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RESEARCH & EXTENSION
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Rice Research Verification Program

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RICE RESEARCH VERIFICATION PROGRAM, 2018

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INTRODUCTION

The 2018 growing season was the thirty-fifth year for the Rice Research Verification Program (RRVP). The RRVP is an interdisciplinary effort between growers, county extension agents, extension specialists, and researchers. The RRVP is an on-farm demonstration of all the research-based recommendations developed by the University of Arkansas System Division Of Agriculture for the purpose of increasing the profitability of rice production in Arkansas. The specific objectives of the program are:

1. To demonstrate and verify research-based recommendations for profitable rice production throughout the rice-producing areas of Arkansas.

2. To develop a database for economic analysis of all aspects of rice production.

3. To demonstrate the benefits of available technology and inputs for the economic production of consistently high rice yields.

4. To identify specific problems and opportunities in Arkansas rice for further investigation.

5. To promote timely implementation of management practices among rice growers.

6. To provide training and assistance to county agents and growers with limited expertise in rice production.

The RRVP fields and cooperators are selected prior to planting. Cooperators agreed to pay production expenses, provide crop expense data for economic analysis, and implement the recommended production practices in a timely manner from seedbed preparation to harvest. Sixteen fields were enrolled in the RRVP in 2018. The fields were located on commercial farms ranging in size from 8 to 159 acres. The average field size was 69 acres.

Counties participating in the program during 2018 included Arkansas, Clay, Clark, Craighead, Chicot, Desha, Jackson, Jefferson, Lee, Lincoln, Lonoke, Poinsett, Randolph, St. Francis, White and Woodruff (Figure 1).

The sixteen rice fields totaled 1,102 acres enrolled in the program. Six different cultivars were seeded: (Diamond [4 fields]; RiceTec XP753 [4 fields]; RiceTec RT Gemini 214 CL [3 fields]; RiceTec RT 7311 CL [2 fields]; CL153 [2 fields]; Roy J [1 field]). University of Arkansas System Division of Agriculture Cooperative Extension Service recommendations were used to manage the RRVP fields. Agronomic and pest management decisions were based on field history, soil test results, rice cultivar, observations, and data collected from individual fields during the growing season. An integrated pest management philosophy was utilized based on CES recommendations. Data collected included components such as stand density, weed populations, disease

infestation levels, insect populations, rainfall, irrigation amounts, dates for specific growth stages, grain yield, milling yield, and grain quality.

Figure 1. County Locations (shaded) of 2018 Rice Research Verification Program Fields.

FIELD REVIEWS

Southern Coordinator – Ralph Mazzanti **Northern Coordinator** – Ron Baker

Arkansas County

The traditionally contoured Arkansas County field was located just west of Stuttgart on Dewitt silt loam soil. The field consisted of 77 acres and the previous crop grown on the field was soybean. The variety chosen was Diamond treated with CruiserMaxx Rice seed treatment and drill seeded. The seeding rate was 75 lbs/acre planted on April 13th. Emergence was observed on May 1st with a stand count of 17 plants ft^2. No tillage practices were used for spring field preparation. According to the soil test a 0-50-60-10 (lbs/acre N-P_2O_5-K2O-Zn) was applied. Command and League herbicides were applied at planting on April 14th. Facet herbicide was applied as a post-emergence herbicide on May 26th. Using the N-STaR recommendation, nitrogen in the form of urea plus an approved NBPT was applied at 225 lbs/acre on May 29th. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. Mid-season nitrogen as urea was applied according to GreenSeeker response index on June 22nd at the rate of 100 lbs/acre. An adequate flood was maintained throughout the growing season. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bugs never reached threshold levels and no insecticides were applied. The field was harvested on September 14th yielding 200 bu/acre and a milling yield of 57/68. The average harvest moisture was 18%. Total irrigation was 12.4 acre-inches and total rainfall was 10 inches.

Chicot County

The 96-acre zero-grade field was located north of Lake Village on a Perry clay soil. No spring tillage practices were utilized. RiceTec RT 7311 CL treated with the company's standard seed treatment including NipsIt INSIDE was drill-seeded on March 22cd at 23 lbs/acre. DAP 18-46-0 (lbs/acre N-P_2O_5-K_2O) was applied on May 5th. Command and League herbicides were applied at planting. Field emergence was recorded on April 18th with a stand density of 7.7 plants/ft^2. Clearpath and Permit Plus were applied as pre- and post-emergence herbicides on May 10th. Based on N-STaR recommendations, nitrogen in the form of urea plus NBPT was applied at 340 lbs/acre on June 11th. A flood was established within 3 days and was maintained throughout the growing season. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. Late-boot nitrogen was applied as urea on June 27th as urea at 70 lbs/acre. The field was checked weekly for diseases. Based on field evaluations, no fungicide application was required. A stink bug reached threshold levels and Karate Z was applied on June 19th. The field was harvested August 22nd with a yield of 219 bu/acre and milling yield of 57/68. The harvest moisture was 19%. Irrigation amount was 12 acre-inches and total rainfall was 21 inches.

Clark County

The 98-acre contour field was located west of Arkadelphia along the Ouachita River. The soil classification was Gurdon silt loam. Spring conventional tillage practices were used for field preparations and based on soil analysis a 0-30-90 (lbs/acre

N-P_2O_5-K_2O) was applied. RiceTec XP753 treated with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at 22 lbs/acre on April 21st. Command herbicide was applied at planting. Emergence was observed on May 1st with 6 plants ft^2. Facet L and Aim were applied as post-emergence herbicides on May 27th. Using the N-STaR recommendation, nitrogen in the form of urea was applied at 300 lbs/acre on May 29th. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. Due to hot and dry weather and limited water supply, flooding took over 15 days in parts of the field. Late-boot nitrogen was applied as urea at 70 lbs/acre on July 13th. Sheath blight reached threshold levels and Amistar Top fungicide was applied on July 10th. Stink bugs also reached threshold levels and Mustang Max was applied on July 10th. The field was harvested September 10th yielding 205 bu/acre. The milling yield was 64/73 and the average harvest moisture was 18%. Total irrigation for the season was 28 acre-inches and total rainfall was 16 inches.

