Missouri Rice Research Update 2014

Southeast Missouri State University
UM Fisher Delta Center
UM Extension

Special Report # 1-2014
February 19, 2014

Introduction

This report is a compilation of research projects, demonstration efforts, and additional Missouri rice information. Its purpose is to inform producers, research and extension personnel, industry representatives, agribusiness consultants, farm suppliers, and commodity organizations about rice activities in Missouri. The information is a result of rice research conducted at the Missouri Rice Research Farm, UM Fisher Delta Center Research Farm, and Southeast—Malden Rice Lab. The research results were summarized by University of Missouri Fisher Delta Center Experiment Station and Southeast Missouri State University Personnel. The use of trade or company names in this report does not constitute recommendation or endorsement.

A special acknowledgement is extended to the Missouri rice producers, Missouri Rice Research and Merchandising Council, Southeast Missouri State University, the University of Missouri College of Agriculture, Food, and Natural Resources, and the Missouri Commercial Agriculture Extension Program for financial support.

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For further information on Missouri Rice visit these websites:

A SEMO Rice Page on the World Wide Web at

http://www.semo.edu/rice/

A Missouri Rice Page on the World Wide Web at

http://www.ext.missouri.edu/agebb/rice/

L Missouri Rice DD50 Program on the World Wide Web at

http://www.agebb.missouri.edu/rice/ricemodel.htm

2015 Missouri Rice Conference
February 19, 2015

Moderator: Sam Atwell, Agronomy MU Rice

8:00 am – Registration, coffee, doughnuts

8:10 – Welcome

8:15 – Seed Treatments - *Dr. Moneen Jones, Entomologist, MU Fisher Delta Research Center*

8:30 - Delta States Irrig. Summary – *Dr. Joe Henggeler, Irrigation Specialist, MU FDRC*

8:45 – Sensor-based N Management – *Dr. AJ Foster, MU Extension*

9:00 – Rice Varieties & Breeding – *Dr. Donn Beighley, Rice Breeder, Southeast Missouri State University*

9:20 - Rice Production Research – *Matt Rhine, MU Fisher Delta Research Center*

9:45-10:00 – Break

10:00 – Rice Weed Control – *Jim Heiser, MU Fisher Delta Research Center*

10:30 – Black Bird Rice Research Update – *Parker Hall, USDA-APHIS Wildlife Director*

11:10 – Rice Production Issues – *Dr. Jarrod Hardke, Rice Specialist, U of Arkansas*

11:50 – US Domestic & Foreign Markets –*Greg Yielding, MO Rice Council, USRPA*

12:10 pm – Lunch

** *After Lunch a Special Farm Bill Meeting will be co-hosted by David Reinbott, Ag Business, MU Extension and Steve Morrison, USDA/FSA Director for Stoddard County* **

Industry Representatives have set up booths and are on-hand to answer questions about their products.

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Cultivar	Highlights
Antonio	A short season, semi-dwarf long-grain variety with very good yield potential and milling quality. Similar to Cocodrie for agronomic characteristics.
Bowman	A short season, high-amylose long-grain variety designed for canning rice market. Has good grain and milling yield potential and is susceptible to blast and moderately susceptible to sheath blight and straighthead.
Caffey	A short season, semi-dwarf medium-grain variety with excellent yield potential and milling quality. Susceptible to blast, sheath blight, and panicle blight.
Cheniere	A short season, semi-dwarf long-grain variety with good yield potential and milling quality comparable to Cypress. Susceptible to sheath blight and blast.
CL111	An early season, semi-dwarf long-grain Clearfield variety similar to CL 131. Susceptible to blast, straighthead, and bacterial panicle blight.
CL142-AR	A mid-season, semi-dwarf long-grain Clearfield variety similar to Francis with good yield potential and high tolerance to Newpath herbicide. It is susceptible to blast and bacterial panicle blight, and moderately susceptible to sheath blight and straighthead.
CL151	A mid-season, semi-dwarf long-grain Clearfield variety similar to Cocodrie with good yield potential and high tolerance to Newpath herbicide. It is very susceptible to blast and straighthead, and susceptible to lodging and sheath blight.
CL152	A mid-season, semi-dwarf long-grain Clearfield variety similar to CL151 with good yield potential and high tolerance to Newpath herbicide. Improved lodging and chalk compared to CL151.
CL172	A mid-season, semi-dwarf long-grain Clearfield variety with good yield potential and milling quality. High tolerance to Newpath herbicide. Moderately resistant to blast and lodging. Susceptible to sheath blight.
CL261	A short season, medium-grain Clearfield variety similar to Bengal.
CL271	A mid-season, medium-grain Clearfield variety.
CL XL729	A short season, long-grain Clearfield hybrid with excellent yield potential and moderately susceptible to sheath blight, and moderately resistant to blast.
CL XL745	A short season, long-grain Clearfield hybrid with excellent yield potential, moderately susceptible to sheath blight, and moderately resistant to blast, and susceptible to lodging. Reported to have improved tolerance to shattering.
CL XP756	A mid-season, long-grain Clearfield hybrid with good yield potential and average milling quality. Similar to CL XL729.
CL XP4534	A short season, long-grain Clearfield hybrid with good yield potential.
Colorado	A short season, semi-dwarf long-grain variety with good yield potential and milling quality.

Cultivar	Highlights
Della-2	A short season, semi-dwarf long-grain aromatic variety with good yield and very good grain quality. Improved lodging compared to Della.
Drew	A mid-season, long-grain variety with average yield potential and milling quality. It is blast resistant, straighthead tolerant, and has a larger kernel size than Kaybonnet.
Francis	A short season, long-grain variety with excellent yield potential, susceptible to rice blast and very susceptible to kernel smut. It is the best long grain for high pH and salt soils of NE Arkansas west of Crowley's ridge but should not be stressed for water due to blast concerns.
Jazzman	A mid-season, Jasmine-type aromatic variety with good yield potential and milling quality.
Jazzman-2	A mid-season, Jasmine-type aromatic variety with fair yield and good milling compared to Jazzman. Susceptible to sheath blight, bacterial panicle blight, and straighthead.
Jupiter	A mid-season, semi-dwarf, medium-grain variety with excellent yield potential and milling quality. It has a small grain size but has moderate resistance to bacterial panicle blight.
LaKast	A mid-season, long-grain variety with excellent yield potential and good milling quality. Susceptible to blast and sheath blight.
Mermentau	A mid-season, semi-dwarf, long-grain variety with good yield potential and physical characteristics similar to Cocodrie, Cheniere, and Catahoula.
Rex	A short season, semi-dwarf long-grain variety with excellent yield potential and good milling quality. Very good straw strength, but is susceptible to most diseases.
Roy J	A mid-season, long-grain variety with excellent yield potential and good milling quality. Excellent straw strength. Susceptible to blast and moderately susceptible to sheath blight.
Taggart	A mid-season, long-grain variety with very good yield potential and average milling quality. Resistant to straighthead. Moderately susceptible to sheath blight and rice blast.
Wells	A short season, long-grain variety with excellent yield potential, average to good milling quality, large kernel size similar to Lemont, but is susceptible to rice blast. Only moderately susceptible to kernel smut and most other diseases.
XL723	A short season, long-grain hybrid with excellent yield potential, average milling quality; resistant to blast and moderately susceptible to sheath blight.
XL753	A short season, long-grain hybrid with excellent yield potential. Resistant to blast, moderately susceptible to sheath blight and straighthead.
XP754	A mid-season, long-grain hybrid with excellent yield potential and good milling quality.
XP760	A short season, long-grain hybrid with good yield potential.
XP4523	A short season, long-grain hybrid with good yield potential.

Rice cultivar reactions[1] to diseases (2014).

