DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

# 2022
# University of Arkansas
# Rice Research Verification Program

The Rice Research Verification Program is funded by Arkansas rice producers through check-off monies administered by the Arkansas Rice Research and Promotion Board.

University of Arkansas
Cooperative Extension Service
Agriculture Experiment Station
U.S. Department of Agriculture
And County Governments Cooperating

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**RICE RESEARCH VERIFICATION PROGRAM, 2022**

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**Acknowledgments:**

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## INTRODUCTION

The 2022 growing season was the thirty-nineth 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.

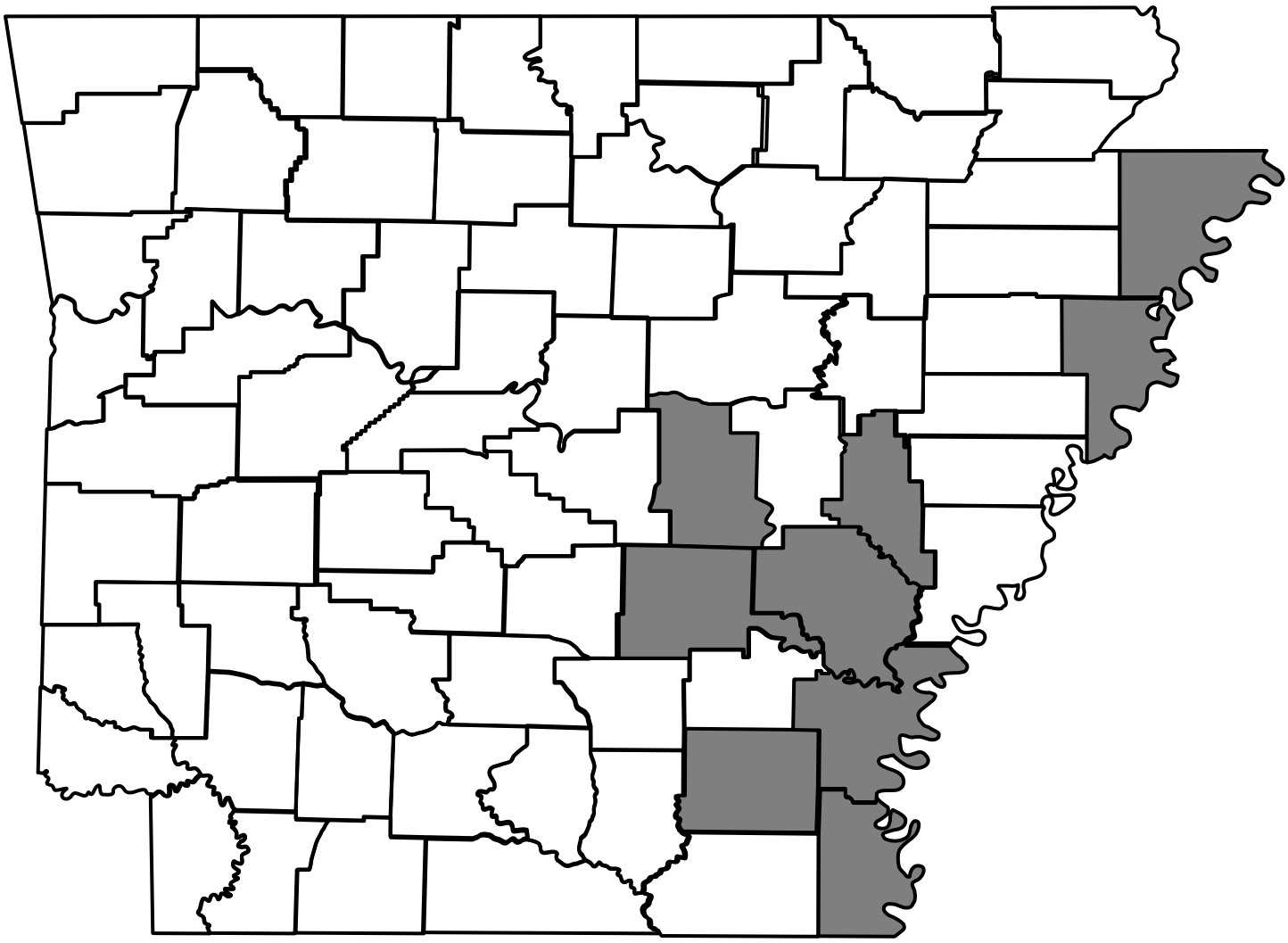
6. To provide training and assistance to county agents and growers with limited expertise in rice production.