Clay County

The precision-graded Clay County field was located west of McDougal on a Foley silt loam soil. This was the second crop following precision-grading work. The field was 52 acres and the previous crop grown on the field was rice. Conventional tillage practices were used for field preparation in the fall and a pre-plant fertilizer based on soil test analysis was applied in the spring at a rate of 0-60-90-10 (lbs/acre N-P_2O_5-K_2O-Zn). CL153 with Apron XL LS + Maxim 4FS seed treatment was drill-seeded at a rate of 60 lbs/acre on April 13th. Rice emergence was observed on May 3rd. The stand count was 14 plants/ft^2. Clearpath was applied post-emergence on May 10th providing good weed control. This was followed by a post-emergence application of Clincher and crop oil concentrate on June 1st. Ammonium sulfate was applied May 25th at the rate of 100 lbs/acre to boost rice growing in weaker areas of the field that were cut in the precision grading process. Based on N-STaR recommendations, a single pre-flood application of urea plus an approved NBPT product was made on June 2nd at a rate of 300 lbs/acre. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was initially applied. However it was determined that a thinner stand in the weaker areas of the field made GreenSeeker less reliable in those particular areas and urea was applied there at the rate of 75 lbs/acre. The field was checked weekly for diseases and rice stink bug populations were monitored each week after 75% heading until 60% hard dough. No insecticide or fungicide treatments were required based on field evaluations. The rice was harvested on September 17th, yielding 166 dry bu/acre. The milling yield was 64/69. The average harvest moisture was 16.3%. Total irrigation for the season was 20.4 acre-inches and total rainfall was 10 inches.

Craighead County

The furrow-irrigated Craighead County field was located east of Bay. The soil classification was a combination of Mhoon fine sandy loam and Roellen silty clay loam. The field was 50 acres and the previous crop grown was soybean. A no-till system on 30-inch beds from the previous soybean crop was used. A burndown herbicide tank-mix of RoundUp Pro Max plus FirstShot was applied in the spring prior to planting.

Based on soil test analysis, a pre-plant fertilizer at the rate of 0-15-60-10 (N-P_2O_5-K_2O-Zn) was applied on 30 acres only. RiceTec XP753 with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at a rate of 25 lbs/acre on April 20th. A pre-emergence tank mix of Bolero and Facet L was applied on April 25th. Rice emergence was observed on May 5th with a stand count of 7 plants/ft^2. A post-emergence herbicide tank mix application of Prowl H_2O, Sharpen, and crop oil concentrate was made on May 16th providing good control of weeds. A final herbicide application of Sharpen and crop oil concentrate was made on June 11th. Using the N-STaR recommendation, urea plus an approved NBPT product was applied at a 180 lbs/acre rate on the sandy loam portion of the field and 135 lbs/acre on the silty clay loam portion on May 31 and again on June 8 at the same rates. A final 100 lbs/acre application of urea plus an approved NBPT product was applied June 21st. Irrigation flushes began with the first urea application and, in the absence of rain, were repeated every 3 days, increasing to every 2 days at grain fill. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. The field was checked weekly for diseases and rice stink bug populations were monitored each week after 75% heading until 60% hard dough. No insecticide or fungicide treatments were required based on field evaluations. The rice was harvested on September 14th yielding 233 dry bu/acre. The milling yield was 60/72. The average harvest moisture was 15%. Total irrigation for the season was 16.4 acre-inches and total rainfall was 15.7 inches.

Desha County

The 107-acre contour-levee field was located east of Tiller on Sharkey and Desha clay soil. No tillage practices were performed and the previous crop was rice. According to the soil test the pre-plant fertilizer DAP 18-46-0 (lbs/acre N-P_2O_5-K_2O) was applied in the spring with an airplane. RT 7311 CL treated with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at 24 lbs/acre on April 21st. Command and glyphosate were applied on April 21st as pre-emergence and burndown herbicides. Emergence was observed on May 5th with 8.3 plants ft^2. Loyant herbicide was applied as a post-emergence herbicide on May 17th. Nitrogen in the form of urea plus an approved NBPT was applied at 300 lbs/acre on May 18th according to the N-STaR recommendation. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. Late-boot nitrogen was applied as urea at 70 lbs/acre on July 5th. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Stink bugs reached threshold levels and lambda-cyhalothrin insecticide was applied on July 17th. The field was harvested on September 4th yielding 195 bu/acre with a milling yield of 61/70. The average harvest moisture was 16%. The irrigation amount was 30 acre-inches and the total rainfall was 18.5 inches.

Jackson County

The precision-graded Jackson County field was southeast of Newport on a Foley-Calhoun Complex soil. The field was 50 acres and the previous crop grown on the field was soybean. Conventional tillage practices were used for field preparation in the spring and based on soil test analysis, a pre-plant fertilizer at the rate of 0-0-60 (N-

P_2O_5-K_2O) was applied. A pre-emergence application of Obey herbicide was made at planting. The variety Diamond with CruiserMaxx Rice seed treatment was drill-seeded at a rate of 69 lbs/acre on April 11th. Rice emergence was observed on April 27th. The stand count was 23 plants/ft^2. A post-emergence application of Grasp plus RiceBeaux was made on May 22nd followed by Regiment plus Triple Play surfactant on June 1st. Good weed control was achieved. Using the N-STaR recommendation, urea plus an approved NBPT product was applied preflood on June 6th at a rate of 260 lbs/acre. A permanent flood was subsequently established within 4 days. Flood levels were maintained well until hydrogen sulfide toxicity developed in a large section of the field. A rapid but carefully controlled flood reduction was employed to stimulate new root growth to overcome the problem. A mid-season application of 100 lbs of urea was applied and flood levels were returned to normal for the remainder of the season. Based on GreenSeeker response index during mid-season growth stages, no additional mid-season nitrogen was applied. The field was checked weekly for diseases and no fungicide application was required. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough and did not reach treatment thresholds to require an insecticide application. The rice was harvested on September 13th yielding 195 dry bu/acre. The milling yield was 57/69. The average harvest moisture was 15%. Total irrigation for the season was 30.5 acre-inches and total rainfall was 11.6 inches.

Jefferson County

The 159-acre conventional-levee field was located just north of Cornerstone and south of Altheimer. The soil classification consisted of Portland Clay and Herbert silt loam soil. The previous crop grown was soybean. The variety Diamond treated with CruiserMaxx Rice and zinc seed treatments was drill-seeded at 75 lbs/acre on April 21st. No pre-plant fertilizer was necessary according to soil test. Glyphosate, Command, and Sharpen were applied at planting. Emergence was observed on April 24th at 17 plants ft^2. Superwham and Command were applied May 5th. Facet L and Permit herbicides were applied on May 25th. Nitrogen in the form of urea was applied at 200 lbs/acre with an approved NBPT according to N-STaR recommendations. Due to a large field and extremely hot and dry conditions a re-lift was used on the west side of the field. However, the canal was too small to supply enough water so the irrigation canal was enlarged over the next 10 days. It required 14-18 days to flood the west side of the field as a result. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. Based on GreenSeeker response index during mid-season growth stages, the response index exceeded 1.15 and mid-season nitrogen was applied as urea on June 26th at 100 lbs/acre. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bugs reached threshold on one end of the field and only 40 acres were treated with Lambda-Cyhalothrin on July 22nd. The field was harvested on September 13th yielding 185 bu/acre with a milling yield of 59/68. The average harvest moisture was 19%. Total irrigation was 30 acre-inches and total rainfall was 11.5 inches.