Cultivar	Sheath Blight	Blast	Straighthead	Bacterial Panicle Blight	Narrow Brown Leaf Spot	Stem Rot	Kernel Smut	False Smut	Black Sheath Rot	Sheath Spot
Antonio	S	S	--	MS	MS	S	S	MS	--	--
Caffey	MS	MR	--	S	R	--	--	MS	--	--
Cheniere	S	VS	VS	VS	S	S	S	S	MS	--
CL111	VS	MS	S	VS	VS	VS	S	S	S	--
CL142-AR	MS	S	MS	S	S	S	S	S	S	--
CL151	S	VS	VS	VS	S	VS	S	S	S	--
CL152	S	VS	S	S	MR	--	VS	S	--	--
CL163	MS	--	--	MS	--	--	--	--	--	--
CL172	MS	MR	--	MS	--	--	--	S	--	--
CL261	MS	VS	S	VS	S	VS	MS	S	MS	--
CL271	S	MR	--	MS	MR	--	--	--	S	--
Cocodrie	S	S	VS	S	S	VS	S	S	S	--
Colorado	S	VS	--	S	MS	--	--	S	--	--
Della-2	S	R	--	S	MS	--	--	--	--	--
Francis	MS	VS	MR	VS	S	S	VS	S	S	--
Jazzman	MS	S	S	S	S	S	MS	S	MS	--
Jazzman-2	VS	S	--	VS	MR	--	S	S	--	--
JES	S	R	VS	S	R	VS	MS	MS	MR	--
Jupiter	S	S	S	MR	MS	VS	MS	MS	MR	--
LaKast	S	S	MS	S	MS	S	S	S	MS	S
Mermentau	S	S	VS	MS	MS	--	S	S	--	--
Rex	S	S	S	S	MS	S	S	S	S	--
Roy J	MS	S	S	S	MR	S	VS	S	MS	--
RTCLXL729	MS	R	MS	MR	MS	S	MS	S	S	--
RTCLXL745	S	R	R	MR	MS	S	MS	S	S	--
RTCLXP756	MS	--	--	--	--	--	--	S	S	--
RTXL723	MS	R	S	MR	MS	S	MS	S	S	--
RTXL753	MS	R	MS	MR	--	--	MS	S	S	--
RTXP754	MS	--	--	--	--	--	--	S	S	S
Taggart	MS	MS	R	MS	MS	S	S	S	MS	--
Templeton	MS	R	S	MS	S	MS	S	S	MS	--
Wells	S	S	S	S	S	VS	S	S	MS	--

[1] Reaction: R = Resistant; MR = Moderately Resistant; MS = Moderately Susceptible; S = Susceptible; VS = Very Susceptible ***Table prepared by Y. Wamishe, Assistant Professor/Extension Plant Pathologist***

Sensor-Based N Fertilization for Midseason Rice Production in Southeast Missouri

AJ Foster[1], Sam Atwell[1], Van Ayers[1], Donn Beighley[2], Michael Aide[2] and David Dunn[3],

[1]University of Missouri Extension

[2]Southeast Missouri State University, Department of Agriculture

[3]University of Missouri Fisher Delta Research Center, Portageville

Abstract

To facilitate the development of nitrogen management strategies that increase the use of N applied each year. A small plot experiment was setup at the Missouri Rice Farm to evaluate the use of remote sensing technology in making mid-season N application. The experiment design was a randomized complete block design with three replications. The treatments in the study were two rice varieties (Jupiter a medium grain and Roy J a long grain) and four N treatments check (no fertilizer) [TRT1], pre-flood applications of 120 lb. N /A with no mid-season [TRT2], 120 lb. N /A with 30 lb. /A of mid-season N [TRT3] also referred to as farmer practice, and 120 lb. N /A with mid-season N based on sensor recommendation [TRT4]. Remote sensing measurements were collect at stem elongation using a GreenSeeker® sensor . Midseason N was applied based on the recommendation of the GreenSeeker handheld crop sensor fertilizer estimation chart. Results from the small plot replicated study indicates that mid-season N rate determined using the sensor yield was 2 bu/A lower than the farmer practice for Jupiter and 6 bu/A more for Roy J. However, yield without mid-season N was only lower by 7-12 bu/A. Nitrogen use efficiency was highest without application of midseason N, but was higher for midseason applied based on sensor compared to the traditional 30 lb. N/A. These results indicate that application of adequate pre-flood N in combination with using a sensor to determine midseason N rate offers great potential for increasing nitrogen use efficiency in Southeast Missouri.

Introduction

The optimal amount of N required for rice crops changes dramatically from year to year. Most producers are aware that their yield levels change significantly, but they are not aware that the yield response to additional N changes as well. Nitrogen responsiveness and yield levels dictate precisely how much N should be applied. Thus, what farmers need to embrace is that their N use efficiency changes each year as well. In Southeast Missouri, the common N management practice is to apply most of the N (70 – 120 lb./A) pre-flood. Then a permanent flood is immediately established. The remaining N is applied based on the plant N status at midseason. Determining the plant status can be very challenging for producers. Therefore, a small plot experiment was setup to evaluate the use of sensor-based technology to determinine midseason N application rate.

The small plot experiment will provide producers with a decision support system for making midseason N application in Southeast Missouri.

Procedure

A field experiment was conducted in 2014 at the Missouri Rice Research Farm in Glennonville to evaluate sensor based nitrogen management in rice. The experiment design was a randomized complete block with three replications. Treatments were two rice varieties (Jupiter a medium grain and Roy J a long grain) and four nitrogen treatments (Table 1). Plots were planted on 3 June and fertilized on 8 July (pre-flood) and on 15 August (mid-season). Sensor reading was collected on 13 August at the internode elongation growth stage. Midseason N recommendation was determined using GreenSeeker handheld crop sensor fertilizer estimation chart developed by Oklahoma State University. The check treatment without fertilizer was used as the reference strip to estimate the mid-season recommendation. Nitrogen use efficiency was computed from the ratio of grain yield and total amount of N fertilizer applied.

$$NUE = \frac{Grain\ yield\ (\frac{lb}{acre})}{Nitrogen\ applied\ (\frac{lb}{acre})}$$

Table 1. Nitrogen application treatments used in the study.

Treatments	Rate of N applied
TRT1	Check (No Fertilizer)
TRT2	Pre-flood 120 lb./A
TRT3	Pre-flood 120 lb./A + 30 lb./A Mid-season (FP)
TRT4	Pre-flood 120 lb./A + RS Mid-season

Remote Sensing (RS) Mid-season N rate determined using GreenSeeker and Farmer Practice (FP).

Results

The total amount of N applied using the sensor was 140 lb. N /A compared to 150 lb. N /A for the farmer practice. The highest yield of 169 and 170 lb. /A were achieved with 140 lb. N/A for Roy J and 150 lb. N /A for Jupiter (Figure 1). Application of 120 lb. total N/A pre-flood produced similar yield to applying midseason N (Figure 1). No statistical significance was observed for grain yield between varieties and among the N application treatments. Figure 2 shows nitrogen use efficiency (NUE) was greatest with 120 lb. total N applied pre-flood followed by the application of 140 lb. total N /A (this includes 20 lb. N/A based on sensor recommendation). These results indicate that midseason N is not always needed and that application of adequate pre-flood N in combination with using a sensor to determined midseason N rate can increase rice yield and NUE.

