



2024

University of Missouri Rice Verification Program

The MU Rice Verification Program is funded by the **North Central Integrated Pest Management Center** through a mini grant reward and the **University of Missouri County Extension Councils**.



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Missouri Rice Research Verification Program, 2024

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Introduction

The Missouri (Mizzou) Rice Verification Program was established in the 2024 growing season. The program is an interdisciplinary effort between growers and consultants, field specialists in agronomy, extension specialists, and researchers. The verification program is an on-farm demonstration of all the research-based recommendations developed by the University of Missouri Extension Service, Division of Plant Science and Technology for the purpose of increasing the profitability of rice production in Missouri. The specific objectives of the program are:

- 1.) Verify that university recommendations are achieving optimal yield and profitability to the grower.
- 2.) Promotion of timeliness in agronomic management decisions.
- 3.) Find areas of research requiring more in-depth evaluation.
- 4.) Educate new field specialists in agronomy.

The verification fields and cooperators are selected prior to planting. Cooperators agreed to pay production expense, provide crop expense data for economic analysis, and implement the recommended production practices in a timely manner from seedbed preparation to harvest. Three fields were enrolled in the verification program for the first season. The fields were located on commercial farms ranging around 70 acres each.

Only two counties participated in the program in 2024, Mississippi and Stoddard County Figure 1.

The three rice fields totaled 212 acres enrolled in the program. Three different cultivars were seeded: Dyna-Gro DG263L; RiceTec RT 7521 FP; and RiceTec RT XP753. The University of Missouri Extension recommendations were used to manage the verification 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 extension recommendations. Data collected included components such as stand density, weed populations, disease infestation levels, insect populations, rainfall, and dates for specific growth stages, grain yield, milling yield, and grain quality.

Figure 1. County locations (Star) of the 2024 Mizzou Rice Verification Program Fields.



Mississippi County

The Mississippi County furrow-irrigated field was located just southeast of Wyatt on a Sharkey and Alligator clay soil. The field consisted of 70.2 acres and the previous crop was soybean. The cultivar chosen was RT XP753 treated with the company's standard seed treatment in the spring, no tillage practices were used. The field was drill-seeded at 24 lbs/acre on April 1. Emergence was on April 23rd with a stand count of 8.5 plants/ft². According to the soil test, pre-plant fertilizer was not needed. Glyphosate, Command, and Sharpen herbicides were applied at planting. Post-emergence Command and Prowl were applied on May 3rd followed by another application of the same herbicides with the addition of Stam on June 7th. Nitrogen in the form of urea plus Agrotain (NBPT) was applied at 163 lbs/acre on May 20th, followed by 163 lbs/acre on June 10th, followed by the last application of 100 lbs/acre on June 28th. Prior to in-season fertilization and irrigation, the middles were pulled to create 'beds' and furrows were ran to ensure proper infiltration of water. Plant tissue samples were collected on June 17th to ensure N unit requirements were met. The field was harvested on September 2nd yielding 220 bu/acre. The average harvest moisture was 16.8%. The total irrigation was 28.5 ac-in/ac and the total rainfall was 23.1 inches. Water was retained at the lower end of the field to back water up into the 'middle' portion of the field.

Stoddard County (McMeans)

The 71.8-acre furrow-irrigated field was located just east of Lake Wappepollo on a Calhoun silt loam soil. Before the rice was planted, the field had grown soybeans previously for three consecutive years. Pre-plant fertilizer was applied at a rate of 0-60-80 along with 4 lbs. of Zinc and .5 lbs. of Boron. The cultivar chosen was RT 7521 FP treated with the company's standard seed treatment. The field was drill-seeded on April 15th at a seeding rate of 22 lbs/acre atop stale seed beds from the previous fall. Emergence was on April 29th with 6 plants/ft² as the final stand count. Glyphosate, Command, and Sharpen herbicides were applied at planting. Post-emergence applications of Preface and Prowl were applied on May 3rd followed by an additional application of Preface and Prowl on May 20th. Nitrogen in the form of urea plus Agrotain (NBPT) was applied at 163 lbs/acre on May 14th, followed by 163 lbs/acre on May 21st, followed by the last application of 100 lbs/acre on /June 14th. On June 25th the presence of leaf blast lesions was visible along the southern and eastern tree line of the field. The progression of the disease was monitored closely. The consideration of cultivar disease resistance and the economics of fungicide applications to control the blast determined the likelihood of a positive return on an application wasn't feasible.