Lee County

The 16-acre field was located just east of Moro with the soil classification being Henry silt loam soil. Soybean was the previous crop grown on the field. Conventional tillage practices were performed on the contour-levee field. A pre-plant fertilizer blend

of 0-40-60 (lbs/acre N-P_2O_5-K_2O) was applied according to the soil sample analysis. Roy J treated with CruiserMaxx Rice plus zinc seed treatment was drill-seeded at 75 lbs/acre. Command was applied on April 26th as burndown and pre-emergence herbicides. Emergence was observed on May 10th with 17 plants/ft^2. Facet L was applied on May 24th as a post-emergence herbicide. Based on N-STaR recommendations, nitrogen in the form of urea plus an approved NBPT product was applied at 200 lbs/acre on June 24th. A minimal flood was maintained throughout the growing season with multiple-inlet irrigation (MIRI). Based on GreenSeeker response index during mid-season growth stages, the response index exceeded 1.15 and midseason nitrogen was applied as urea at 100 lbs/acre on July 27th. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. The field was harvested on October 1st with a yield of 165 bu/acre and a milling yield of 50/66. The average harvest moisture was 15%. Total irrigation was 26.4 acre-inches and total rainfall was 12.1 inches.

Lincoln County

The 39-acre zero-grade field was located just east of Star City on a Perry clay soil. The previous crop has been continuous rice. There was no spring tillage practices performed on the field. RiceTec RT 7311 CL treated with the company's standard seed treatment including NipsIt INSIDE was drill-seeded on May 2nd. The seeding rate was 24 lbs/acre. Command and League herbicides were applied at planting. The rice emerged on May 24th at 6 plants/ft^2. Weedy rice also emerged between the drills from the continuous rice cropping system. Newpath herbicide was applied as post and pre-emergence herbicides on May 30th. Loyant herbicide and methylated seed oil were applied on June 3rd. Using the N-STaR recommendation, nitrogen in the form of urea with an approved NBPT was applied at 180 lbs/acre on June 6th. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. Clincher herbicide with crop oil concentrate was applied on June 18th for weed escapes. The late boot urea application was made on July 20th at 75 lbs/acre. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough and did not reach treatment thresholds to require an insecticide application. The field was harvested on September 18th yielding 177 bu/acre with a milling yield of 53/66 and the average harvest moisture was 15%. Total irrigation water use was 15 acre-inches and total rainfall was 12.3 inches.

Lonoke County

The 40-acre contour field was located north of Lonoke on a Callaway silt loam soil. Spring conventional tillage practices were used and pre-plant fertilizer was applied at 0-60-90-10 (N-P_2O_5-K_2O-Zn) according to the soil test. RiceTec XP753 treated with the company's standard seed treatment including NipsIt Inside was drill-seeded at 22 lbs/acre on May 2nd. Glyphosate and Command were applied on May 4th as burndown and pre-emergence herbicides. Stand emergence was observed on May 10th with 6 plants ft^2. Facet L and Sharpen were applied as post-emergence herbicides on June 23rd. Nitrogen in the form of urea with NBPT was applied May 24th according to the N-STaR recommendation. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. Based on GreenSeeker response index during mid-

season growth stages, no mid-season nitrogen was applied. The late-boot urea application was made on July 12th at 75 lbs/acre. Sheath blight reached threshold levels and Quadris fungicide was applied on July 16th. Stink bugs reached threshold levels and were treated with Karate Z on July 16th. The field was harvested on September 3rd yielding 207 bu/acre and a milling yield of 66/71. Total irrigation water use was 30 acre-inches and total rainfall was 4.2 inches.

Poinsett County

The precision-graded Poinsett County field was located northwest of Harrisburg on a Henry silt loam soil. The field was 8.3 acres and the previous crop grown on the field was soybean. Conventional tillage practices were used for field preparation in the fall and a pre-plant fertilizer was applied in the spring at a rate of 0-60-90 (lbs/acre N-P_2O_5-K_2O). The variety Diamond with CruiserMaxx Rice seed treatment was drill-seeded at a rate of 69 lbs/acre on April 20th. Rice emergence was observed on May 6th. The stand count was 24 plants/ft^2. Command pre-emergence herbicide was applied on April 20th. On May 22nd a post-emergence herbicide tank mix of Facet L plus Ricestar HT was applied followed by Loyant plus Methylated Seed Oil (MSO) surfactant. Although scattered barnyardgrass escapes remained, likely due at least in part to environmental factors, adequate weed control was achieved. Based on N-STaR recommendations, urea plus an approved NBPT product was applied in a single preflood application at a rate of 260 lbs/acre on June 8th. Flood-up was achieved within 24 hours. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. However, due to a miscommunication, an unplanned treatment of urea was applied simultaneously with some other fields at the rate of 75 lbs/acre. The field was checked weekly for diseases. A generic propiconazole fungicide treatment was applied on July 20th as a preventive treatment for smut disease. The rice stink bug population was monitored each week after 75% heading until 60% hard dough but did not reach threshold for insecticide treatment. The rice was harvested on October 5th yielding 170 dry bu/acre and a milling yield of 61/71. The average harvest moisture was 19%. Total irrigation for the season was 29.4 acre-inches and total rainfall was 13.9 inches.