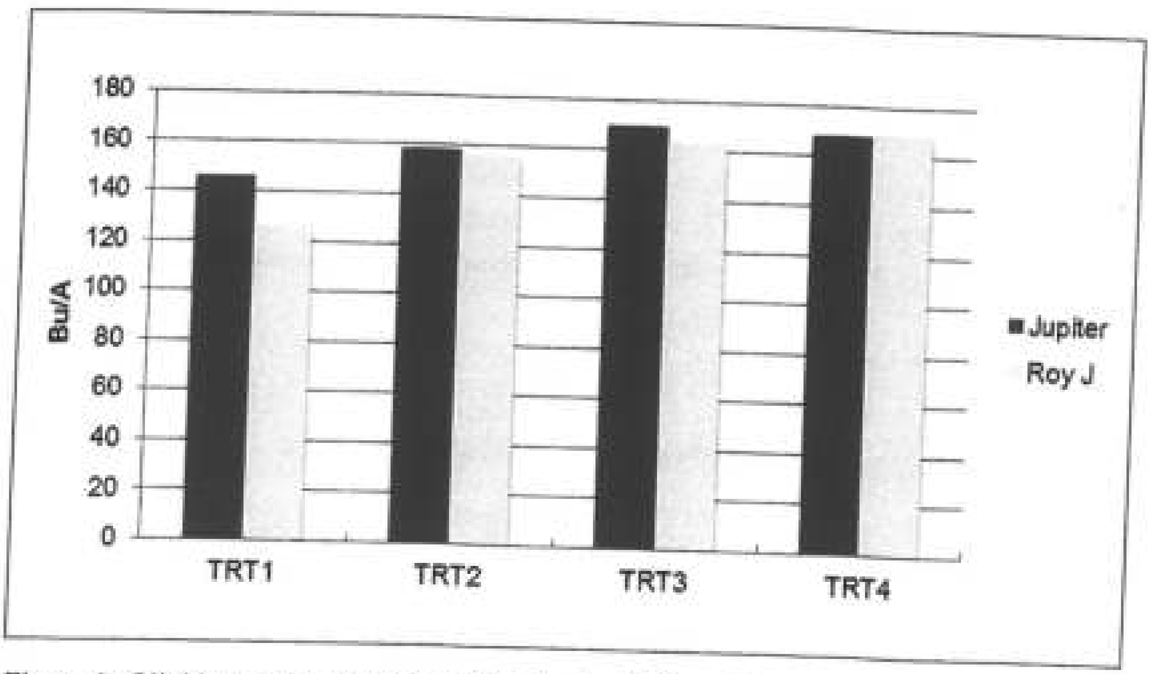


Figure 1: Yield response of rice varieties to the different N treatments (TRT1: Check [no N fertilizer], TRT2: 120 lb. N/ac pre-flood, TRT3: 120 lb. N/A pre-flood + 30 lb. N/A mid-season, and TRT4: 120 lb. N/A pre-flood + sensor-based recommended mid-season).

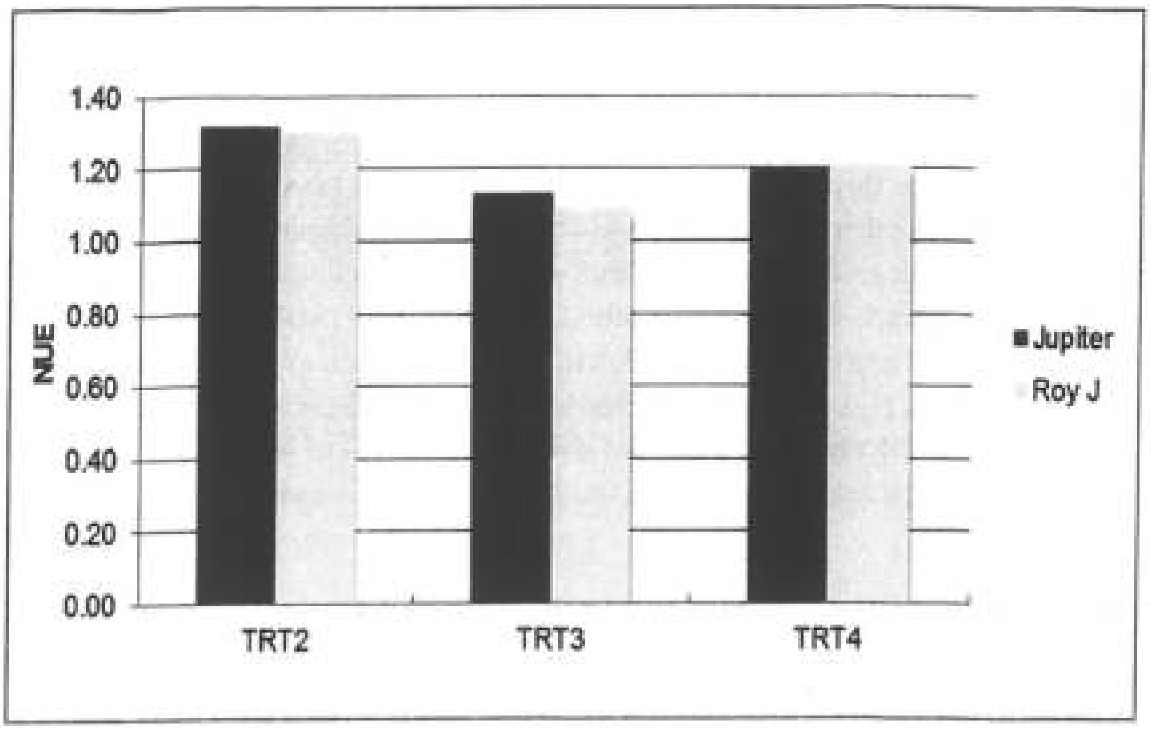


Figure 2: Nitrogen use efficiency for two rice varieties under three N application rates (TRT2: 120 lb. N/A pre-flood, TRT3: 120 lb. N/A pre-flood + 30 lb. N/A mid-season, and TRT4: 120 lb. N/A pre-flood + sensor-based recommended mid-season).

2014 Missouri Rice Variety Performance Trials

Donn Beighley, Chad Mickel, Jason Stovall, Gene Stevens, Matt Rhine, and Jim Heiser,

In 2014 the Missouri Rice Council, University of Missouri-Delta Center and Southeast Missouri State University conducted the Missouri rice variety trials as a cooperative effort. These trials are conducted as a service to Missouri rice producers to provide a reliable, unbiased, up-to-date source of information for comparing rice varieties grown in the southeast Missouri environment.

Procedure

Rice plots were planted at five locations in 2014: the Missouri Rice Research Farm near Glennonville, MO and at the UM Jake Fisher Delta Center Farm at Portageville, MO. The Rice Research Farm yield trial consisted of drill-seeded plots following soybeans, drill-seeded plots following rice and water-seeded plots following rice which were planted on April 17, May 27 and May 28, respectively on a Crowley silt loam. Also planted was a row (bedded) rice yield trial planted on May 20 on 30 inch beds. The plots at the UM Delta Center were drill seeded on May 21 on Sharkey clay and under the center pivot area on May 21.

The trial consisted of 40 public, private, and experimental varieties. The main experimental lines are included in this report. Seed of all public varieties were obtained from: Karen Moldenhauer–UA, Stuttgart, AR; Steve Linscombe – LSU, Crowley, LA; Dante Tabien, Beaumont, TX; Ed Rodante – MSU, Stoneville, MS, and Horizon Ag.

Pre-flood fertilizer was applied at a rate of 90 lbs. N with 30 lbs. N applied midseason on the drill-seeded at the MO Rice Farm. In the water-seeded trial 60 lb. urea was applied post emergence, 60 lb. N applied at panicle initiation and 60 lb. N applied 14 days later.

For primary weed control, 12 oz. Command applied post plant, 2 pts. Prowl, 2 oz. Aim, 78 oz. Permit, 4 qt. Rice Beau and ¾ lb. Facet per acre were applied prior to flooding. The flood was maintained throughout the growing season. The plots at the Rice Research Farm were harvested with a Wintersteiger research plot combine while a Kincaid plot combine was used at the Delta Center. The grain from the plots was weighed and moisture was determined.

Depending on the location and test data was recorded for: emergence date, the number of days to 50% heading, plant height, lodging, and yield for each variety in the field. Milling quality was determined in the laboratory. Emergence date was the date when ten plants per square foot on the drill-seeded trial and ten plant per square foot emerged from the water surface in the water-seeded trial. The days to 50% heading was determined from the number of days from emergence to the presence of 50% of the panicles at least partially emerged from the boot. Plant height was taken as the average distance in inches from the soil surface to the top of the panicle on the plant. Lodging, which indicates the degree of erectness, was scored on a percent scale of 0 to 100 with 0 indicating all plants in a plot were erect (no lodging) and 100 indicating all plants were lodged. Yields were adjusted to 12 percent moisture and reported on a bushel per acre basis. Milling quality was determined at the Rice Lab located at the Southeast-Malden Education Center located in Malden, MO.

Results

All of the 2014 Missouri Rice Variety Trials were taken to completion. However, due to high variability of the data the UM Center Pivot trial and row / bedded rice trial, those results were not included in this report.

The center pivot trial was harvested but the yield data was erratic. The row rice trial was harvested but the yield values fluctuated greatly within varieties so it was not included in the yield average. The 2014 continuous rice trial was not taken to completion due to a high incidence of volunteer rice from the previous year's rice crop.

The average yields were as follows: (MO Rice Farm) conventional drill test– 226 Bu/A, water-seeded – 143 Bu/A, and UM Delta Center clay – 141 Bu/A.

In 2014 differences among long grain varieties were observed. The top yielding line across all trials was Roy J (187 Bu/A), followed by LaKast, and Mermentau. In the conventional drill-seeded trial at the Missouri Rice Farm – Mermentau (263 Bu/A) followed by Mo0307009 and Mo0326011. The top yielding line in the water-seeded trial was Roy J (179 Bu/A) followed by Taggart and LaKast. The top yielding line on the UM Delta Center clay was LA2171 (184 Bu/A) followed by Mo0302002 and Roy J. Table 1.

