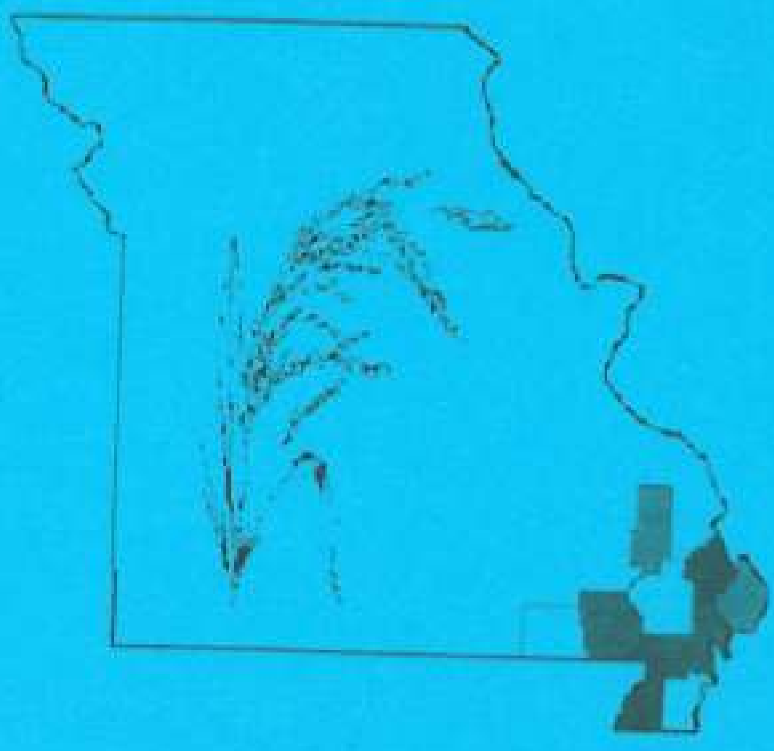
Missouri Rice Research Update 2007



Southeast Missouri State University
University of Missouri - Columbia
University of Missouri Outreach and Extention

Special Report #01-2008

February 2008

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 resulted from contributions of the University of Missouri Agricultural Experiment Station Personnel, and Southeast Missouri State University, United States Department of Agriculture – Wildlife Services. 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 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:

∧ Missouri Rice Page on the World Wide Web at
http://www.ext.missouri.edu/agebb/rice/

∧ Missouri Rice DD50 Program on the World Wide Web at
http://www.agebb.missouri.edu/rice/ricemodel.htm

Missouri Rice Producers Conference
February 13, 2008
Program

8:30 Program begins

Soil Testing 101 for Rice Growers – David Dunn

Update on the DD50 Rice Growth Prediction Program – Gene Stevens

A Crop Decision Aid – David Reinbott

Rice Varieties – Donn Beighley

Notes on Stratus Rice Herbicide – Darryl Loggains, RiceCo

Managing Hybrid Rice – Brian Ottis

Mid-morning Break

Water in Southeast Missouri – Shannon Erismann

Comparisons of Irrigation Costs between Power Sources – Joe Henggeler

Updates on Rice Fungicides and Soybean Rust – Allen Wrather

Rice Insects and Insecticides – Kelly Tindall

Rice Policy and Market Update – Patrick Westhoff

Missouri Rice Council Report – John Burnett and Greg Yielding

Noon Lunch

Table of Contents

Rice Variety Reactions to Diseases - 2007

Variety	Blast	Stem Rot	Kernel Smut	False Smut	Brown Spot	Straighthead	Lodging	Black Sheath Rot	Bacterial Panicle Blight	Narrow Brown Leaf Spot
Bengal	S	VS	MS	MS	VS	MR	MR	MR	VS	S
Jupiter	MS	S	MS	MS	R	MS	MR	MR	MR	MS
CL161	S	S	S	S	R	MS	MS	S	S	MS
CL171AR	MS	S	S	S	R	MS	MS	MS	S	MS
Cocodrie	MS	S	VS	S	R	VS	MR	MS	VS	MS
Cybonnet	R	S	S	S	R	MS	MR	S	MS	S
Francis	VS	S	VS	S	R	MS	MS	MS	VS	S
Spring	MS	VS	MS	MS	R	VS	S	MS	S	MS
Trenasse	S	S	S	S	R	VS	MS	MS	S	MS
Wells	S	VS	MS	S	R	MS	MS	MS	S	S
RiceTec XL723	R	S	MS	S	R	MR	MS	MS	R	MR
RiceTec CLXL729	MR	S	MS	S	MR	MR	MS	MS	MR	MR
RiceTec CLXL730	MR	S	MS	S	R	MR	S	MS	MR	MR
RiceTec XP744	S	R	S	MS	S	R	S	MS	R	MR
RiceTec CLXP745	S	R	S	MS	S	R	S	MS	R	MR