Randolph County

The precision-graded Randolph County field was located east of Pocahontas on Amagon and Kobel silt loam soils. The field was 150 acres and the previous crop grown was soybean. Spring conventional tillage practices were used for field preparation and a pre-plant fertilizer based on soil test analysis was applied at a rate of 18-46-90 (lbs/acre N-P_20_5-K_20). On April 21st, CL153 was drill-seeded at a rate of 65 lbs/acre. Rice emergence was observed on May 8th and consisted of 18.2 plants/ft^2. A pre-emergence tank mix of Command plus Newpath herbicides was applied on May 1st. This was followed by a herbicide tank mix of Clearpath, Sharpen and crop oil concentrate applied post-emergence on June 6th providing excellent control of weeds. Using the N-STaR split application recommendation, urea plus an approved NBPT product was applied preflood with an application rate of 260 lbs/acre on June 8th. Flood-up with surface water was achieved in 7 days. Once the permanent flood was established, flood levels were maintained well throughout the season. Based on GreenSeeker response index during mid-season growth stages, nitrogen levels held

unexpectedly well into late mid-season before moving significantly closer to a response index level that would trigger treatment. The decision was reached as a precaution to proceed as originally planned with a split application recommendation but at a reduced urea rate of 75 lbs/acre in an effort to correspond more precisely with the N uptake ability of the rice at that point. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough, but did not reach treatment thresholds and no insecticides were applied. The field was harvested on September 17th yielding 145 dry bu/acre, which was similar to yields from other near-by fields with the same variety planted at the same time. Moisture at harvest was 16%. The milling yield was 66/71. Total irrigation was 16.4 acre-inches and total rainfall was 17.9 inches.

St. Francis County

The traditionally-contoured St. Francis County field on a relatively steep slope was located southeast of Wheatley on Hillemann silt loam soil. The field was 58 acres and the previous crop grown was soybean. Spring conventional tillage practices were used for field preparation and a pre-plant fertilizer based on soil test analysis was applied at a rate of 0-60-90-5 (lbs/acre N-$P_2 0_5$-$K_2 0$-Zn). A burndown herbicide tank mix of glyphosate and Sharpen was applied prior to planting. On April 19th, RiceTec hybrid RT Gemini 214 CL with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at a rate of 22 lbs/acre. Rice emergence was observed on May 7th and consisted of 6.6 plants/ft². A pre-emergence herbicide application of Clearpath was made on April 21st. A post-emergence herbicide of Newpath plus surfactant was applied on May 19th providing effective control of weeds. Using the N-STaR recommendation, urea plus an approved NBPT product was applied preflood at a rate of 200 lbs/acre on May 31st. Flood-up required 7 days. Multiple Inlet Rice Irrigation (MIRI) was utilized to achieve a more efficient permanent flood. After permanent flood establishment, flood levels were maintained sufficiently. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. A late boot application of urea was made at the rate of 70 lbs/acre on July 11th. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough, but did not reach treatment thresholds and no insecticides were applied. The field was harvested on September 17th yielding 192 bu/acre and a milling yield of 66/69. Moisture at harvest was 17%. Total irrigation was 22.5 acre-inches and total rainfall was 8.9 inches.

White County

The precision-graded White County field was located southeast of Kensett on Calhoun, Callaway and Immanuel silt loam soils. The field was 33 acres and the previous crop grown was soybean. Spring conventional tillage practices were used for field preparation and a pre-plant fertilizer based on soil test analysis was applied at a rate of 0-30-0-5 (lbs/acre N-$P_2 0_5$-$K_2 0$-Zn). On May 1st, RiceTec XP753 with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at a rate of 23 lbs/acre. Rice emergence was observed on May 7th and consisted of 7.7 plants/ft². A pre-emergence application of Obey herbicide was made on May 2nd

followed by a post-emergence application on May 21st of Facet L plus crop oil concentrate providing good control of weeds. Using the N-STaR recommendation, urea plus an approved NBPT product was applied preflood at a rate of 300 lbs/acre on June 2nd. The permanent flood was established in 4 days. Flood levels were maintained sufficiently throughout the season. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. A late boot application of urea was made at the rate of 70 lbs/acre on July 7th. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough, but did not reach treatment thresholds and no insecticides were applied. The field was harvested on September 14th yielding 200 bu/acre and a milling yield of 56/71. Moisture at harvest was 14.3%. Total irrigation was 24 acre-inches and total rainfall was 14.1 inches.

Woodruff County

The precision-graded Woodruff County field was located 3 miles northeast of Augusta on Jackport silty clay loam soil. The field was 74 acres and the previous crop grown was rice. Spring conventional tillage practices were used for field preparation and a pre-plant fertilizer based on soil test analysis was applied at a rate of 18-46-0 (lbs/acre N-$P_2 0_5$-$K_2 0$). On May 11th, RiceTec hybrid RT Gemini 214 CL with the company's standard seed treatment including NipsIt INSIDE was drill-seeded at a rate of 25 lbs/acre. Rice emergence was observed on May 24th and consisted of 7 plants/ft². From this point onward, barnyardgrass control became extremely problematic. A pre-emergence tank-mix of Command plus Newpath was discussed and scheduled after confirmation of no known resistance issues in the field with these or other herbicides. However, the two herbicides were applied separately due to prevailing winds in the direction of neighboring conventional rice susceptible to Newpath. Command was applied on May 21st but not activated before the barnyardgrass germinated and emerged on May 23. The following morning on May 24th a light shower fell and the wind direction changed allowing a post-emergence application of Newpath plus surfactant that afternoon. Good control of the small, 1-leaf barnyardgrass was anticipated. Instead, the grass maintained a steady growth. On June 2nd barnyardgrass had reached the 4-leaf stage and a post-emergence tank mix of QuinStar, Clincher, and crop oil concentrate was applied. This was followed on June 14th by the second Newpath application just ahead of flood-up. Again, little to no control of barnyardgrass resulted from either of these applications. On June 15th the N-Star recommendation of 110 lbs/acre of urea plus an approved NBPT product was applied. Flood-up occurred over the next 7 days using the Multiple Inlet Rice Irrigation (MIRI) system. On June 25th Ricestar HT was applied post-flood in a final attempt to at least suppress the barnyardgrass. Suppression/stunting of the grass was somewhat successful, but a severe reduction in rice tillering had already become an unrecoverable loss by this point. Based on GreenSeeker response index during mid-season growth stages, no mid-season nitrogen was applied. A late boot application of urea was made at the rate of 65 lbs/acre on July 30th. The field was checked weekly for diseases and no fungicide application was required based on field evaluations. Rice stink bug populations were monitored each week after 75% heading until 60% hard dough. On August 20th, rice stink bugs reached the threshold for treatment and a Lambda Cyhalothrin application

was made providing good control. The field was harvested on October 22nd with a yield of 121 bu/acre reflecting the severity of barnyardgrass competition during critical growth stages of the rice. Moisture at harvest was 14.3%. The milling yield was 58/69. Total irrigation was 16.1 acre-inches and total rainfall was 9.7 inches. Based on the lack of barnyardgrass control with multiple herbicides, barnyardgrass samples from the field have been submitted for herbicide resistance testing. This will be critical information to have on hand for future management decisions made for this field.