Across multiple years (2012-2014) at all locations CL151 (171 Bu/A) was the top yielding line followed by Roy J and Taggart. The experimental line Mo0318016 (197 Bu/A) yielded well across years.

In 2014 the top yielding medium grain line across all trials was Mo0902162 (203 Bu/A) followed by Mo0215035, and Caffey. RU0902162 (265 Bu/A) was the top line in the Missouri Rice Farm conventional drill-seeded trial followed by Caffey and CL271. Mo0902162 (184 Bu/A) was the top line in the water-seeded trial followed by CL271 and Mo0215035. Mo0215035 (164 Bu/A) was the top yielding line on the UM Delta Center clay followed by Mo0902162 and Caffey. Table 1

Across multiple years years Mo0215035 (181 Bu/A) yielded the best followed by Caffey and Jupiter. Table 2.

Among the aromatic rice varieties (Della-2, Jazzman 2 and CLJazzman), the top yielding aromatic line across all trials was Jazzman 2 (154 Bu/A), followed by Della-2 and CLJazzman. Table 1.

Days to 50% heading was taken at each of the yield trial locations. The results are: the conventional drill-seeded (100 days), water-seeded trial (75 days), row rice drill-seeded (94 days), UM Delta Center Pivot (92 days), and UM Delta Center Clay (90 days). The average number of days to 50% heading observed for the varieties in the combined trials ranged from 87 days for Colorado / CL111 to 92 days for Roy J / Taggart. Table 1.

The 2014 average plant heights across locations were 37 inches. Individual location plant heights were: Conventional drill-seeded (41 inches), water-seeded (37 inches), row drill-seeded (34 inches),, UM Delta Center clay (42 inches) and Center pivot (33 inches). Table 1.

Percent lodging differences were observed across locations with the water-seeded trial averaging 38% across lines. Differences were observed within lines also.

Rice Disease Data

No significant disease symptoms were observed in 2014 other than the Brown Spot under the center pivot and some smut in other tests.

Summary

The long grain rice varieties that have performed well over the last three years include CL151, Roy J, Taggart, CL111, Wells, Cheniere, and Antonio while Memantau is showing promise. Medium grain types have continued to perform well or better than the long grain types. These include Caffey, Jupiter, Mo0215035, and Mo0902162, while a new variety CL271 is showing promise.

Depending on the 2014 season growing conditions, we have observed some problems due to lodging and some disease incidence in the various varieties.

Growing conditions in Missouri continue to provide a good environment for high milling quality values.

Table 1. 2014 Missouri Rice Variety Trial Agronomic Trait Average

Entry	Bushels Per Acre	Days to 50% Heading	Plant Height (IN)	Percent Lodging	Percent Total Rice	Percent Whole Rice
Antonio	148	89	33	4	74	67
Cheniere	161	90	36	8	73	67
Colorado	139	87	34	15	74	65
Francis	160	89	38	13	74	67
Della-2	158	89	36	3	70	67
Jazzman 2	165	90	33	1	74	65
CL Jazzman	138	91	37	7	71	67
CL111	167	87	35	13	72	64
CL151	161	90	35	7	71	64
CL152	165	89	34	5	74	66
CLX4122	158	89	36	18	71	64
LA2171	176	89	34	3	72	65
LaKast	186	89	40	10	70	65
Mermentau	186	88	35	4	74	68
Rex	175	89	37	2	74	68
Roy J	187	92	42	2	67	65
Taggart	180	92	42	7	70	63
Wells	157	90	39	12	70	62
Mo0302002	161	88	35	8	72	65
Mo0318016	168	89	37	14	72	66
Mo0326011	168	91	37	13	71	66
Mo0327009	166	91	41	15	71	64
Mo04062311	163	89	43	14	73	64
Caffey	190	90	36	2	73	64
CL271	175	90	35	2	74	68
Jupiter	165	89	36	8	74	67
Mo0215035	190	90	34	1	74	70
Mo0902162	203	89	34	0	72	62

Table 2	Missouri Multiple Year Yield Data (Bu/A)				
Variety	2012	2013	2014	2013 - 2014	2012 - 2014
Antonio	145	187	148	167	160
Cheniere	152	169	161	165	161
CL111	135	178	167	173	160
CL151	150	202	161	181	171
CL152	147	166	165	165	159
Colorado	163	161	139	150	155
Della-2	139	155	158	156	150
Francis	132	176	160	168	156
Jazzman 2	132	161	165	163	153
Mermentau	91	173	186	179	150
RoyJay	144	180	187	184	170
Taggart	137	181	180	181	166
Wells	152	175	157	166	161
Mo0318016	139	185	168	176	164
Caffey	132	184	190	187	168
Jupiter	159	185	165	175	169
Mo0215035	161	194	190	192	181
RU0902162		184	203	194	

The 2014 Effect of Planting Date on Rice Varieties

Donn Beighley, Chad Mickel and Jason Stovall

In southeast Missouri there are several rice varieties grown that meet the needs of Missouri rice producers. These varieties are planted as the weather and the field conditions permit during the period from late March to late June. However, the time of planting may vary from year-to-year based on the planting environment, i.e. the weather. Consequently we attempt to provide as much information possible concerning varietal performance with respect to harvest date, yield, quality and their agronomic traits when planted at different dates between early April and post wheat harvest in mid-June.

Procedure

The Date of Planting rice plots were established at the Missouri Rice Research Farm near Glennonville, MO on a Crowley silt loam. The plots were planted on: April 2, April 17, May 5, May 20, and June 19. At each planting date there were 10 varieties that represent the major rice varieties grown in southeast Missouri as well as seven experimental varieties. The released varieties were: Jupiter, Roy J, Mermentau, and seven experimental lines.

Each planting date was evaluated as a separate trial and all varieties were included at each date. Each test was arranged in a randomized complete block design with four replications. Each plot consisted of seven rows, 12 feet long, with a between-row spacing of 7.5 inches.

Seed of all public varieties were obtained from: Karen Moldenhauer – UA, Stuttgart, AR. and Steve Linscombe – LSU, Crowley, LA.

The drill plots were planted with an Almaco no-till plot drill. For primary weed control, 12 oz. Command was applied post plant, 1 oz. /A Permit, 3 qtr. /A Rice Beaux and ¾ lbs. Facet herbicides were applied prior to flooding. The fertilizer was applied at a rate of 90 lbs. N pre-flood with 40 lbs. N midseason application. The flood was maintained throughout the growing season. A single row was harvested to determine milling quality. Milling quality was determined on two replications of each variety from each planting date. The plots were harvested with a Wintersteiger research plot combine.

Agronomic notes taken on each plot included: Emergence date, days to 50% percent heading, plant height, lodging and any disease reactions observed as well as measuring yield for each variety. Emergence date was noted as the date when ten plants per square foot were emerged. The days to 50% heading is determined by counting the days from emergence to the presence of 50% of the panicles at least partially emerged from the boot. Height was taken as the average distance in inches from the soil surface to the top of the panicle. Lodging, which indicates the degree of erectness, was scored on a percent scale of 0 to 100 with 0 percent indicating all plants in a plot were erect (no lodging) and 100 percent indicating all plants were lodged. Total and head milling yield were determined after milling a sample of each variety in the study.

Results

In 2014 all of the planting dates were harvested for yield.

The early April planting had the highest yields at 263 Bu/A followed by the mid-April (214 Bu/A), mid-May (204 Bu/A), early May (202 Bu/A), and mid-June (68 Bu/A) planting dates.

The April 2 date the top yielding lines were Jupiter, Mo0318016, and Mo0215035.

The April 17 date top yielding lines were Jupiter, Mo0902162, and Mo0215035.

The May 5 top yielding lines were Mo0215035, Mermentau, and Jupiter.

The May 20 top yielding lines were Mo0902162, Jupiter, and Mo0215035.

The June 19 date top yielding lines were Mo0125035, Jupiter, and Mo0302002.

The highest yielding variety across dates was the variety Jupiter at 221 Bu/A followed by the experimental lines Mo0215035 and Mo0318016. Tables 1and 2.

