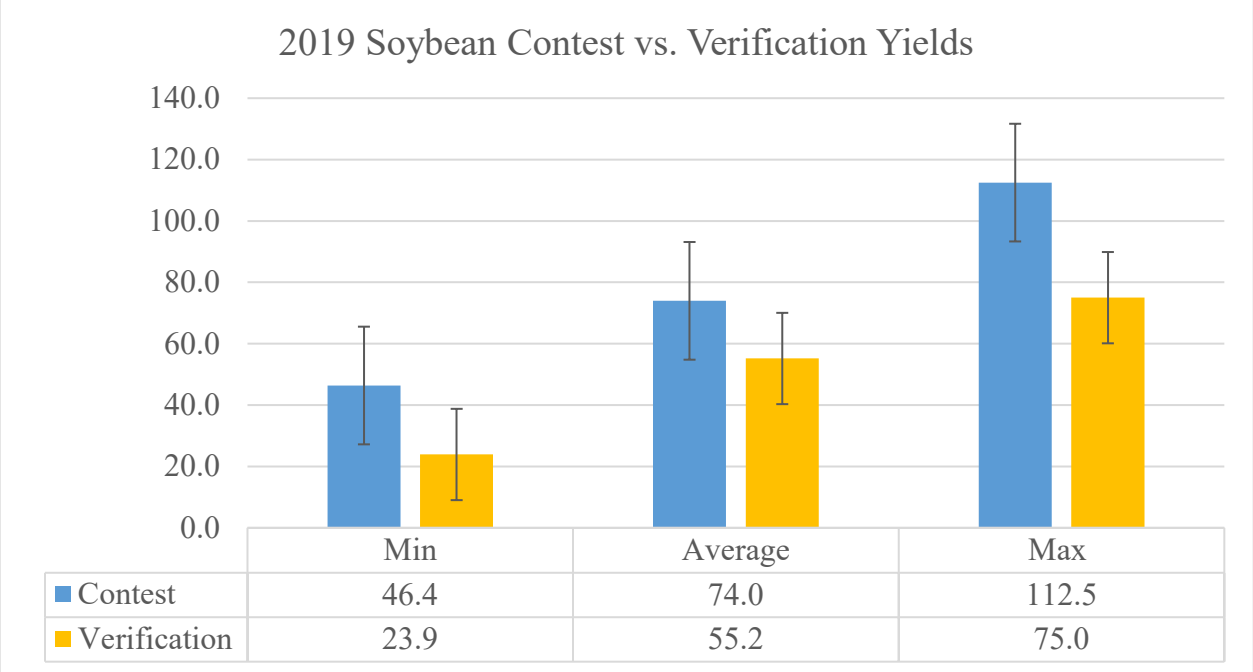


Figure 21. Soybean Yield Contest Average vs. Verification Average

Figure 22. (From left to right) Jeffrey Works, Mike Hamilton, Craig Allen and James Wray.

The soybean division winner, James Wray (Figure 22) saw many improvements compared to his first contest participation in 2018. There was a 43% increase in WUE between 2018 & 2019 growing seasons. Computerized-hole selection (Pipe Planner), sensor-based irrigation scheduling, and variety selection played a significant role in his conservation efforts and on-farm profitability. Previously, Wray's primary irrigation strategy was the old "experience" method as he describes it but looks past that now after seeing beneficial yield results from his contest field this past season.

"This was my first year using sensors for irrigation timing in soybeans. I honestly didn't trust them at first so I would go check every time I thought I needed to turn the pump on. "Based on my experience this

year, I have concluded that I have been overwatering. I would have watered this field three additional times." Wray said in efforts to promote water conservation for his farm. Wray's field is located west of Marked Tree in Poinsett County where the soil is classified as a silt loam soil.

Figure 23. Mississippi County Producer, Becton Bell alongside his contest field

Producer Becton Bell (Figure 23) achieved a WUE of 3.8 bushels/acre-inch that allowed him to take the second place spot in the soybean division. Bell credits the use of watermark sensors that influenced his irrigation decision-making for the contest field. Variety selection also played an integral role in the overall WUE.

Figure 24. Cross County Producer, Clint Boles, with county agent Rick Wimberley (his Harvest Supervisor) and his truck driver, At the Cross county field near St Francis river.

Clint Boles (Figure 24) placed third in the soybean division with a WUE of 2.96 bushels/inch. Boles is a start-up producer as he spent time working in the steel mill industry prior to farming. His Cross-County farm had an unusual summer due to frequent rains that prevented him from having a full irrigation. Boles who planted in the latter part of May, credits great variety selection as one of the contributing factors to achieve his WUE.

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 contest also provides real water use efficiency data that can be used to protect the long-term profitability of the region. The impact and synergisms of utilizing the many water management practice technologies that are available are also quantified through this program.

The 2019 Irrigation Yield Contest impact results were significant and created many success stories. Two of the contest winners this year participated in 2018 with the same crop and saw many improvements using IWM tools. Many of the contest producers stated that adoption of the IWM tools such as watermark sensors take time especially in the first year where trust is not established.

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Thank you to all the sponsors!

Acknowledgments

The Irrigation Team wishes to extend a special thank you to all University of Arkansas Extension Agents, Natural Resource Conservation Service technicians, conservationists, the sponsors and the contestants for their contribution to the 2019 Irrigation Yield Contest.