Table 1. Agronomic information for fields enrolled in the 2018 Rice Research Verification Program.

Field Location by County	Cultivar	Field size (acres)	Previous crop	Seeding rate (lbs/acre)	Stand density (plants/ft^2)	Planting date	Emergence date	Harvest date	Yield (bu/A)	Milling yield[z]	Harvest Moisture (%)
Arkansas	Diamond	77	Soybean	75	17	13-Apr	1-May	14-Sep	200	57/68	18.5
Chicot	RT 7311 CL	96	Soybean	23	8	22-Mar	18-Apr	22-Aug	219	57/68	19.6
Clark	RT XP753	98	Soybean	22	6	21-Apr	1-May	4-Sep	205	64/73	17.5
Clay	CL 153	52	Rice	65	14	13-Apr	3-May	17-Sep	166	64/69	15.5
Craighead	RT XP753	50	Soybean	25	7	21-Apr	5-May	15-Sep	233	60/72	14.6
Desha	RT 7311 CL	107	Rice	24	8	21-Apr	5-May	4-Sep	195	61/70	16.5
Jackson	Diamond	50	Soybean	75	23	11-Apr	27-Apr	13-Sep	195	57/69	15
Jefferson	Diamond	159	Soybean	75	17	21-Mar	24-Apr	13-Sep	185	59/68	18.7
Lee	Roy J	16	Soybean	78	17	1-May	10-May	1-Oct	173	50/66	13.5
Lincoln	RT Gemini 214 CL	38	Rice	24	6	14-May	24-May	18-Sep	177	53/66	15
Lonoke	RT XP753	35	Soybean	22	6	2-May	10-May	3-Sep	207	66/71	15
Poinsett	Diamond	8	Soybean	69	24	20-Apr	6-May	16-Sep	170	61/71	18.6
Randolph	CL 153	150	Soybean	65	18	21-Apr	8-May	16-Sep	145	66/71	16
St. Francis	RT Gemini 214 CL	58	Soybean	21	7	19-Apr	7-May	16-Sep	192	66/69	17
White	RT XP753	34	Soybean	23	8	1-May	7-May	14-Sep	200	56/71	14.3
Woodruff	RT Gemini 214 CL	74	Rice	25	7	11-May	24-May	22-Oct	121	58/69	15.5
Average		**69**		[y]	[x]	**20-Apr**	**5-May**	**14-Sep**	**186**	**60/69**	**16.3**

[z] Head rice milling yield / Total rice milling yield.
[y] Seeding rates averaged 72 lbs/acre for conventional cultivars and 23 lbs/acre for hybrid cultivars.
[x] Stand density averaged 19 plants/ft^2 for conventional cultivars and 7 plants/ft^2 for hybrid cultivars.

Table 2. Soil test results, fertilization program, and soil classification for fields enrolled in the 2018 Rice Research Verification Program.

Field Location by County	Soil Test				Applied Fertilizer (lbs/acre)			Soil Classification
		lbs/acre			Mixed Fertilizer [v] N-P-K-Zn[w]	N-Star Urea (46%N) rates and timing [x, y]	Total N rate (lbs N/acre) [z]	
	pH	P	K	Zn				
Arkansas	6.7	56	190	9.8	0-50-60-10	225-100-0	150	Dewitt silt loam
Chicot	7.0	45	594	3.2	18-46-0-0	340-0-70	189	Perry clay
Clark	5.6	74	194	4.4	0-30-90-0	300-0-70	170	Gurdon silt loam
Clay	6.7	27	151	6.5	0-60-90-10	315-0-0	162†	Foley silt loam
Craighead	6.4	198	564	8.6	0-0-0-0	180*-180*-100*	212	Mhoon fine sandy loam (30 acres)
	6.5	126	186	5.4	0-15-60-10	135*-135*-100*	170	Roellen silty clay loam (20 acres)
Desha	6.9	18	743	5.8	18-46-0-0	300-0-70	170	Sharkey and Desha clay
Jackson	7.1	94	240	11	0-0-60-0	260-100-0	165	Foley-Calhoun Complex
Jefferson	7.1	52	693	6.0	0-0-0-0	200-100-0	138	Portland clay/Herbert silt loam
Lee	6.9	162	278	9.0	0-40-60-0	200-100-0	138	Henry silt loam
Lincoln	6.5	76	719	11	0-0-0-0	180-0-75	117	Perry clay
Lonoke	6.5	33	89	3.7	0-60-90-10	240-0-75	145	Callaway silt loam
Poinsett	7.2	32	126	13.8	0-60-90-0	260-0-0	154†	Henry silt loam
Randolph	6.3	40	162	12.4	18-46-90-0	260-75-0	154	Amagon/Kobel silt loams
St. Francis	7.3	31	162	7.5	0-60-90-5	200-0-70	124	Hillemann silt loam
White	6.2	40	316	6.8	0-30-0-5	300-0-70	170	Calhoun/Callaway/Immanuel silt loams
Woodruff	6.3	19	416	4.4	18-46-0-0	110-0-65	81	Jackport silty clay loam

[w] N=nitrogen, P=phosphorus, K=potassium, Zn=zinc.

[x] Timing: preflood – midseason – boot. Each field was fertilized according to its N-STaR recommendation. The mark (*) denotes an adjusted N-STaR urea rate and timing for furrow irrigated rice (due to estimated ammonia volatilization losses) based on the 100% relative grain yield recommendation. These N-STaR urea rate recommendations before the adjustments were 294-0-65 lbs of urea (30 acres) and 207-0-65 lbs of urea (20 acres).

[y] The N-Star preflood N recommendation in all fields was treated with an approved NBPT product to minimize nitrogen loss due to ammonia volatilization.

[z] Certain fields received seasonal N exceeding the N-Star recommendation due to factors encountered during the season (details in field reviews). This additional N is included in the totals marked (†). Extra N applied 2 weeks or more before flood-up to address other issues is recorded in the Mixed Fertilizer column. The total marked (†) in Clay County is a field average that includes 21 lbs of N from Ammonium Sulfate applied across the field 10 days before the pre-flood urea plus a midseason application on 25 of the field's 52 acres (details in field review).

Table 3. Herbicide rates and timings for fields enrolled in the 2018 Rice Research Verification Program.