Reaction: R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible,
VS = Very Susceptible

Prepared by Don Groth, Louisiana; R.D. Cartwright & F.N. Lee, Arkansas

Variety/Hybrid	Year Released & State	General Characteristics of Rice Varieties. Highlights
Banks	2004-Arkansas	A short-season, long-grain LaGrue type rice with blast resistance.
Bengal	1992 – Louisiana	A short season, semi dwarf, medium-grain with good yield potential and milling quality. It has a preferred large grain size. Represented about 10% of 2003 rice acreage in Arkansas.
Cheniere	2003 – Louisiana	A very short season, semi-dwarf long-grain with good yield potential, less oil in bran than Cocodrie, and improved straighthead tolerance. It has L202 and Jodon cooking type.
CL 131	2005-BASF, Horizon Ag.	A midseason, semi-dwarf long-grain similar to CL 161 with shorter plant height, similar sheath blight susceptibility, very susceptible to straighthead, and improved grain yield potential.
CL 161	2002 – BASF	A midseason, semi-dwarf, long-grain similar to Cypress with high tolerance to Newpath herbicide. It is susceptible to sheath blight, moderately resistant to blast and moderately susceptible to straighthead.
CL XL8	2003 – Rice Tec, Inc.	A short-season, long grain with excellent yield potential and high tolerance to Newpath herbicide, moderate resistance to sheath blight, and resistance to blast.
CL 171 AR	2006 - BASF, Horizon Ag.	A mid-season, semi-dwarf, long-grain similar to Wells with high tolerance to Newpath herbicide. It is susceptible to sheath blight, moderately susceptible to blast and straighthead. Yield id similar to CL 616
CL XP 730	2005Rice Tec, Inc.	A short-season, long grain with excellent yield potential and high tolerance to Newpath herbicide, moderate resistance to sheath blight, and resistance to blast.
Cocodrie	1997 – Louisiana	A short season semi-dwarf long-grain with good yield potential and milling quality. Represented about 21% of the 2003 rice acreage in Arkansas.
Cybonnet	1996-Arkansas	A mid-season, semi-dwarf long-grain with good yield potential and excellent milling quality similar to Cypress. It has blast resistance similar to Katy.
Cypress	1992 – Louisiana	A mid-season, semi-dwarf long-grain with good yield potential and excellent milling quality and excellent seedling vigor.
Francis	2002 – Arkansas	A very sort season, long-grain with excellent yield potential, susceptible to rice blast. Represented about 6.4% of the 2003 rice acreage in Arkansas.
Medark	2004 – Arkansas	A short season, semidwarf, medium-grain with good yield potential and milling quality. It has a preferred large grain size.
Spring	2005-Arkansas	A very short season, long grain with good yield potential and rice blast resistance. It is one of the earliest maturing long-grain rice lines.
Wells	1999 Arkansas	A short season, long grain with excellent yield potential, average milling quality, kernel size similar to Lemont, and susceptible to rice blast. Represented about 47% of the 2003 rice acreage in Arkansas.
XL723	RiceTec, Inc	The conventional (non-herbicide tolerant) long grain RiceTec hybrid line, XL723 offers superior yield, excellent disease resistance and above average straw strength. XL723 has a short season, making it an excellent choice after wheat. The product also has excellent milling.

The Economics of Liming for a Rice-Soybean Rotation

David Dunn

Introduction

Rotating rice with soybeans is a common practice in Southeast Missouri. These crops have different soil pH requirements with soybeans requiring a higher pH than rice to achieve maximum yields. Current University of Missouri soil test recommendations for lime treat rice and soybeans as separate crops. The standard recommendation is to lime before soybeans but not before rice. In 1999 a one year liming study found that one ton of lime increased soybean yields 25%. However, rice yields were lowered by 9 bu/acre. In this study the increased value of the soybean crop was approximately equal to the lost value in the rice crop. A study conducted by the University of AR indicated similar results on the soybean side but indicated that rice yields generally were increased with lime applications.

This study investigates the economics of lime and P & K fertilizer applications in the rice-soybean rotation.