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. Nine fields were enrolled in the RRVP in 2022. The fields were located on commercial farms ranging in size from 36 to 72 acres. The average field size was 47 acres.

Counties participating in the program during 2022 included Arkansas, Crittenden, Drew, Jefferson, Lonoke, Mississippi, Monroe, Phillips and St. Francis. (Figure 1).

The nine rice fields totaled 421 acres enrolled in the program. Six different cultivars were seeded: Dyna Gro DG 263L [4 fields]; RiceTec [RT] 7521 FP [2 fields]; RT 7321 FP [2 fields]; RT 7401 [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, and dates for specific growth stages, grain yield, milling yield, and grain quality.

**Figure 1. County Locations (shaded) of 2022 Rice Research Verification Program Fields.**



## FIELD REVIEWS

**Verification Coordinator** – Ralph Mazzanti

### Arkansas County

The Arkansas County was located just North of Reydell (Bayou Meto) on Hebert silt loam soil. Conventional tillage practices were used for spring preparation. The field consisted of 38 acres and the previous crop grown was soybean. The cultivar chosen was RT 7321 FP treated with the company's standard seed treatment. The field was drill-seeded at 22 lbs/ac and planted May 12. Emergence was observed on May 28 with a stand count of 6.4 plants/$ft^2$. A field cultivator and Land plane were used prior to planting. According to the soil test a 0-0-60 (lb/acre N-$P_2O_5$-$K_2O$) was applied in the spring. Preface and Prowl herbicides were applied at planting on May 24. Facet, Prowl and Preface were applied as post-emergence herbicides on June 4. Regiment, Command and League herbicides were applied June 11 for weed escapes. N-STaR (Nitrogen Soil Test for Rice) was taken on the field. Nitrogen in the form of urea plus an approved NBPT was applied at 275 lbs/acre on June 14 followed by 70 lbs/acre on July 26. Surface water was adequately maintained with use of a re-lift pump. Using Trimble GreenSeeker technology, the N response levels remained adequate throughout the growing season. Rice stink bugs numbers reach treatment level and Endigo insecticide was applied August 10. The field was harvested on September 26 yielding 145 bu/ac and a milling yield of 49/72. The disappointing yield was thought to be from late planting and high heat during pollination. The average harvest moisture was 17.2% Total irrigation was 28-acre inches and total rainfall was 7.9 inches.

### Crittenden County

The No-till Crittenden County field was located just North of Crawfordsville on Sharkey Silty Clay soil. The field consisted of 49 acres and the previous crop grown was soybean. The cultivar chosen was Rice Tec RT 7321 FP treated with the company's standard seed treatment. The field was drill-seeded at 22 lbs/ac planted April 29. Glyphosate was applied as a burndown herbicide on May 3. Preface, Command and Sharpen herbicides were applied at planting on May 9. Emergence was observed on May 9 with a stand count of 7 plants/$ft^2$. No tillage practices were used for spring field preparation. According to the soil test a 0-46-0 (lb/acre N-$P_2O_5$-$K_2O$) was applied in the spring. Regiment, Command and Postscript were applied as post-emergence herbicides on June 1. N-STaR (Nitrogen Soil Test for Rice) was utilized on the field. Nitrogen in the form of urea plus an approved NBPT was applied at 260 lbs/acre on May 23, followed by 70 lbs/acre on June 7. Using Trimble GreenSeeker, the N response levels remained adequate throughout the season. An adequate flood was maintained throughout the growing season. Quilt Excel was applied June 20 for a smut history. Rice stink bugs numbers reached treatment levels and Lambda cyhalothrin was applied July 5. The field was harvested on September 11 yielding 201 bu/ac and a milling yield of 52/69. The average harvest moisture was 16%. Total irrigation was 30 acre-inches and rainfall totaled 13 inches.

### Drew County

The Drew County furrow-irrigated rice (FIR) field was located just west of Tiller on Portland clay soil. The field consisted of 41 acres and the previous crop grown was soybean. The cultivar chosen was DG 263 L treated with the company's standard seed treatment. The field was drill-seeded at 45 lbs/ac planted April 10. Emergence was observed on May 7 with a stand count of 12 plants/ft$^2$. In the spring, no tillage practices were used. According to the soil test a 10-46-0 (lb/acre N-$P_2O_5$-$K_2O$) was applied in the spring. Glyphosate, Command, and Sharpen herbicides were applied at planting on April 10. Rebel X was applied as a post-emergence herbicide on May 16. Regiment herbicide was applied June 6. N-STaR (Nitrogen Soil Test for Rice) was taken on the field. Nitrogen in the form of urea plus an approved NBPT was applied at 165 lbs/acre on May 20 followed by 165 lbs/acre on June 6, followed by 100 lbs/acre on June 22. Using Trimble GreenSeeker, the N response levels remained adequate throughout the season. Intermittent flushing was utilized for irrigation. Propiconazole fungicide was applied July 2 for smut control. Sheath blight disease exceeded threshold levels and Quilt Xcel fungicide was applied July 23. Rice stink bugs reached threshold levels and Lambda-cyhalothrin was applied July 26. Rice stink bug numbers continued to increase and Endigo insecticide was applied August 11. The field was harvested on September 1 yielding 165 bu/ac and a milling yield of 48/62. The average harvest moisture was 17%. Total irrigation was 8.57 ac-in/ac and total rainfall was 16.3 inches.