Due to field history, a fungicide application of Tilt was applied on July 13th to suppress false smut. The field was harvested on September 10th yielding 191.8 bu/acre and a milling yield of 50/69. The average harvest moisture was 12.7%. The total irrigation was 29.0 ac-in/ac and the total rainfall was 30.1 inches. Unlike most furrow-irrigated rice fields, the water was not retained at the lower end of the field.

Stoddard County (Schuchart)

The 70.0-acre furrow-irrigated field was located north-northwest of Vanduser on predominately Mhoon silt loam and Dundee silt loam soil with a “vein” Sharkey silty clay running perpendicular in the field. Pre-plant fertilizer was applied at a rate of 18-46-60. The cultivar chosen was DG 263L treated with the company’s standard seed treatment. The field was drill-seeded on April 23rd with a target seeding rate of 40 lbs/acre atop stale seed beds from the previous fall. Due to drill calibration issues, the western ¼ portion of the field received a seeding rate of half of the targeted rate. Emergence was on May 8th with 17 plants/ft² as the final stand count. On the portion of the field with a decreased seeding rate there was an average of 8 plants/ft². Glyphosate, Command, Facet, and Sharpen herbicides were applied at planting. Post-emergence applications of Command and Prowl were applied on May 20th followed by an application of Ricestar and Prowl on June 3rd with the last herbicide application on June 15th consisting of Ricebeaux and Facet. Nitrogen in the form of urea plus Agrotain (NBPT) was applied at 100 lbs/acre on June 3rd, followed by 100lbs/acre on June 17th, followed by the last application of 100 lbs/acre on June 27th. On July 29th the presence of sheath blight reached threshold levels and on August 1st an application of the fungicide, Satori, was flown on the field. The field was harvested on October 2nd yielding 180 bu/acre. The average harvest moisture was 12.4 %. The total irrigation was 31.0 ac-in/ac and the total rainfall was 22.5 inches. The drain at the lower end of the field was blocked which allowed water to be backed up in the field creating a flooded environment for the lower end of the field.

Table 1. Agronomic Information for fields enrolled in the 2024 Mizzou Rice 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/ac)	Milling yield ^a	Harvest moisture
Mississippi	RT XP753	70.2	Soybean	23	8.5	1-Apr	23-Apr	6-Sep	220.6	*	16.8
Stoddard (McMeans)	RT 7521 FP	71.8	Soybean	22	6.0	15-Apr	29-Apr	10-Sep	191.8	50/69	12.7
Stoddard (Schuchart)	DG 263 L	70.0	Soybean	40 ^a	17.0	23-Apr	8-May	2-Oct	180.0	*	12.4

^aMilling yield: % Head rice (whole white grains % Total white rice (whole grains + broken grains).

Table 2. Soil test results, fertilization program, and soil classification for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location by County	Soil Test				Applied Fertilizer (lbs/acre)			Soil Classification
	pH	lbs/acre			Mixed Fertilizer ^a N-P-K-Zn-B ^b	Urea (46% N) rates and timing ^{c,d}	Total N Rate (lbs N/acre)	
		P	K	Zn				
Mississippi	6.3	32.6	158.2	3.9	0-0-0-0-0	(75-75-46)	196	Sharkey silty clay and Alligator silty clay
Stoddard (McMeans)	6.6	70.0	233.5	5.3	0-40-80-4-.5	(75-75-46)	196	Calhoun silt loam
Stoddard (Schuchart)	6.7	37.1	162.2	3.1	18-46-60-0-0	(46-46-46)	138	Mhoon silt loam and Dundee silt loam

^aColumn represents regular pre-plant applications.

^bN = Nitrogen, P = Phosphorus (P₂O₅), K = potassium (K₂O), Zn = Zinc, B= Boron.

^cTiming: 4-5-leaf - two weeks after 1st application - one week after 2nd applicaton.

^dAll fields were treated with an approved NBPT product to minimize N loss due to ammonia volatilization.

Table 3. Plant tissue analysis for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location by County	Analysis ^a	%							ppm					
		<i>N</i>	<i>P</i>	<i>K</i>	<i>S</i>	<i>Mg</i>	<i>Ca</i>	<i>Na</i>	<i>B</i>	<i>Zn</i>	<i>Mn</i>	<i>Fe</i>	<i>Cu</i>	<i>Al</i>
		Mississippi	3.60	0.22	2.08	0.42	0.34	1.21	0.02	19	22	204	122	12
Stoddard (Schuchart)	3.33	0.19	2.09	0.28	0.31	0.88	0.02	13	20	91	132	13	81	

^aCollection of the uppermost leaf blades was sent to Waypoint Analytical for in-season nutrient monitoring.