Methods and Materials

Rice and soybean field plots were established on a Crowley silt loam soil located at the Missouri Rice Research Farm at Qulin, MO. The soil $pH_{(s)}$ at this location was 5.1, the P level was 23 lbs/a, and the K level was 181 lbs/a. The recommended limestone rate for both rice and soybeans was 1 ½ tons/a. For rice 70 lbs P_2O_5 & 30 lbs K_2O was recommended, for soybeans 80 lbs P_2O_5 & 120 lbs K_2O was recommended. The experimental design was a split plot with crop as the main plot and fertilizer treatment as the sub plot. Four replications were employed. Two rates of aglime (0 & 1 ½ ton/a) and one rate of pelletized lime (200 lb/a) were evaluated. Two rates of P & K (0 & 100% of the recommended rate) were evaluated. These rates were based on the individual recommendations for each crop.

Each plot was harvested and grain yield determined. Net returns to producers were calculated based on grain prices of soybeans @ $10.00/bu, and rice @ $5.00/bu. Input costs were based on lime @ $25.00/ton, pelletized lime @ $110.00/ton, P @ $0.25/lb, and K @ $0.35/lb

Results and Discussion

The average grain yields and net returns to producers for lime and fertilizer treatments for 2007 are presented in Tables 4, 5, & 6. When averaged for all fertilizer treatments, the 1.6 ton/a lime rate produced the greatest rice yields. When averaged for all lime treatments, the 70-30 rate of P & K produced the greatest yields for rice. When averaged for all fertilizer treatments, the 1.6 ton/a lime rate produced the greatest soybean yields. When averaged for all lime treatments, the 80-120 rates of P & K produced the greatest yields for soybean. For both rice and soybeans the 200 lb/a pelletized lime treatment increased yields relative to the no lime treatment. When averaged for all fertilizer treatments, the 0.4 t lime treatment produced the greatest returns to producers for rice. When averaged for all lime treatments, the 30-70 rates of P & K produced the greatest returns to producers for rice. When averaged for all fertilizer treatments, the 0.8 ton/a lime rate produced the greatest returns to producers for soybeans. When averaged for all lime treatments, the 80-120 rates of P & K produced the greatest returns to producers for soybeans.

Table 1.
Average grain yield, input costs, gross and net returns for lime and fertilizer treatments for rice and soybeans, Qulin, MO in 2007.

2007 Rice						
#	P+K (lb/a)	Lime (t/a)	Yield (bu/a)	Gross return* ($/a)	Input costs** ($/a)	Net returns ($/a)
1	0	0	141	705.00	0.00	705.00
2	0	0.4	141	705.00	9.40	695.60
3	0	0.8	149	745.00	18.75	726.25
4	0	1.2	140	700.00	28.20	671.80
5	0	1.6	144	720.00	37.50	682.50
6	0	200 lb pel	142	710.00	11.00	699.00
7	70-30	0.4	141	705.00	37.40	667.60
8	70-30	0.8	159	795.00	46.75	748.25
9	70-30	1.2	151	755.00	56.20	698.80
10	70-30	1.6	153	765.00	65.50	699.50
11	70-30	200 lb pel	157	785.00	39.00	746.00

2007 Soybeans						
#	P+K (lb/a)	Lime (t/a)	Yield (bu/a)	Gross return* ($/a)	Input costs** ($/a)	Net returns ($/a)
1	0	0	36	360	0.00	360.00
2	0	0.4	38	380	9.40	370.60
3	0	0.8	39	390	18.75	371.25
4	0	1.2	41	410	28.20	381.80
5	0	1.6	42	420	37.50	382.50
6	0	200 lb pel	39	390	11.00	379.00
7	80-120	0.4	46	460	71.40	388.60
8	80-120	0.8	49	490	80.75	409.25
9	80-120	1.2	43	430	90.20	339.80
10	80-120	1.6	49	490	99.50	390.50
11	80-120	200 lb pel	45	450	73.00	377.00

*Based on rice @ $5.00/bu and soybeans @ $10.00/bu
**Based on lime @ $25.00/ton, pelletized lime @ $110.00/ton, P @ $0.25/ lb P_2O_5 and K @ $0.35/ lb K_2O.

Table 2. Average rice and soybean yields and net returns for fertilizer treatments averaged for all lime rates, Qulin, MO in 2007.