The percent total rice and percent whole rice yield values ranged from 71 / 65 on May 5 to 72 / 67 planted on three other dates. Table 1. Across varieties, Mo0318016 (74 / 69) had the highest average milling quality and Jupiter had the lowest average (68 / 65).

The trend usually appears to be that the medium grain varieties have the highest milling values across all planting dates but this was not observed in 2014.

The number of days from planting to emergence ranged from 28 days at the April 5 planting date and decreases to 6 days at the June 19 planting date. Table 1. The data indicates that medium grain types are two to four days later emerging than long grain types. Some varieties, Jupiter and Mo0215035 were on average two days later emerging than the rest of the varieties in the trial. Roy J had the fastest overall emergence period.

Across planting dates the average number of days to 50% heading ranged from 71 days at June 5 up to 104 days planted April 5 (Table 1). A similar trend was observed within varieties. There were several varieties that averaged 90 days from emergence to 50% heading across the five planting dates. While the shortest time was 68 days for Mermentau and Mo0326011 at the June 5 planting date.

Summary

The early April planting date continues to result in the higher yields and milling quality values.

From Table 2 released varieties, Mermentau and Jupiter both appear to be better yielding rice varieties across five planting dates. From the experimental lines, Mo0215035 and Mo0318016 were the better yielding varieties.

Table 1. 2014 Planting Date Agronomic Trait Means

Planting Date	Bu/A	Days to Emerge	Days to 50% Heading	% Total Weight	% Whole Weight
2-Apr	263	28	104	72	67
17-Apr	214	18	100	71	67
5-May	202	11	91	71	65
20-May	204	7	78	72	67
19-Jun	68	6	71	72	67

Table 2. 2014 Planting Date Variety Agronomic Trait Average

Entry	Bu/A	Days to Emerge	Days to 50% Heading	% Total Weight	% Whole Weight
Roy J	181	13	89	73	66
Jupiter	221	15	88	68	65
Mermentau	193	13	89	72	67
Mo0215035	215	15	89	71	68
Mo0302002	181	15	88	73	69
Mo0318016	202	13	90	74	69
Mo0902162	201	14	90	71	65
Mo0326011	160	14	85	73	68
Mo0327009	177	13	90	72	65
Mo04062311	169	13	90	72	65

Silicon and Lime Applications on Rice to Increase Yield and Reduce Arsenic Levels in Grain

Gene Stevens, David Dunn, Matt Rhine, Jim Heiser, and Manjula Nathan

Healthy rice plants contain 7 to 10% silicon. Rice stems and kernel hulls contain more silica (silicon dioxide) than all the other macronutrients (NPK) combined. Silica is used by rice in a disease defense mechanism against blast and sheath blight and strengthens cell walls to minimize lodging. Silicon is one of the most abundant elements on earth but is mostly insoluble and not available to plants. Roots absorb silicon as monosilicic acid, $Si(OH)_4$.

In 2014, we conducted silicon fertilizer trials at Portageville and Qulin, Missouri. The Portageville location was grown under center pivot irrigation, while Qulin was grown in a flooded culture. Trial 1 included various broadcast rates of calcitic and dolomitic lime, as well as calcium silicate slag derived from steel processing and potassium silicate fertilizer (Table 1). These amendments were broadcast at planting with the exception of potassium silicate, which was sprayed as a foliar application at late boot. Trial 2 included in-furrow applications of calcium silicate slag, silica gel granules and ammonium sulfate with various amendments to make the silicon readily available. These amendments included hydro-hume, humic acid, oxalic acid (Portageville location only), and ammonium sulfate (Table 2). Yield was taken on these plots and grain was saved for total arsenic analysis.

Across broadcast rates, grain yields were increased under center pivot with applications of calcitic (+13 bu/ac) and dolomitic lime (+5 bu/ac). Yields were also increased 34 bushels per acre with an application of 450 lb. calcium silicate per acre under center pivot compared to untreated checks. Rates of calcium silicate above 450 lb. did not increase yield. Under flooded conditions at Qulin, no broadcast soil amendments were shown to increase grain yield over untreated plots. Generally, flooded systems provide enough silicon through the reduction of iron under anaerobic conditions, so little yield increase was expected at flooded locations. However, silicon competes with arsenic for rice uptake, so total arsenic is being measured to see if silicon amendments reduce arsenic levels in the grain.

Across in-furrow rates, yields were slightly increased at Qulin with 200 lb. calcium silicate slag applied in-furrow (+3 bu/ac). Highest yields were found when calcium slag was mixed with humic acid at the Qulin location (Table 2). An increase in yield (+5 bu/ac) was also found at the Portageville location for 200 lb. slag, although yields were highest when slag was applied alone. Other amendments did not increase yields at either location when averaged across application rates. Grain has been saved from both trials and will be sent for analysis of total arsenic. Those results will be available once analysis is complete. Thank you for your support of this research.

Table 1. Effect of broadcast soil amendments on rice grain yield at Portageville and Qulin, MO.

Trt	Cultivar	Amend	Rate	Portageville Bu/ac	Qulin Bu/ac
16	CLXL745	None	0	137.0	130.7
17	CLXL745	CalLime	750	165.4	118.1
18	CLXL745	CalLime	1500	146.5	122.5
19	CLXL745	CalLime	2250	139.7	104.2
20	CLXL745	DolLime	750	145.7	118.4
21	CLXL745	DolLime	1500	142.4	135.3
22	CLXL745	DolLime	2250	138.6	122.9
23	CLXL745	CASI	450	171.8	134.7
24	CLXL745	CASI	900	121.2	126.0
25	CLXL745	CASI	1350	129.3	145.6
26	CLXL745	CASI	1800	126.4	132.3
27	CLXL745	CASI	2250	142.9	130.4
28	CLXL745	KSI	0.17	139.7	132.0
29	CLXL745	KSI	0.21	144.6	134.3
30	CLXL745	KSI	0.25	136.7	127.1
61	Nerica4	CASI	900	118.4	-
62	Nerica4	CASI	1800	121.1	-
63	Cardi703	CASI	1800	84.7	-
64	CLXL745	CASI	3000	157.3	-
65	CLXL745	CASI	3750	139.0	-
68	CLXL745	CASI	1800	149.6	-

Table 2. Effect of in-furrow soil amendments on rice grain yield at Portageville and Qulin, MO.

Trt	Amendment 1	lb./ ac	Amendment 2	lb./ac	Portageville Bu/Ac	Qulin Bu/Ac
1	none	0	none	0	134.2	121.5
2	none	0	Hyrdra Hume	50	136.6	82.1
3	none	0	AmS as N	150 N	138.3	85.2
4	Harsco Slag Pellets	100	none	0	144.1	69.0
5	Harsco Slag Pellets	200	none	0	149.3	98.5
6	Harsco Slag Pellets	100	Hyrdra Hume	50	132.7	52.9
7	Harsco Slag Pellets	200	Hyrdra Hume	50	125.8	97.0
8	Harsco Slag Pellets	100	Humic Acid	soak	130.7	123.0
9	Harsco Slag Pellets	200	Humic Acid	soak	146.9	81.7
10	Harsco Slag Pellets	100	Oxalic Acid	soak	127.6	-
11	Harsco Slag Pellets	200	Oxalic Acid	soak	147.4	-
12	Harsco Slag Pellets	100	AmS as N	50	127.1	97.9
13	Harsco Slag Pellets	200	AmS as N	50	136.5	119.7
14	M&M Silica Gel Granules	100	none	0	135.4	78.6
15	M&M Silica Gel Granules	200	none	0	118.3	114.7
16	M&M Silica Gel Granules	100	Hyrdra Hume	50	138.3	94.0
17	M&M Silica Gel Granules	200	Hyrdra Hume	50	137.9	63.2
18	M&M Silica Gel Granules	100	Humic Acid	soak	127.6	97.1
19	M&M Silica Gel Granules	200	Humic Acid	soak	142.0	96.1
20	M&M Silica Gel Granules	100	Oxalic Acid	soak	148.2	-
21	M&M Silica Gel Granules	200	Oxalic Acid	soak	142.3	-
22	M&M Silica Gel Granules	100	AmS as N	50	135.1	-
23	M&M Silica Gel Granules	200	AmS as N	50	123.3	-
24	Am Sulfate	50	none	0	-	90.3
25	Am Sulfate	100	none	0	-	87.3

Nitrogen Rates on Rice Varieties and Hybrids for DD-50 Program

Gene Stevens, Matt Rhine, David Dunn, and Ron Shipman

In the 1990's, we conducted a nitrogen x variety test for seven years at the Missouri Rice Research Farm. The project was started by Dr. Paul Tracey and Steve Hefner. Results provided assurance to Missouri farmers that they were applying the correct nitrogen rate on varieties that were developed at other states. Soil fertility specialists in Louisiana and Arkansas work with breeders in their states to develop N recommendations before new varieties are released. Differences in soils and weather could impact N fertilizer response by varieties in Missouri. This research also provided valuable information that helped the MU Extension service calibrate growth stages for new varieties in the Missouri Rice DD-50 program. Through your funding we began this study again to evaluate N fertilizer on new and old varieties.