### Jefferson County

The 68-acre, Jefferson County field was located just North of Reydell on silty clay loam soil. No tillage practices were chosen for the field. No pre-plant fertilizer was necessary according to the soil sample analysis. The field was drill-seeded April 10 with DG 263 L at 40 lbs/acre. The seed was treated with the company's standard seed treatment. Rice emergence was observed on April 29 at 13 plants ft$^2$. Command, League and Roundup were used as pre-emergence and burndown herbicides on April 10. Propanil, Facet and Rice One were applied as post-emergence herbicides on May 7. Levee construction was delayed causing another herbicide application. Propanil and Permit Plus herbicides were applied June 6. Using the N-STaR recommendation N fertilizer in the form of urea plus NBPT was applied at 260 lbs/acre on June 8. The mid-season N application was applied July 1 at 100 lbs/acre. GreenSeeker technology was utilized during midseason growth stages to monitor the crop's N level. No treatments were necessary for disease or insects. The field was harvested September 14. The yield was 165 bu/acre. The milling yield was 50/62 and average harvest moisture was 13%. Total irrigation use was 30 acre-inches and rainfall totaled 14.1 inches.

### Lonoke County

The 72-acre contour field was located West of Parkers Corner on Dewitt silt loam soil. Conventional tillage practices were utilized, and pre-plant fertilizer was applied at 0-40-60-5 lbs/acre (N-$P_2O_5$-$K_2O$-Zn) according to the soil test. Glyphosate, Command and Sharpen were applied as a burndown and pre-emergence herbicides May 10. The cultivar RT 7401 treated with the company's standard seed treatment was drill-seeded at

22 lbs/acre on May 10. Stand emergence was observed on June16 with 11.1 plants/$ft^2$. Facet and Permit Plus were applied as post-emergence herbicides on June 17. Nitrogen fertilizer in the form of urea plus NBPT was applied June 18. The urea was applied at 260 lbs/acre according to the N-STaR fertilizer recommendation Multiple-inlet rice irrigation (MIRI) was utilized to achieve a more efficient permanent flood. GreenSeeker technology was utilized during midseason growth stages to monitor the crop's N level. The late-boot N fertilizer application was made on July 27 at 70 lbs/acre. The field required no treatments for disease or insects. The field was harvested on September 28 yielding 177 bu/acre and a milling yield of 42/71. Total irrigation usage use was 30 acre-in/acre and total rainfall was 6.25 inches.

**Mississippi County**

The precision-graded Mississippi County field was located just west of Burdette on a Sharkey-Steel complex soil. The field was no-till and based on soil test analysis pre-plant fertilizer was applied at 0-50-60 (lbs/acre N-$P_20_5$-$K_20$). On April 30, RT 7321 FP treated with the company's standard seed treatment was drill-seeded at 23 lbs/acre. Command and Roundup were applied at planting as pre-emergence and burndown herbicides. Stand emergence was observed on May 11 with 8.3 plants/$ft^2$. Preface and Facet herbicides were applied on May 20. Nitrogen fertilizer in the form of urea plus NBPT were applied at 270 lbs/acre on May 20, according to the N-STaR recommendation. The late-boot urea application of 80 lbs/acre was made on July 11. Stink bugs reached treatment level and the field was sprayed with Endigo insecticide on August 16. The field was harvested September 23 yielding 218 bu/acre with a milling yield of 48/65. The harvest moisture was 13%. Total irrigation use was 30 acre-in/acre and rainfall totaled 12.0 inches.