Table 4. Herbicide rates and timings for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location by county	Burdown/Pre-emergence Herbicide Applications (Trade name & Product rate/acre)	Post-emergence Herbicide Applications (Trade name & product rate/acre) ^a
Mississippi	Glyphosate (1 qt) + Command (12 oz) + Sharpen (3 oz)	Command (8 oz) + Prowl (1 qt) fb Command (8 oz) + Prowl (1 qt) + Stam (4 qt)
Stoddard (McMeans)	Glyphosate (1 qt) + Command (12 oz) + Sharpen (3 oz)	Preface (4 oz) + Prowl (1 qt) fb Preface (4 oz) + Prowl (1 qt)
Stoddard (Schuchart)	Glyphosate (1 qt) + Command (16 oz) + Facet (16 oz) + Sharpen (3 oz)	Command (16 oz) + Prowl (1 qt) fb Ricestar (24 oz) + Prowl (1 qt) fb Ricebeaux (4 qt) + Facet (16 oz)

^a'Fb' = 'followed by' and is used to separate herbicide application events.

Table 5. Seed treatments used and foliar fungicide and insecticide applications made on fields enrolled in the Mizzou Rice Verification Program.

Field Location by county	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 ^a	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
Mississippi	RTST	--	--	--	--
Stoddard (McMeans)	RTST	Tilt (6 oz)	--	--	--
Stoddard (Schuchart)	DGST	Satori (12 oz)	--	--	--

^aRTST = 'RiceTec Seed Treatment' and 'DGST' = 'Dyna-Gro Seed Treatment. These abbreviations define those fields with seed treated by RiceTec or purchase and consist of insecticide and fungicides in addition to other seed treatment products.

Table 6. Rainfall and irrigation information for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location by county	Rainfall (inches)	Irrigation ^a (acre-in/acre)	Rainfall + Irrigation (inches)
Mississippi	23.1	28.5	51.6
Stoddard (McMeans)	30.1	29.0	59.1
Stoddard (Schuchart)	22.5	31.0	53.5

^aThe historical irrigation average amount in fields and rainfall dates were used for best-guess estimates.

Economic Analysis

Each verification field had information collected on production costs and returns for the 2024 Missouri Rice Verification Program. Records of field operations provided the basis for the estimation of production costs. The field records were compiled by the field specialist in agronomy, crop consultants, and the cooperators. Production data from the three fields were applied to determine costs and returns above operating costs along with 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 combined from the 2024 Crop Enterprise Budgets published by the Arkansas Cooperative Extension Service, 2024 Missouri Crop and Livestock Enterprise Budgets published by the University of Missouri Extension, and information provided by the cooperating producers. 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 of prices of new equipment. This measure differs from typical depreciation methods, as well as actual annual cash expenses for machinery.

Operating costs, fixed costs, per bushel (bu), and returns above operating and total specified costs are presented in Table 8. Costs in this report do not include land costs, management, or other expenses and fees not associated with production. Operating costs ranged from \$709.88/acre for Mississippi County to \$867.25/acre for Stoddard (McMeans) County, while operating costs per bushel ranged from \$3.22/bushel for Mississippi County to 4.52/bushel for Stoddard (McMeans) County. Total costs per acre (operating plus fixed) ranged from 845.11/acre for Mississippi County to 1,002.48/acre for Stoddard (McMeans) County, and total costs per bushel ranged from \$3.83 per bushel for Mississippi County to \$5.23 per bushel for Stoddard (McMeans) County. The returns above operating costs ranged from \$379.45/acre for Stoddard (McMeans) to \$724.09 for Mississippi County, and returns above total costs ranged from \$244.22/acre for Stoddard (McMeans) County to \$588.86/acre for Mississippi County.

A summary of yield, rice price, revenues, and expenses by expense type for each verification field is presented in Table 7. The average yield for the 2024 Missouri Rice Verification field was 197.5 bu/acre, ranging from 180 bu/acre from Stoddard (Schuchart) County to 220 bu/acre for Mississippi County. The Missouri average long-

grain cash prices of \$7.61, were estimated using the USDA, National Agricultural Statistics Services (NASS) US long grain prices for the months of October and November. A premium or discount was given to each field based on the milling yield observed from each field with the standard milling yield of 55/70 for long-grain rice. Only the Stoddard (McMeans) County has reported milling yields so far.