Main Plots. The cultivars in this study included Roy J, Wells, Jupiter, Jazzman, CL151, RiceTec CLXL729, RiceTec XL753, RiceTec CLXL745, and three breeding lines provided by Dr. Donn Beighley (RU1305178, RU1305001, and RU1405155).

Sub Plots. Each main plot was divided into subplots and received 75%, 100%, and 125% of recommended nitrogen rates. These were split into preflood and midseason applications for conventionals and late boot for hybrids.

Locations. Missouri Rice Research Farm at Qulin (silt loam soil) and University of Missouri-Lee Farm at Hayward (clay soil).

Results. Significant differences were found for yield among cultivars and nitrogen treatments. Across nitrogen rates, Jupiter was the highest yielding cultivar at Qulin, with an average of 179 bushels per acre. This was followed by CL151 (164 bu/ac) and the breeding line RU1305178 (163 bu/ac). The lowest yielding cultivar at Qulin was breeding line RU1405155 at 135 bushels per acre. Across all cultivars, grain yields dropped 7 bushels per acre as nitrogen rates increased beyond 150 lb. nitrogen per acre (Figure 1). Head rice yields also decreased numerically as nitrogen rates increased across cultivars. Jupiter had the highest milling yield in the study, while Jazzman was the lowest. Yields at the Lee Farm were considerably lower due to severe shattering losses during high winds. While we cannot gather much from those yield results, we do have enough grain from each plot to run milling analysis. Those measurements are being taken now and will be presented when complete along with statistical analysis of all results. We appreciate your support of this research.

Table 1. Rice Grain Yield and Milling effects due to cultivar and nitrogen rate at Qulin, MO.

		Nitrogen Applications (lb./ac)				Milling	
Trt	Cult	Preflood	Midseason	Late Boot	Total	Quality	Bu/Ac†
1	RU1305178	75	45	0	120	64/70	161 BCDEFG
2	RU1305178	105	45	0	150	64/72	175 ABCD
3	RU1305178	135	45	0	180	61/72	156 BCDEFG
4	RU1305001	75	45	0	120	50/56	145 EFG
5	RU1305001	105	45	0	150	63/69	171 ABCDE
6	RU1305001	135	45	0	180	61/69	152 CDEFG
7	RU1405155	75	45	0	120	54/65	135 G
8	RU1405155	105	45	0	150	57/68	138 G
9	RU1405155	135	45	0	180	49/69	134 G
10	Roy J	75	45	0	120	57/69	181 AB
11	Roy J	105	45	0	150	55/69	156 BCDEFG
12	Roy J	135	45	0	180	52/68	143 EFG
13	Wells	75	45	0	120	58/70	149 DEFG
14	Wells	105	45	0	150	54/70	157 BCDEFG
15	Wells	135	45	0	180	51/68	135 G
16	Jupiter	75	45	0	120	65/71	192 A
17	Jupiter	105	45	0	150	63/68	179 ABC
18	Jupiter	135	45	0	180	62/68	166 ABCDEF
19	Jazzman	75	45	0	120	58/69	144 FG
20	Jazzman	105	45	0	150	54/68	137 G
21	Jazzman	135	45	0	180	45/54	135 G
22	CL151	75	45	0	120	62/71	177 ABCD
23	CL151	105	45	0	150	62/71	166 ABCDEF
24	CL151	135	45	0	180	57/67	149 DEFG
25	RTCLXL729	90	0	30	120	63/72	174 ABCD
26	RTCLXL729	120	0	30	150	59/69	142 FG
27	RTCLXL729	150	0	30	180	60/71	154 BCDEFG
28	RTXL753	90	0	30	120	58/71	150 DEFG
29	RTXL753	120	0	30	150	54/70	160 BCDEFG
30	RTXL753	150	0	30	180	54/70	171 ABCDE
31	RTCLXL745	90	0	30	120	63/71	167 ABCDEF
32	RTCLXL745	120	0	30	150	63/70	153 BCDEFG
33	RTCLXL745	150	0	30	180	59/70	158 BCDEFG

† Yields followed by the same letter were not significantly different at $\alpha = 0.05$

Figure 1. Effect of nitrogen rate on rice grain yield and head rice yield across all cultivars at Qulin, MO.

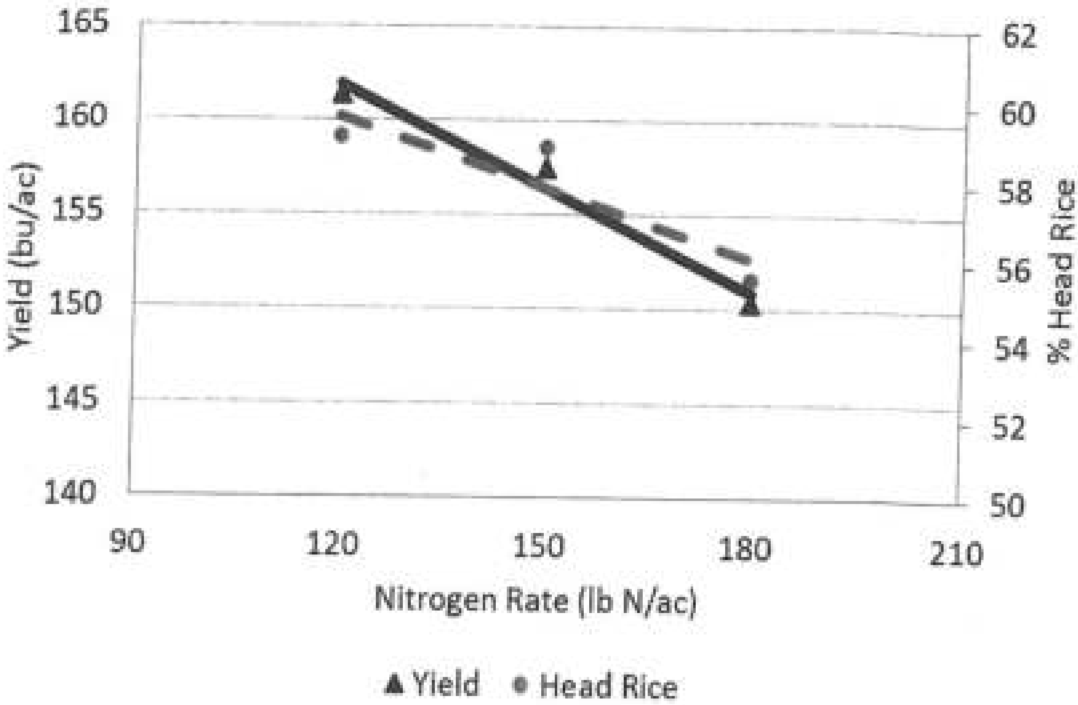
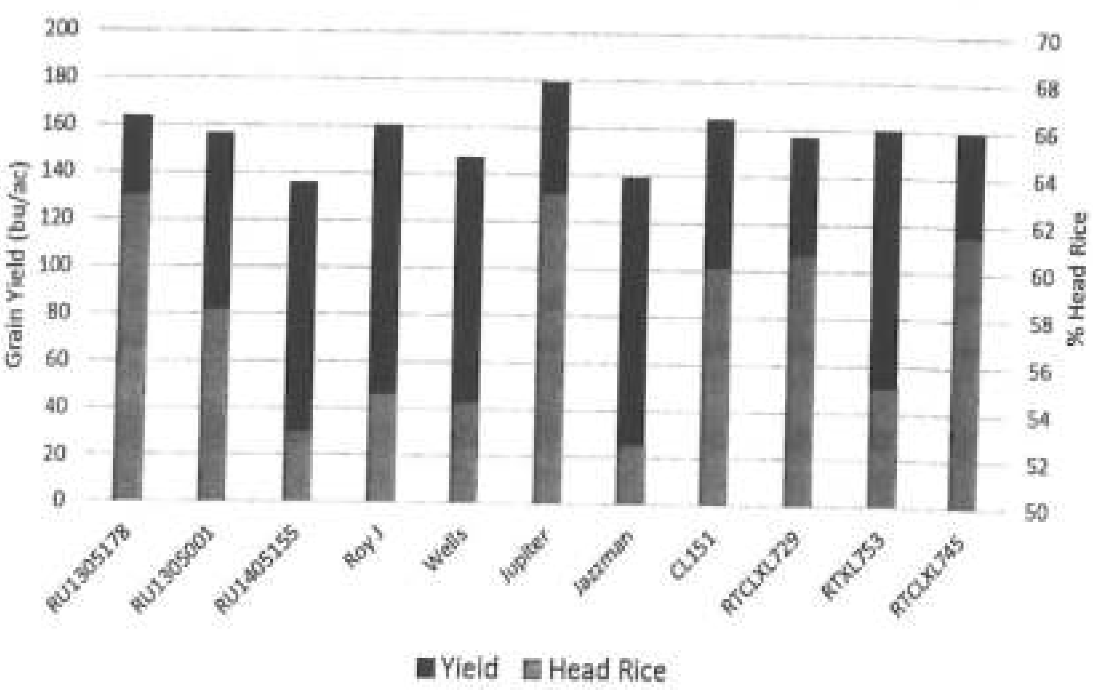