**Monroe County**

The 44-acre furrow irrigated (FIR) field was located east Clarendon. The soil classification is a Foley-Bonn complex soil. Spring conventional tillage practices were used for field preparation and based on soil analysis a 0-0-50 lbs/acre (N-$P_2O_5$-$K_2O$) was applied April 4. The cultivar DG 263 L treated with the company's standard seed treatment was drill-seeded at 45 lbs/acre on April 12. Command, Sharpen and Glyphosate were applied at planting as pre-emergence and post-emergence herbicides. Emergence was observed on April 28 with 10 plants/$ft^2$. Facet L and Permit Plus herbicides were applied May 17. N-STaR (Nitrogen Soil Test for Rice) was taken on the field. N fertilizer in the form of urea was applied at 100 lbs/acre on June 21 followed by 100 lbs/acre on June 31. Another 100 lbs/acre was applied on July 2 followed by the late boot 70 lbs/acre on July 20. GreenSeeker technology was utilized during growth stages to monitor the crop's N level. Barnyard grass escapes were spotty and Clincher herbicide was spot sprayed. Propiconazole fungicide was sprayed July 11 due to a history of smuts. Stink bugs reached treatment level and lambda-cyhalothrin was applied on August 9. The field was harvested August 29 yielding 170 bu/acre. The milling yield was 55/63 and the average harvest moisture was 18%. Total irrigation for the season was 26 acre-in/acre and total rainfall was 3.95 inches.

### Phillips County

The precision-graded field was located just west of Helena on a Newellton Silty Clay soil. Spring conventional tillage practices were used for field preparation and based on soil analysis a 0-40-60 lbs/acre (N-$P_2O_5$-$K_2O$) was applied April 4 based on soil test analysis. On May 1, RT 7521 FP treated with the company's standard seed treatment was drill-seeded at 22 lbs/acre. Command, Facet L and Roundup were applied at planting as pre-emergence and burndown herbicides. Stand emergence was observed on May 14 with 12 plants/$ft^2$. Newpath, SuperWham and Facet L herbicides were applied on May 19. Regiment and Newpath herbicides were applied May 30. Nitrogen fertilizer in the form of urea plus NBPT was applied at 275 lbs/acre on June 2, according to the N-STaR recommendation. The late-boot urea application of 70 lbs/acre was applied on July 22. Quilt Xcel was applied July 10 as a smut preventative. The field was harvested September 1 yielding 200 bu/acre with a milling yield of 49/66. The harvest moisture was 17%. Total irrigation use was 30 acre-in/acre and rainfall totaled 12.5 inches.

### St. Francis County

The 42-acre contour field was located South of Pine Tree Calloway Silt Loam soil. Conventional tillage practices were utilized, and pre-plant fertilizer was applied at 0-60-90 lbs/acre (N-$P_2O_5$-$K_2O$) according to the soil test. Glyphosate and 2,4, D amine were used as burndown herbicides in the spring. The cultivar DG 263 L treated with the company's standard seed treatment was drill-seeded at 42 lbs/acre on May 1. Command was applied as a pre-emergence herbicide May 3. Stand emergence was observed May 12 with 10 plants $ft^2$. Facet L and Permit Plus were applied as post-emergence herbicides on May 12. Sharpen herbicide was applied on May 16. Nitrogen fertilizer in the form of urea plus NBPT was applied June 2 at 200 lbs/acre, according to the N-STaR recommendation. Multiple-inlet rice irrigation (MIRI) was utilized to achieve a more efficient permanent flood since the levees were numerous. GreenSeeker technology was utilized during midseason growth stages to monitor the crop's N level. The Mid-season N fertilizer application was made on July 13 at 100 lbs/acre. The field required no treatments for disease or insects. The field was harvested on September 29 yielding a disappointing 145 bu/acre and a milling yield of 58/69. The harvest moisture averaged 12%. Total irrigation usage use was 30 acre-in/acre and total rainfall was 8.1 inches.

**Table 1. Agronomic information for fields enrolled in the 2022 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[a] | Harvest Moisture |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arkansas | RT 7321 FP | 38 | Soybean | 22 | 6 | 12-May | 28-May | 26-Sept | 145 | 49/72 | 17% |
| Crittenden | RT 7321 FP | 40 | Soybean | 22 | 7 | 29-April | 9-May | 11-Sept | 201 | 52/69 | 16% |
| Drew | DB 263 L | 41 | Soybean | 45 | 12 | 10-April | 7-May | 1-Sept | 165 | 48/62 | 17% |
| Jefferson | DG 263 L | 68 | Fallow | 40 | 13 | 10-April | 29-April | 14-Sept | 165 | 50/62 | 13% |
| Lonoke | RT 7401 | 72 | Soybean | 22 | 11 | 10-May | 16-May | 28-Sept | 177 | 42/71 | 12% |
| Mississippi | RT 7521 FP | 36 | Soybean | 23 | 8 | 30-April | 11-May | 23-Sept | 218 | 48/65 | 13% |
| Monroe | DG 263 L | 44 | Soybean | 45 | 10 | 12-May | 28-May | 29-Aug | 170 | 55/63 | 18% |
| Phillips | RT 7321 FP | 40 | Soybean | 22 | 12 | 1-May | 14-May | 1-Sept | 200 | 49/66 | 17% |
| St. Francis | DG 263 L | 42 | Soybean | 45 | 10 | 1-May | 9-May | 29-Sept | 145 | 58/69 | 12% |
| | | | | | | | | | | | |
| **Average** | ------ | **47** | ------ | [b]32 | [c]10 | **12-May** | **17-May** | **18-Sep** | **176** | **50/67** | **15%** |