The average operating expense for the three verification fields was \$783.72/acre (Table 8). Irrigation energy cost expenses accounted for the largest share of operating expenses on average (22.5%) followed by Fertilizer and Nutrients (20.0%), seed (18.0%), and chemical (17.4%). Although seed's share of operating expenses was 18.0% across the three fields, its average cost and share of operating expenses varied depending on whether a proprietary non-herbicide tolerant pure-line cultivar was used (\$95.30/acre; 12.2% of operating expenses), or a herbicide-tolerant hybrid was used (\$176.87/acre; 22.5% of operating expenses).

The average return above operating expenses from the three fields was \$499.83/acre and ranged from \$379.45/acre for Stoddard (McMeans) County to \$724.09/acre for Mississippi County. The average return above total specified expenses for the three fields were \$364.60/acre and ranged from \$244.22 for Stoddard (McMeans) County to \$588.86 /acre for Mississippi County. Table 9. provides select variable costs for each field and includes a further breakdown of chemical cost into herbicides, insecticides, and fungicides. Table 9 also lists the specific rice cultivars grown on each verification field.

Table 7. Summary of Revenue and Expenses per acre for fields enrolled in the 2024 Mizzou Rice Verification Program.

Receipts	Mississippi	Stoddard (McMeans)	Stoddard (Schuchart)
Yield	220.6	191.8	180.0
Price Received (\$/bushel)	\$6.50	\$6.50	\$6.50
Total Crop Revenue	\$1,433.97	\$1,246.70	\$1,170.00
Operating Expenses			
Seed	\$152.26	\$176.87	\$95.30
Fertilizer & Nutrients	\$146.93	\$191.93	\$131.29
Chemicals	\$71.94	\$151.00	\$189.94
Custom Applications	\$101.21	\$107.21	\$105.00
Diesel Fuel ^a	\$3.25	\$2.96	\$3.25
Repairs & Maintenance ^a	\$4.68	\$4.68	\$4.68
Irrigation Energy Cost	\$170.72	\$173.71	\$185.69
Labor, Field Activities ^a	\$7.59	\$7.59	\$7.59
Post-harvest Expenses ^a	\$51.30	\$51.30	\$51.30
Total Operating Expenses	\$709.88	\$867.25	\$774.04
Returns to Operating Expenses	\$724.09	\$379.45	\$395.96
Capital Recovery & Fixed Costs ^a	135.23	135.23	135.23
Total Specific Expenses^b	\$845.11	\$1,002.48	\$909.27
Returns to Specified Expenses	\$588.86	\$244.22	\$260.73
Operating Expenses/Yield Unit	\$3.22	\$4.52	\$4.30
Total Expenses/Yield Unit	\$3.83	\$5.23	\$5.05

^aCost were assumed based on the Arkansas Furrow Irrigated Production Handbook.

^bDoes not include land costs, management, or other expenses and fees not associated with production.

Table 8. Operating Costs, Total Costs, and Returns for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location	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)
Mississippi Stoddard (McMeans)	\$709.88	\$3.22	\$724.09	\$135.23	\$845.11	\$588.86	\$3.83
Stoddard (Schuchart)	\$867.25	\$4.52	\$379.45	\$135.23	\$1,002.48	\$244.22	\$5.23
	\$774.04	\$4.30	\$395.96	\$135.23	\$909.27	\$260.73	\$5.05
Average	\$783.72	\$4.01	\$499.83	\$135.23	\$918.95	\$364.60	\$4.70

Table 9. Selected Variable Input Cost Per Acre for fields enrolled in the 2024 Mizzou Rice Verification Program.

Field Location	Seed Type	Seed	Fertilizers & Nutrients	Herbicides	Insecticides	Fungicides & Other Inputs	Diesel Fuel	Irrigation Energy Costs
Mississippi Stoddard (McMeans)	RT XP753	\$152.26	\$146.93	\$71.94	---	---	\$5.05	\$170.72
Stoddard (Schuchart)	RT 7521 FP	\$176.87	\$191.93	\$136.00	---	\$4.50	\$2.96	\$173.71
	DG 263 L	\$95.30	\$131.29	\$179.54	---	\$10.40	\$5.05	\$185.69
Average	---	\$141.48	\$156.72	\$129.16	---	\$7.45	\$4.35	\$176.71