Figure 2. Effect of cultivar on rice grain yield and head rice yield across all nitrogen rates at Qulin, MO.



2015 Rice Weed Control Research Summary

Jim Heiser

Smallflower Umbrella Sedge Control

Several herbicides were evaluated for the control of smallflower umbrella sedge. Sharpen (Salflufenacil) provided very good control of smallflower umbrella sedge throughout the season when applied at 2 oz. /ac as a pre-emerge. Early season ratings showed 100% control and was still rated at 92% control at 53 days after application. Sharpen applied as a POST treatment provided just as good early season control, but control steadily diminished toward the end of the season. Additionally, stand reductions up to 25% were observed. Sharpen applied sequentially showed similar results as Sharpen applied as a POST treatment.

Prowl showed little activity early on applied as a delayed pre. However, this poor control was probably due to some of the umbrella sedge beginning germination before the treatment was applied. With no POST activity, this first flush made the plots look worse in comparison to other treatments. Later evaluations showed good control of umbrella sedge, as later germinating umbrella sedge was controlled. Ricebeaux provided good control throughout the season when applied as an early POST followed by a second application pre-flood. Aim was applied at similar timings as Ricebeaux but control began to diminish around 35 days after application. Benzobicyclon, an herbicide not yet labeled for use in Missouri, was applied sequentially at pre-flood and post-flood and provided 96% control at the final rating.

It should be noted that while umbrella sedge was present at the study site, populations were not uniform. Lower, wet areas tended to have a more dense population than higher and drier spots. This study was performed off-station and some management of the location may have impacted the results. The flood was established at an earlier stage than was anticipate. Pre-flood treatments were applied into shallow water as the flood was being established. It is also believed that covering the plot area with plastic to allow for an herbicide application to the remainder of the field may have killed much of the emerging umbrella sedge.

Pennsylvania Smartweed and Amazon Sprangletop Control

Results for these two studies, unfortunately, only include yield results. Populations of the target species were not present in sufficient numbers to provide useful data. Yields in the sprangletop study averaged from 147.5 bu/ac when Ricestar HT was applied at Mid POST (before flooding) up to 179 bu/ac. when Clincher was applied sequentially at Mid POST followed by a post flood application. This was a 15 oz. followed by a 10 oz. /ac application. Poast herbicide (not labeled) did not injure or kill rice in this study and average nearly 170 bu/ac for 3 of the four locations (the fourth replicate yielded 350 bu/ac. and was considered an outlier and removed). Ricestar HT had two of the four replications with low and very low yields. The three highest yielding plots averaged 158 bu/ac. No substantial injury was observed from any of the treatments.

Fomesafen Carryover to Rice

This project was initiated in May 2014 and is intended to rollover into 2015. The objective of this study was to evaluate the effect of fomesafen (Reflex/Flexstar) residues that may carryover to rice after application in soybeans the previous year. The work performed this year was to set up these evaluations in 2015. Twelve combinations of fomesafen rates and application timings were applied to soybeans throughout the season. In 2015, rice will be planted into these plots and incidence and severity of injury will be documented. In addition, crop yield and quality measurements will be taken to evaluate what, if any, effect these residues may have on the rice crop if possible.

Furrow Irrigated and Drill –Seeded, Delayed Flood Irrigated Rice: Two-Year Assessment of Rice Agronomic Performance

Michael Aide and Donn Beighley, Southeast Missouri State University
David Dunn, University of Missouri-Fisher Delta Research Center,
Samuel Atwell, University Missouri Extension

Grower interest in furrow irrigation of rice (row rice) is increasing, largely attributed to reduced costs associated with water pumping and field preparation. This two year study determines the economic and agronomic efficiency of furrow irrigated rice compared to drill seeded-delayed flood irrigated rice. Two soil types (Sharkey clay and Crowley silt loam) were employed to assess soil textural differences. Yields of furrow irrigated rice were comparable to drill seeded-delayed flood rice. Only the 2014 results are present.

Perceived advantages of furrow irrigated rice include: (i) reduced water usage (in theory), (ii) reduced labor, (iii) reduced energy usage, (iv) reduced levee construction, (v) more opportunities to use ground equipment instead of airplanes, (vi) more rapid field drying, and (vii) reduced land preparation for rotation crops. Disadvantages of furrow irrigated rice include: (i) it requires graded land and producers must place water down each furrow, (ii) potentially a five to twenty percent yield reduction, (iii) possible delays in maturity, (iv) weed management must be properly adjusted, (v) greater potential of having yield-limiting water stress, (vi) less information and experience with row rice, (vii) nitrogen management must be improved to prevent nitrification-denitrification, and (viii) crop insurance any not be available for row rice until underwriters provide risk assessments.

Soil Nitrogen Distribution in the Sharkey Series for 2014

Soil nitrate and ammonium concentrations were assessed throughout the 2014 growing season. Nitrate concentrations in the Sharkey clay furrow irrigation treatment demonstrated a substantial peak at 13 July, a result of nitrogen fertilization on 7 July 2014. The soil nitrate concentrations were substantially reduced by the next interval of sampling (30 July), a result of rice plant uptake and nitrification-denitrification soil reactions (Figure 1). The loss of nitrate by 30 July is problematic because 31 lbs. N / acre as urea was applied 21 July 2014.

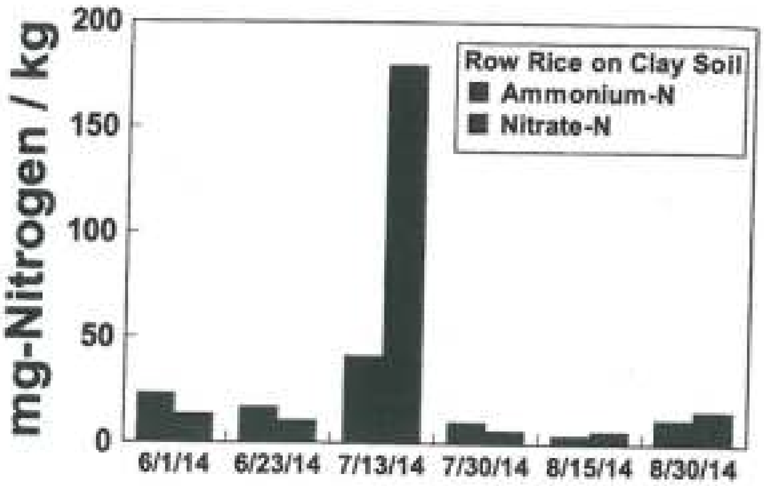


Figure 1. Distribution of nitrate and ammonium concentrations during the growing season for the Sharkey soil.