[a] Milling yield: % Head rice (whole white grains) / % Total white rice (whole grains + broken grains).
[b] Seeding rates averaged 44 lbs/acre for conventional cultivars and 22 lbs/acre for hybrid cultivars.
[c] Stand density averaged 11 plants/ft$^2$ for conventional cultivars and 9 plants/ft$^2$ for hybrid cultivars.

**Table 2. Soil test results, fertilization program, and soil classification for fields enrolled in the 2022 Rice Research Verification Program.**

| Field Location by County | Soil Test | | | | Applied Fertilizer (lbs/acre) | | | Soil Classification |
|---|---|---|---|---|---|---|---|---|
| | | lbs/acre | | | | | | |
| | pH | P | K | Zn | Mixed Fertilizer [a] N-P-K-Zn [b] | N-Star Urea (46%N) rates and timing [c, d] | Total N rate (lbs N/acre) | |
| Arkansas | 6.5 | 56 | 260 | 6.2 | 0-60-60-10 | 275-70 | 159 | Hebert Silt Loam |
| Crittenden | 6.9 | 50 | 567 | 5.4 | 0-50-0-0 | 260-70 | 152 | Sharkey-Silty Clay |
| Drew | 6.3 | 86 | 469 | 7.8 | 0-40-60-0 | 165-165-100 | 198 | Portland Clay |
| Jefferson | 7.1 | 59 | 683 | 9.3 | 0-0-0-0 | 260-100 | 165 | Portland Clay and Rilla Silt Loam |
| Lonoke | 6.1 | 30 | 209 | 3.3 | 0-40-60-0 | 260-70 | 152 | Dewitt Silt Loam and Stuttgart Silt Loam |
| Mississippi | 6.9 | 71 | 508 | 9.5 | 0-50-60-0 | 270-80 | 161 | Sharkey-Steel Complex |
| Monroe | 7.1 | 64 | 423 | 9.5 | 0-0-60-0 | 100-100-100-70 | 170 | Foley-Calhoun-Bonn Complex |
| Phillips | 7.1 | 35 | 198 | 6.8 | 0-40-60-0 | 275-70 | 160 | Loring-Memphis-Collins |
| St. Francis | 6.6 | 18 | 115 | 4.6 | 0-60-90 | 200-100 | 138 | Calhoun-Henry silt loam |

[a] Column represents regular pre-plant applications.
[b] N=nitrogen, P=phosphorus, K=potassium, Zn=zinc.
[c] Timing: preflood – midseason – boot. Each field was fertilized according to its N-STaR recommendation. The mark (*) denotes an adjusted N-STaR rate and timing for furrow irrigated rice.
[d] The N-Star preflood N recommendation in all fields was treated with an approved NBPT product to minimize N loss due to ammonia volatilization.
[e] Row rice fields received additional seasonal N exceeding the N-Star recommendation by 46 lbs.