Field Location by County	Burndown/Pre-emergence Herbicide Applications (Trade name & product rate/acre)[x]	Post-emergence Herbicide Applications (Trade name & product rate/acre)[x]
Arkansas	Glyphosate (1 qt) + Command (12.8 oz) + League (6.4 oz)	Facet L (32 oz) + COC (1 pt)
Chicot	Command (12.8 oz) + League (6.4 oz)	Clearpath (0.5 lb) + Permit Plus (0.75 oz) + COC (1 qt)
Clark	Command (21 oz)	Facet L (32 oz) + Aim (1.25 oz) + COC (1 pt)
Clay	Clearpath (0.5 lb)	Clincher (15 oz) + COC (1 qt)
Craighead	RoundUp Pro Max (32 oz) + FirstShot (0.5 oz) FB Bolero (48 oz) + Facet L (25 oz)	Prowl H_2O (2.1 pt) + Sharpen (1 oz) + COC (1 pt) FB on (15 acres only) Sharpen (1 oz) + COC (1 qt)
Desha	Command (16 oz) + Glyphosate (32 oz)	Loyant (1 pt)
Jackson	Obey (31 oz)	Grasp (2 oz) + RiceBeaux (3 qt) FB Regiment (0.5 oz) + Triple Play Surfactant (12.8 oz)
Jefferson	Glyphosate (1 qt) + Command (12.8 oz) + Sharpen (2 oz)	Superwham (3 qt) + Command (16 oz) + COC (16 oz) FB Facet L (22 oz) + Permit (1 oz) + COC (16 oz)
Lee	Command (12.8 oz)	Superwham (3 qt) + Facet L (32 oz)
Lincoln	Command (20 oz) + League (6.4 oz)	Newpath (6 oz) FB Loyant (16 oz) + MSO (16 oz) FB Clincher (15 oz) + COC (1 qt)
Lonoke	Command (12.8 oz) + Glyphosate (6.4 oz)	Facet L (32 oz) + Sharpen (1 oz) + COC (1 pt)
Poinsett	Command (12.8 oz)	Ricestar HT (24 oz) + Facet L (22 oz) FB Loyant (1 pt) + MSO (8 oz)
Randolph	Command (12.8 oz) + Newpath (4 oz)	Clearpath (0.5 lb) + Sharpen (1 oz) + COC (6.4 oz)
St. Francis	Glyphosate (32 oz) + Sharpen (1 oz) FB Clearpath (0.5 lb)	Newpath (4 oz) + Surfactant (1.6 oz)
White	Obey (28 oz)	Facet L (22 oz) + COC (6.4 oz)
Woodruff	Command (12.8 oz) FB Newpath (4 oz) + Surfactant (6.4 oz)	QuinStar (9 oz) + Clincher (15 oz) + COC (1 qt) FB Newpath (4 oz) + Surfactant (6.4 oz) FB Ricestar HT (24 oz)

[x] 'FB' = 'followed by' and is used to separate herbicide application events; COC = Crop Oil Concentrate; MSO = Methylated Seed Oil

Table 4. Seed treatments used and foliar fungicide and insecticide applications made on fields enrolled in the 2018 Rice Research Verification Program.

Field Location by County	Seed treatments (trade name and product rate/cwt seed)	Foliar fungicide and insecticide applications (trade name and product rate/acre)			
	Fungicide and/or Insecticide Seed Treatment for Control of Diseases and Insects of Seedling Rice[z]	Fungicide Applications for Control of Sheath Blight/Kernel Smut/False Smut	Fungicide Applications for Control of Rice Blast	Insecticide Applications for Control of Rice Water Weevil	Insecticide Applications for Control of Rice Stink Bug/Chinch Bug
Arkansas	CruiserMaxx Rice (7 fl oz)	------	------	------	------
Chicot	RTST	------	------	------	Lambda-Cyhalothrin (1.8 oz)
Clark	RTST	Amistar Top (15 oz)	------	------	Mustang Max (3 oz)
Clay	Apron XL LS (0.64 oz) + Maxim 4FS (0.16 oz)	------	------	------	------
Craighead	RTST	------	------	------	------
Desha	RTST	------	------	------	Karate Z (1.8 oz)
Jackson	CruiserMaxx Rice (7 fl oz)	------	------	------	------
Jefferson	CruiserMaxx Rice (7 fl oz)	------	------	------	Lambda-Cyhalothrin (1.8 oz)
Lee	CruiserMaxx Rice (7 fl oz)	------	------	------	------
Lincoln	RTST	------	------	------	------
Lonoke	RTST	------	Quadris (8.5 oz)	------	Lambda-Cyhalothrin (1.8 oz)
Poinsett	CruiserMaxx Rice (7 fl oz)	Propiconazole (6oz)	------	------	------
Randolph	------	------	------	------	------
St. Francis	RTST	------	------	------	------
White	RTST	------	------	------	------
Woodruff	RTST	------	------	------	Lambda-Cyhalothrin (2.5 oz)

[z] RTST = 'RiceTec Seed Treatment'. This abbreviation defines those fields with seed treated by RiceTec, Inc. prior to seed purchase. 'RTST seed is treated with compounds intended to enhance germination and early-season plant growth, plus the insecticide NipsIt INSIDE to further protect seedlings.

Table 5. Rainfall and irrigation information for fields enrolled in the 2018 Rice Research Verification Program.

Field Location by County	Rainfall (inches)	Irrigation[z] (acre inches)	Rainfall + Irrigation (inches)
Arkansas	10.1	24.4	34.5
Chicot	21.2	41.0	62.2
Clark	16.2	28.4	44.6
Clay	10	20.4	30.4
Craighead	15.7	16.4	32.1
Desha	18.5	30*	48.5*
Jackson	11.6	35	46.6
Jefferson	11.5	30*	41.5*
Lee	12.1	26.4	38.5
Lincoln	12.2	19.2	31.4
Lonoke	4.2	30*	34.2*
Poinsett	13.9	29.4	43.3
Randolph	17.9	16.4	24.3
St. Francis	8.9	22.5	31.4
White	14.1	30*	44.1*
Woodruff	9.7	16.1	25.8
Average	**13.0**	**24.6**	**38.3**

[z] Not all fields were equipped with flow meters to monitor water use for irrigation. Therefore, the average irrigation amount in fields with flow meters over a period of years was calculated and this average was used for fields with no irrigation data. Irrigation amounts using this calculated average are followed by an asterisk (*).

ECONOMIC ANALYSIS

This section provides information on production costs and returns for the 2018 Rice Research Verification Program (RRVP). Records of field operations on each field provided the basis for estimating production costs. The field records were compiled by the RRVP coordinators, county Extension agents, and cooperators. Production data from the 16 fields were applied to determine costs and returns above operating costs, as well as total specified costs. Operating costs and total costs per bushel indicate the commodity price needed to meet each cost type.