Soil Nitrogen Distribution in the Crowley Series for 2014

Soil nitrate and ammonium concentrations associated with the delayed flood regime showed appreciable nitrate accumulation in June and early July, with an appreciable ammonium presence at the end of July and again at the end of August, a feature attributed to nitrogen fertilization (Figure 2). Soil nitrate and ammonium concentrations associated with the furrow irrigation regime showed appreciable ammonium nitrate accumulation in early July (13 July), with only incidental ammonium and nitrate for the remainder of the growing season. Concern resides with the loss of nitrogen post 13 July because of soil nitrification-denitrification reactions (Figure 3).

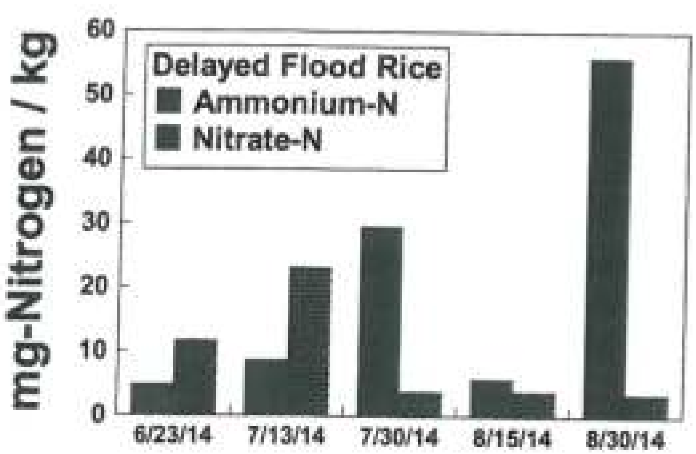


Figure 2. Distribution of nitrate and ammonium concentrations during the growing season for the Crowley soil having delayed flood irrigation.

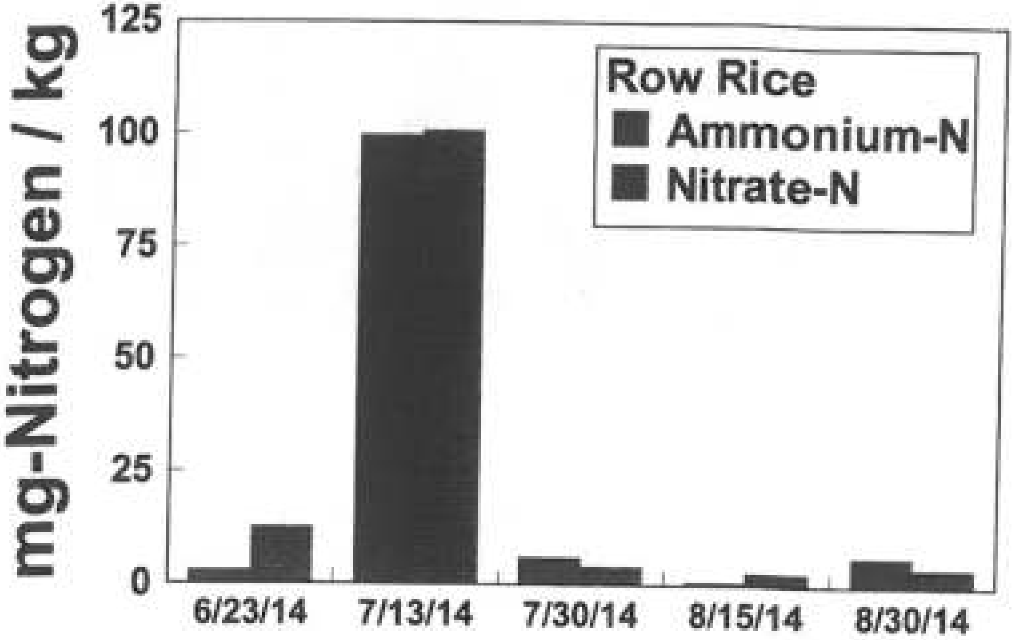


Figure 3. Distribution of nitrate and ammonium concentrations during the growing season for the Crowley soil having delayed flood irrigation.

Rice tissue concentrations for the 2014 growing season

Nitrogen tissue concentrations are representative of rice plants experiencing normal nitrogen for the furrow irrigated Sharkey clay regime; however, nitrogen uptake on the Crowley silt loam soil shows a slight nitrogen deficiency in mid-July (Figure 4). As in 2013, plant tissue concentrations show a gradual decline during the 2014 growing season, suggesting that dry matter accumulation is greater than nitrogen uptake.

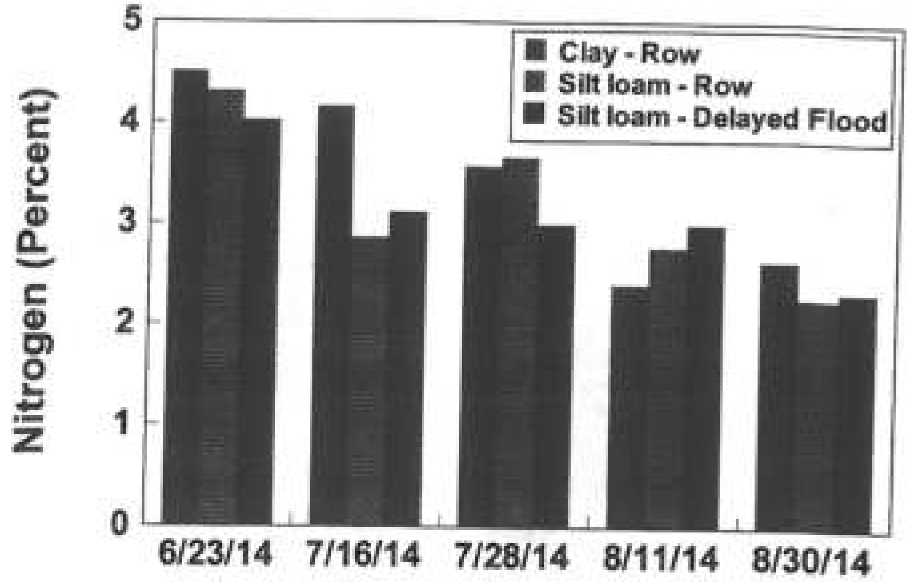


Figure 4. Nitrogen rice tissue concentrations during the growing season (2014)

Phosphorus plant tissue concentrations are appropriate for all treatments. On the Crowley silt loam soils, phosphorus uptake is slightly greater for the delayed-flood irrigation regime. Potassium plant tissue concentrations are appropriate to slightly deficient for all treatments, with not significant differences in the potassium uptake rates attributed to the type of irrigation. Plant tissue sulfur concentrations are normal and show declining concentrations during the growing season because of increasing dry matter accumulation. Iron concentrations are normal for rice. Manganese shows greater uptake during the progression of the growing season for the Crowley silt loam soil having delayed flood irrigation, a feature attributed to increasing soil anaerobic conditions because of the soil paddy water. Zinc plant tissue concentrations are normal.

Delayed flood and furrow irrigated yields

Missouri Rice Research Farm

In 2014 the furrow irrigated rice (nine observations) yielded 120 Bu/A (standard deviation = 9.1 Bu/A), whereas the delayed flood yielded 131 B/A (standard deviation = 7.2 Bu/A). The delayed flood irrigated system's yield was significantly greater ($\alpha = 0.005$).

Sharkey Clay Soils

Row rice yielded 162 Bu/A in 2013 and 166 Bu/A in 2014. These yields are very acceptable for the variety Clearfield 111.

SUMMARY

• Furrow irrigated rice yielded (field combine average of 162 Bu/A on Sharkey clay in 2013 and 166 Bu/A in 2014) which was greater than the corresponding Crowley furrow irrigated and drill-seeded, delayed flood irrigation system,

- Furrow irrigated rice requires a new look at nitrogen fertilization in terms of fertilizer timing, sources (ammonium sulfate versus urea, and amounts) to minimize nitrogen losses attributed to denitrification.

Consequently it is suggested the producer consider following these procedures:

• Select rice varieties that have some plant resistance to the rice disease 'Blast'.

• Split application of the first 120 lbs. N / acre nitrogen application (80 lbs. N / acre followed two weeks by 40 lbs. N / acre. Nitrogen application at mid-season is critical.

• Plant tissue test for nitrogen two weeks post-nitrogen application.

• Monitor furrow irrigation to always maintain wet soils.