**Table 3. Herbicide rates and timings for fields enrolled in the 2022 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 | Preface (6 oz) + Prowl (2.1 pt) fb Preface (4 oz) + Prowl (2.1 oz) + Facet L (32 oz) | Regiment (.6 oz) + Command (12.8 oz) + League (6.4 oz) + Triple Play (1 pt.) |
| Crittenden | Glyphosate (32 oz) fb Preface (6 oz) + Command (10 oz) + Sharpen (3 oz) | Regiment (.5 oz) + Command (10 oz) + Postscript (5 oz) Triple Play (1 pt) |
| Drew | Command (20oz) + Glyphosate (32 oz) + Sharpen (2 oz) | Rebel X (20 oz) fb Regiment (.6 oz) + Triple Play (1 pt) |
| Jefferson | Command (16 oz) + Roundup Power Max (20 oz) + League (6.4 oz) | Propanil (3 qts) + Facet L (22 oz) + Rice One (1 qt) fb Propanil (3 qts) + Permit Plus (.75 oz) + COC (1pt) |
| Lonoke | Command (20 oz) + Glyphosate (32 oz) + Sharpen (2 oz) | Facet L (32 oz) + Permit Plus (.75 oz) + COC (1 pt) |
| Mississippi | Command (16 oz) + Roundup Power Max (28 oz) | Preface (4 oz) + Facet L (32 oz) + COC (1 pt) |
| Monroe | Command (16 oz) + Glyphosate (32 oz) + Sharpen (2 oz) | Facet L (32 oz) + Permit Plus (.75 oz) fb Clincher (20 oz) + COC (1 qt) |
| Phillips | Command (16 oz) + (Roundup Power Max (28 oz) + Facet L (32 oz) | Newpath (6 oz) + SuperWham (4 qts) + Facet L (16 oz) fb Regiment (.5 oz) + Newpath (5 oz) + Triple Play (1 pt) |
| St. Francis | Glyphosate (32 oz) + 24D (16 oz) fb Command (16 oz) | Permit Plus (.75 oz) + Facet (32 oz) + Sharpen (1 oz) fb Riceshot (4 qts) + Sharpen (1 oz) |

[x] 'FB' = 'followed by' and is used to separate herbicide application events; COC = Crop Oil Concentrate; NIS = Non-Ionic Surfactant; Triple Play = Organo-Silicone Surfactant

**Table 4. Seed treatments used and foliar fungicide and insecticide applications made on fields enrolled in the 2022 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/Armyworms |
| Arkansas | RTST | ------- | ------ | ------ | Endigo (5 oz) |
| Crittenden | RTST | Quilt Excel (14 oz) | ------ | ------ | Lambda-Cyhalothrin (4 oz) |
| Drew | RTST | Propiconazole (6 oz)<br>Quilt Excel (17 oz) | ------ | ------ | Endigo (5 oz) |
| Jefferson | DGST | ------- | ------ | ------ | ------ |
| Lonoke | RTST | ------- | ------ | ------ | ------ |
| Mississippi | RTST | ------- | ------ | ------ | Lambda-Cyhalothrin (2 oz)<br>Endigo (5 oz) |
| Monroe | RTST | Propiconazole (6 oz) | ------ | ------ | Lambda-Cyhalothrin (2 oz) |
| Phillips | RTST | Quilt Excel (16 oz) | ------ | ------ | ------ |
| St. Francis | DGST | ------ | ------ | ------ | ------ |

[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 zinc and compounds intended to enhance germination and early-season plant growth.

**Table 5. Rainfall and irrigation information for fields enrolled in the 2022 Rice Research Verification Program.**

| Field Location by County | Rainfall (inches) | Irrigation[z] (acre-in/acre) | Rainfall + Irrigation (inches) |
|---|---|---|---|
| Arkansas | 7.9 | 28 | 35.9 |
| Crittenden | 13 | 30[Z] | 43 |
| Drew | 16.3 | 8.57 | 24.87 |
| Jefferson | 14.1 | 30[Z] | 44.1 |
| Lonoke | 6.25 | 30[Z] | 36.25 |
| Mississippi | 12 | 30[Z] | 42 |
| Monroe | 3.95 | 26 | 29.95 |
| Phillips | 12.5 | 30[Z] | 42.5 |
| St. Francis | 8.1 | 30[Z] | 38.1 |

[z] Not all fields were equipped with flow meters to monitor water use for irrigation. Therefore, the historical average irrigation amount in fields with flow meters 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 2022 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 9 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 2022 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 $693.28/acre for Jefferson County to $1,042.98 for Phillips County, while operating costs per bushel ranged from $3.51/bushel for Mississippi County to $5.89/bushel for St. Francis County. Total costs per acre (operating plus fixed) ranged from $766.62/acre for Jefferson County to $1,142.61/acre for Phillips County, and total costs per bushel ranged from $3.85/bushel for Mississippi County to $6.64/bushel for St. Francis County. Returns above operating costs ranged from $199.60/acre for St. Francis County to $747.46/acre for Mississippi County and returns above total costs ranged from $80.12/acre for Arkansas County to $673.57/acre for Mississippi 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 2022 RRVP was 176 bushels/acre but ranged from 145 bushels/acre for Arkansas County to 218 bushels/acre for Mississippi County. An Arkansas average long-grain cash price of $7.23/bushel was estimated using USDA, National Agricultural Statistics Service (NASS) US long grain 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, a standard milling yield of 55/70 for long-grain rice, and 2022 loan values for whole kernels ($11.13/cwt; $5.01/bushel) and broken kernels ($6.47/cwt; $2.91/bushel). Estimated long-grain prices adjusted for milling yield varied from $6.85/bushel in Drew County to $7.26/bushel in St. Francis County (Table 7).