Operating costs are those expenditures that would generally require annual cash outlays and would be included on an annual operating loan application. Actual quantities of all operating inputs as reported by the cooperators are used in this analysis. Input prices are determined by data from the 2018 Crop Enterprise Budgets published by the Cooperative Extension Service and information provided by the cooperating producers. Fuel and repair costs for machinery are calculated using a budget calculator based on parameters and standards established by the American Society of Agricultural and Biological Engineers. Machinery repair costs should be regarded as estimated values for full-service repairs, and actual cash outlays could differ as producers provide unpaid labor for equipment maintenance.

Fixed costs of machinery are determined by a capital recovery method which determines the amount of money that should be set aside each year to replace the value of equipment used in production. Machinery costs are estimated by applying engineering formulas to representative prices of new equipment. This measure differs from typical depreciation methods, as well as actual annual cash expenses for machinery.

Operating costs, fixed costs, costs per bushel, and returns above operating and total specified costs are presented in Table 6. Costs in this report do not include land costs, management, or other expenses and fees not associated with production. Operating costs ranged from $424.83/acre for Jefferson County to $729.06 for Craighead County, while operating costs per bushel ranged from $2.16/bu for Arkansas County to $4.72/bu for Woodruff County. Total costs per acre (operating plus fixed) ranged from $512.61/acre for Jefferson County to $825.76/acre for Craighead County, and total costs per bushel ranged from $2.64/bu for Arkansas County to $5.69/bu for Woodruff County. Returns above operating costs ranged from $53.88/acre for Woodruff County to $583.76/acre for Arkansas County, and returns above total costs ranged from -$64.79/acre for Woodruff County to $487.30/acre for Arkansas County.

A summary of yield, rice price, revenues, and expenses by expense type for each RRVP field is presented in Table 7. The average rice yield for the 2018 RRVP was 186 bushels/acre but ranged from 121 bushels/acre for Woodruff County to 233 bushels/acre for Craighead County. An Arkansas average long-grain cash price of $5.13/bu was estimated using USDA, National Agricultural Statistics Service (NASS) US long price data for the months of August through October. The RRVP had all fields planted to long grain rice. A premium or discount was given to each field based on the milling yield observed for each field and a standard milling yield of 55/70 for long-grain rice. Broken rice was assumed to have 65% of whole grain price value. If milling yield was higher than the standard, a premium was made while a discount was given for milling less than the standard. Estimated long-grain prices adjusted for milling yield varied from $4.79/bu in Lee County to $5.53/bu in Clark County (Table 7).

The average operating expense for the 16 RRVP fields was $548.59/acre (Table 7). Post-harvest expenses accounted for the largest share of operating expenses on average (20.5%) followed by seed (19.9%), fertilizers & nutrients (18.2%), and chemicals (14.4%). Although seed's share of operating expenses was 19.9% across the 16 fields, it's average cost and share of operating expenses varied depending on whether a Clearfield hybrid was used ($169.54/acre; 29.4% of operating expenses), a non-Clearfield hybrid was used ($137.31/acre; 22.2% of operating expenses), a Clearfield non-hybrid (pureline) variety was used ($61.98/acre; 12.6% of operating expenses) or a non-Clearfield non-hybrid (pureline) variety was used ($45.14/acre; 9.2% of operating expenses).

The average return above operating expenses for the 16 fields was $424.56/acre and ranged from $53.88/acre for Woodruff County to $583.76/acre for Arkansas County. The average return above total specified expenses for the 16 fields was $317.17/acre and ranged from -$64.79/acre for Woodruff County to $487.30/acre for Arkansas County. Table 8 provides select variable input costs for each field and includes a further breakdown of chemical costs into herbicides, insecticides, and fungicides. Table 8 also lists the specific rice cultivars grown on each RRVP field.

Table 6. Operating Costs, Total Costs, and Returns for fields enrolled in the 2018 Rice Research Verification Program.

County	Operating Costs ($/acre)	Operating Costs ($/bushel)	Returns to Operating Costs ($/acre)	Fixed Costs ($/acre)	Total Costs ($/acre)	Returns to Total Costs ($/acre)	Total Costs ($/bushel)
Arkansas	432.24	2.16	583.76	96.45	528.70	487.30	2.64
Chicot	597.79	2.73	514.73	71.34	669.13	443.39	3.06
Clark	613.65	2.99	520.00	112.66	726.31	407.34	3.54
Clay	545.90	3.29	337.75	112.21	658.11	225.55	3.96
Craighead	729.06	3.13	522.15	96.70	825.76	425.45	3.54
Desha	593.41	3.04	438.14	123.57	716.97	314.58	3.68
Jackson	552.54	2.84	445.76	124.99	677.53	320.77	3.48
Jefferson	424.83	2.30	526.07	87.79	512.61	438.29	2.77
Lee	437.14	2.65	353.21	93.41	530.55	259.80	3.22
Lincoln	534.55	3.02	327.44	82.15	616.70	245.29	3.48
Lonoke	607.62	2.94	526.74	115.29	722.92	411.44	3.49
Poinsett	584.31	3.44	325.19	119.06	703.37	206.13	4.14
Randolph	439.17	3.02	356.64	118.80	557.97	237.84	3.84
St. Francis	584.81	3.05	448.15	105.81	690.63	342.33	3.60
White	529.24	2.64	513.28	139.32	668.57	373.95	3.34
Woodruff	571.20	4.72	53.88	118.67	689.87	-64.79	5.69
Average	**548.59**	**3.00**	**424.56**	**107.39**	**655.98**	**317.17**	**3.59**

Table 7. Summary of Revenue and Expenses per Acre for fields enrolled in the 2018 Rice Research Verification Program.