The average operating expense for the 9 RRVP fields was $849.27/acre (Table 7). Fertilizer and nutrient expenses accounted for the largest share of operating expenses on average (26.8%) followed by chemicals (17.1%), seed (14.0%), and post-harvest expenses (12.5%). Although seed's share of operating expenses was 14.0% across the 9 fields, it's average cost and share of operating expenses varied depending on whether a proprietary non-herbicide tolerant pure-line cultivar was used

($72.92/acre; 9.26% of operating expenses), a non-herbicide tolerant hybrid was used ($136.19/acre; 15.21% of operating expenses) or a herbicide-tolerant hybrid was used ($160.68/acre; 17.87% of operating expenses).

The average return above operating expenses for the 9 fields was $387.96/acre and ranged from $199.60/acre for St. Francis County to $747.46/acre for Mississippi County. The average return above total specified expenses for the 9 fields were $293.10/acre and ranged from $80.12/acre for Arkansas County to $673.57/acre for Mississippi 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 2022 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 | 829.84 | 5.72 | 208.71 | 128.59 | 958.43 | 80.12 | 6.61 |
| Crittenden | 959.46 | 4.77 | 475.27 | 94.20 | 1,053.67 | 381.07 | 5.24 |
| Drew | 759.18 | 4.60 | 371.12 | 70.62 | 829.80 | 300.50 | 5.03 |
| Jefferson | 693.28 | 4.20 | 443.93 | 73.34 | 766.62 | 370.60 | 4.65 |
| Lonoke | 895.34 | 5.06 | 341.27 | 111.67 | 1,007.01 | 229.60 | 5.69 |
| Mississippi | 764.94 | 3.51 | 747.46 | 73.90 | 838.84 | 673.57 | 3.85 |
| Monroe | 844.73 | 4.97 | 349.72 | 93.24 | 937.97 | 256.48 | 5.52 |
| Phillips | 1042.98 | 5.21 | 354.57 | 99.64 | 1,142.61 | 254.93 | 5.71 |
| St. Francis | 853.65 | 5.89 | 199.60 | 108.54 | 962.18 | 91.07 | 6.64 |
| **Average** | **849.27** | **4.88** | **387.96** | **94.86** | **944.13** | **293.10** | **5.44** |

**Table 7. Summary of Revenue and Expenses per Acre for fields enrolled in the 2022 Rice Research Verification Program.**

| Receipts | Arkansas | Crittenden | Drew | Jefferson | Lonoke |
|---|---|---|---|---|---|
| Yield (bushels) | 145 | 201 | 165 | 165 | 177 |
| Price Received ($/bushel) | 7.16 | 7.14 | 6.85 | 6.89 | 6.99 |
| **Total Crop Revenue** | **1038.55** | **1434.73** | **1130.30** | **1137.22** | **1236.61** |
| | | | | | |
| **Operating Expenses** | | | | | |
| Seed | 160.36 | 160.36 | 75.00 | 66.67 | 136.19 |
| Fertilizers & Nutrients | 203.56 | 202.55 | 238.49 | 164.75 | 253.94 |
| Chemicals | 181.07 | 154.70 | 160.28 | 166.85 | 91.31 |
| Custom Applications | 54.00 | 74.80 | 76.00 | 52.80 | 52.30 |
| Diesel Fuel | 25.23 | 17.74 | 17.93 | 16.75 | 27.48 |
| Repairs & Maintenance | 27.50 | 25.11 | 18.31 | 20.87 | 24.79 |
| Irrigation Energy Costs | 25.42 | 137.84 | 15.05 | 45.66 | 137.84 |
| Labor, Field Activities | 48.35 | 46.13 | 44.18 | 45.73 | 46.81 |
| Other Inputs & Fees, Pre-harvest | 16.86 | 18.94 | 14.36 | 13.62 | 17.86 |
| Post-harvest Expenses | 87.51 | 121.30 | 99.58 | 99.58 | 106.82 |
| **Total Operating Expenses** | **829.84** | **959.46** | **759.18** | **693.28** | **895.34** |
| **Returns to Operating Expenses** | **208.71** | **475.27** | **371.12** | **443.93** | **341.27** |
| | | | | | |
| Capital Recovery & Fixed Costs | 128.59 | 94.20 | 70.62 | 73.34 | 111.67 |
| **Total Specified Expenses [z]** | **958.43** | **1,053.67** | **829.80** | **766.62** | **1,007.01** |
| | | | | | |
| **Returns to Specified Expenses** | **80.12** | **381.07** | **300.50** | **370.60** | **229.60** |
| | | | | | |
| Operating Expenses/Yield Unit | 5.72 | 4.77 | 4.60 | 4.20 | 5.06 |
| Total Expenses/Yield Unit | 6.61 | 5.24 | 5.03 | 4.65 | 5.69 |