Receipts	Arkansas	Chicot	Clark	Clay	Craighead	Desha	Jackson	Jefferson
Yield (bu.)	200	219	205	166	233	195	195	185
Price Received	5.08	5.08	5.53	5.32	5.37	5.29	5.13	5.14
Total Crop Revenue	**1016.00**	**1112.52**	**1133.65**	**883.65**	**1251.21**	**1031.55**	**998.30**	**950.90**
Operating Expenses								
Seed	45.00	164.22	131.34	64.16	149.25	171.36	41.40	48.00
Fertilizers & Nutrients	102.64	102.36	106.00	141.35	180.11	107.67	80.47	55.30
Chemicals	57.55	80.55	94.50	58.84	78.93	47.68	104.82	110.58
Custom Applications	36.75	44.80	42.00	56.00	72.10	59.50	53.20	35.00
Diesel Fuel	13.78	11.50	19.04	17.05	12.45	14.83	16.45	12.14
Repairs & Maintenance	22.61	16.25	23.69	24.92	21.83	27.47	27.48	20.13
Irrigation Energy Costs	6.37	23.84	45.84	53.01	42.62	16.43	79.25	5.90
Labor, Field Activities	9.10	6.61	11.52	9.75	7.57	9.58	11.68	8.34
Other Inputs & Fees, Pre-harvest	17.76	15.50	16.01	20.58	23.59	21.21	20.36	17.79
Post-harvest Expenses	120.70	132.17	123.72	100.24	140.62	117.68	117.44	111.65
Total Operating Expenses	**432.24**	**597.79**	**613.65**	**545.90**	**729.06**	**593.41**	**552.54**	**424.83**
Returns to Operating Expenses	**583.76**	**514.73**	**520.00**	**337.75**	**522.15**	**438.14**	**445.76**	**526.07**
Capital Recovery & Fixed Costs	96.45	71.34	112.66	112.21	96.70	123.57	124.99	87.79
Total Specified Expenses [z]	**528.70**	**669.13**	**726.31**	**658.11**	**825.76**	**716.97**	**677.53**	**512.61**
Returns to Specified Expenses	**487.30**	**443.39**	**407.34**	**225.55**	**425.45**	**314.58**	**320.77**	**438.29**
Operating Expenses/Yield Unit	2.16	2.73	2.99	3.29	3.13	3.04	2.84	2.30
Total Expenses/Yield Unit	2.64	3.06	3.54	3.96	3.54	3.68	3.48	2.77

[z] Does not include land costs, management, or other expenses and fees not associated with production.

Table 7. Summary of Revenue and Expenses per Acre for fields enrolled in the 2018 Rice Research Verification Program (Continued).

Receipts	Lee	Lincoln	Lonoke	Poinsett	Randolph	St. Francis	White	Woodruff	Average
Yield (bu.)	165	177	207	170	145	192	200	121	186
Price Received	4.79	4.87	5.48	5.35	5.48	5.38	5.21	5.16	5.23
Total Crop Revenue	**790.35**	**861.99**	**1134.36**	**909.50**	**795.81**	**1032.96**	**1042.52**	**625.08**	**973.15**
Operating Expenses									
Seed	49.92	171.36	131.34	41.40	59.80	159.50	137.31	181.25	109.16
Fertilizers & Nutrients	87.35	47.37	121.24	111.17	111.73	105.98	78.83	57.03	99.79
Chemicals	61.07	120.28	61.74	130.30	53.01	45.82	47.69	111.97	79.08
Custom Applications	35.00	33.60	44.80	60.20	46.20	49.00	49.00	33.25	46.90
Diesel Fuel	14.24	11.56	18.82	18.72	17.23	17.86	20.41	18.15	15.89
Repairs & Maintenance	20.96	19.03	25.05	25.08	26.92	24.23	30.65	23.62	23.74
Irrigation Energy Costs	40.34	3.35	45.84	76.40	8.42	34.38	12.32	41.84	33.51
Labor, Field Activities	10.37	6.47	12.51	8.31	9.63	11.10	12.47	9.30	9.64
Other Inputs & Fees, Pre-harvest	18.30	14.70	21.36	10.14	18.60	21.07	19.80	21.68	18.65
Post-harvest Expenses	99.58	106.82	124.92	102.60	87.64	115.87	120.76	73.11	112.22
Total Operating Expenses	**437.14**	**534.55**	**607.62**	**584.31**	**439.17**	**584.81**	**529.24**	**571.20**	**548.59**
Returns to Operating Expenses	**353.21**	**327.44**	**526.74**	**325.19**	**356.64**	**448.15**	**513.28**	**53.88**	**424.56**
Capital Recovery & Fixed Costs	93.41	82.15	115.29	119.06	118.80	105.81	139.32	118.67	107.39
Total Specified Expenses [z]	**530.55**	**616.70**	**722.92**	**703.37**	**557.97**	**690.63**	**668.57**	**689.87**	**655.98**
Returns to Specified Expenses	**259.80**	**245.29**	**411.44**	**206.13**	**237.84**	**342.33**	**373.95**	**-64.79**	**317.17**
Operating Expenses/Yield Unit	2.65	3.02	2.94	3.44	3.02	3.05	2.64	4.72	3.00
Total Expenses/Yield Unit	3.22	3.48	3.49	4.14	3.84	3.60	3.34	5.69	3.59

[z] Does not include land costs, management, or other expenses and fees not associated with production.

Table 8. Selected Variable Input Costs per Acre for fields enrolled in the 2018 Rice Research Verification Program.

County	Rice Type	Seed	Fertilizers & Nutrients	Herbicides	Insecticides	Fungicides and Other Inputs	Diesel Fuel	Irrigation Energy Costs
Arkansas	Diamond	45.00	102.64	57.55	---	---	13.78	6.37
Chicot	RT7311CL	164.22	102.36	79.74	0.81	---	11.50	23.84
Clark	XP753	131.34	106.00	49.61	4.02	40.87	19.04	45.84
Clay	CL153	64.16	141.35	58.84	---	---	17.05	53.01
Craighead	XP753	149.25	180.11	78.93	---	---	12.45	42.62
Desha	RT7311CL	171.36	107.67	46.88	0.81	---	14.83	16.43
Jackson	Diamond	41.40	80.47	104.82	---	---	16.45	79.25
Jefferson	Diamond	48.00	55.30	109.77	0.81	---	12.14	5.90
Lee	Roy J	49.92	87.35	61.07	---	---	14.24	40.34
Lincoln	RT7311CL	171.36	47.37	120.28	---	---	11.56	3.35
Lonoke	XP753	131.34	121.24	45.98	0.81	14.95	18.82	45.84
Poinsett	Diamond	41.40	111.17	124.30	---	6.00	18.72	76.40
Randolph	CL153	59.80	111.73	53.01	---	---	17.23	8.42
St. Francis	Gemini 214 CL	159.50	105.98	45.82	---	---	17.86	34.38
White	XP753	137.31	78.83	47.69	---	---	20.41	12.32
Woodruff	Gemini 214 CL	181.25	57.03	110.85	1.12	---	18.15	41.84
Average	**---**	**109.16**	**99.79**	**74.70**	**1.40**	**20.61**	**15.89**	**33.51**