[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 2022 Rice Research Verification Program (Continued).**

| Receipts | Mississippi | Monroe | Phillips | St. Francis | Average |
|---|---|---|---|---|---|
| Yield (bushels) | 218 | 170 | 200 | 145 | 176 |
| Price Received ($/bushel) | 6.94 | 7.03 | 6.99 | 7.26 | 7.03 |
| **Total Crop Revenue** | **1512.40** | **1194.45** | **1397.54** | **1053.25** | **1237.23** |
| | | | | | |
| **Operating Expenses** | | | | | |
| Seed | 164.58 | 75.00 | 157.42 | 75.00 | 118.95 |
| Fertilizers & Nutrients | 160.95 | 305.67 | 243.99 | 276.69 | 227.84 |
| Chemicals | 93.63 | 148.49 | 205.68 | 102.50 | 144.95 |
| Custom Applications | 69.60 | 64.00 | 69.50 | 62.00 | 63.89 |
| Diesel Fuel | 15.61 | 21.12 | 18.97 | 22.32 | 20.35 |
| Repairs & Maintenance | 20.41 | 21.04 | 24.79 | 24.83 | 23.07 |
| Irrigation Energy Costs | 49.18 | 45.66 | 137.84 | 137.84 | 81.37 |
| Labor, Field Activities | 44.93 | 45.00 | 44.01 | 47.58 | 45.86 |
| Other Inputs & Fees, Pre-harvest | 14.49 | 16.15 | 20.07 | 17.38 | 16.64 |
| Post-harvest Expenses | 131.56 | 102.60 | 120.70 | 87.51 | 106.35 |
| **Total Operating Expenses** | **764.94** | **844.73** | **1,042.98** | **853.65** | **849.27** |
| **Returns to Operating Expenses** | **747.46** | **349.72** | **354.57** | **199.60** | **387.96** |
| | | | | | |
| Capital Recovery & Fixed Costs | 73.90 | 93.24 | 99.64 | 108.54 | 94.86 |
| **Total Specified Expenses [z]** | **838.84** | **937.97** | **1,142.61** | **962.18** | **944.13** |
| | | | | | |
| **Returns to Specified Expenses** | **673.57** | **256.48** | **254.93** | **91.07** | **293.10** |
| | | | | | |
| Operating Expenses/Yield Unit | 3.51 | 4.97 | 5.21 | 5.89 | 4.88 |
| Total Expenses/Yield Unit | 3.85 | 5.52 | 5.71 | 6.64 | 5.44 |

[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 2022 Rice Research Verification Program.**

| County | Rice Type | Seed | Fertilizers & Nutrients | Herbicides | Insecticides | Fungicides & Other Inputs | Diesel Fuel | Irrigation Energy Costs |
|---|---|---|---|---|---|---|---|---|
| Arkansas | RT 7521 FP | 160.36 | 203.56 | 173.42 | 7.65 | --- | 25.23 | 25.42 |
| Crittenden | RT 7321 FP | 160.36 | 202.55 | 126.09 | 7.52 | 21.09 | 17.74 | 137.84 |
| Drew | DG 263 L | 75.00 | 238.49 | 118.58 | 11.41 | 30.29 | 17.93 | 15.05 |
| Jefferson | DG 263 L | 66.67 | 164.75 | 166.85 | --- | --- | 16.75 | 45.66 |
| Lonoke | RT 7401 | 136.19 | 253.94 | 91.31 | --- | --- | 27.48 | 137.84 |
| Mississippi | RT 7521 FP | 164.58 | 164.58 | 75.81 | 11.41 | 6.41 | 15.61 | 49.18 |
| Monroe | DG 263 L | 75.00 | 75.00 | 140.04 | 3.76 | 4.69 | 21.12 | 45.66 |
| Phillips | RT 7521 FP | 157.42 | 157.42 | 181.58 | --- | 24.10 | 18.97 | 137.84 |
| St. Francis | DG 263 L | 75.00 | 75.00 | 102.50 | --- | --- | 22.32 | 137.84 |
| **Average** | **---** | **118.95** | **170.59** | **130.69** | **8.35** | **17.31** | **20.35** | **81.37** |