P&K	Rice			Soybeans	
	Yield (bu/a)	Net returns ($/a)		Yield (bu/a)	Net returns ($/a)
No P & K	143.2	695.00		39.8	377.00
+ P & K	155.4	728.00		46.4	443.0.0

Table 3. Average Rice and soybean yields and net returns for lime treatments averaged for all fertilizer rates, Qulin, MO in 2007.

Lime	Rice			Soybeans	
	Yield (bu/a)	Net returns ($/a)		Yield (bu/a)	Net returns ($/a)
0	141	705.00		36.0	360.00
0.4 t	150	726.60		42.0	410.60
0.8 t	150	717.25		44.0	421.25
1.2 t	146.5	690.30		42.0	391.80
1.6 t	150.5	701.00		44.5	417.50
200 lb pel	149.5	722.50		42.0	409.00

Additives for Increasing Nitrogen Efficiency in Rice

David Dunn and Gene Stevens

Introduction

Rice needs supplemental nitrogen fertilizer additions to achieve maximum yields. In the standard dry seeded, delayed flood rice production system, the bulk of the nitrogen is supplied as urea. Then a permanent flood is immediately established. However, in real farm situations the establishment of the permanent flood can be delayed for several days. During the time period between fertilizer application and flood establishment the applied urea is subject to losses by several pathways. These include volatilization of urea and conversion of urea to nitrate followed by subsequent leaching and denitrification. Several products are commercially available to control these losses. This study compares several products in their ability to achieve rice yields in a dry seeded, delayed flood production system.

Methods and Materials

In 2007 this evaluation was conducted at two locations representing the two major soil types used for rice production in Missouri. The soil types were: Sharkey clay soil, University of Missouri-Delta Center, Portageville, MO and Crowley silt loam, Missouri Rice Research Farm, Quin, Missouri. At each location a small plot evaluation with a randomized complete block design employing four replications was conducted. Rice was cultivated using the standard methods of P and K fertilization, water management, and weed & insect control for dry-seeded, delayed flood rice in Southeast Missouri. At both locations four pre-plant N rates (35, 70, 105, and 140 lbs N/a) were compared to an untreated check. No additional N was applied. At the clay soil location the following products: ammonium nitrate, urea, urea + Agrotain®,(Agrotain, International, St Louis, MO) urea + NSN (NurtiSphere-N™, Specialty Fertilizer Products, Belton, MO), ESN® (Environmentally Smart Nitrogen, Agrium Inc, Calgary, AB, Canada) and sulfur coated urea (The Scott's Miracle Grow Company, Marysville, OH). At the silt loam location the following products were evaluated urea, urea + Agrotain®, urea + NSN, and CaTs® (Calcium thiosulfate infused urea, Tessenderlo Kerley Inc., Phoenix, AZ). At the silt loam location the CaTs® product was combined with Agrotain® and NSN. At each location the N fertilizers were applied 7 days prior to flood establishment. SPAD 502 chlorophyll meter, plant height, Arkansas plant area board, and Missouri yardstick readings were collected from each plot at midseason. At seasons end each plot was harvested and the resulting rice yield was measured.

Results

Yield results for the clay soil location are given in Table 1, for the silt loam soil location in Table 2. At both locations the 140 lbs N as urea produced the greatest yields. At the clay soil location when yield results were averaged for all N rates ESN® produced the numerically greatest yields and Sulfur coated urea produced the lowest yields. At the silt loam soil location when yield results were averaged for all N rates urea produced the numerically greatest yield and CaTs® produced the lowest yields.

Conclusions

The yield results from both locations indicate that environmental conditions promoting N losses due to volatilization, denitrification, or leaching were not present in 2007. The environmental conditions found in 2007 may or may not be typical for Southeast Missouri. More study is needed before definitive conclusions are drawn. Rice producers should exercise caution before extending these results in to future years.

Acknowledgement:

This research was made possible by the generous and continuing support of the Missouri Rice Research and Merchandising Council, Specialty Fertilizer Products, Belton, MO, and Tessenderlo Kerley Inc., Phoenix, AZ. Use of trade or product names is for identification purposes only and does not constitute an endorsement or recommendation by the University of Missouri.

Table 1. Average rice yields for N treatments for a clay soil located at the University of Missouri-Delta Center, Portageville, MO, 2007

N rate	Urea	Urea + Agrotain®	ESN®	AmNitrate	Sulfur coated urea	NSN
0	155					
35	178	181	174	169	157	173
70	187	196	196	183	153	186
105	202	196	209	206	158	197
140	221	218	217	188	165	216
Average for N rates	197	198	199	187	158	193

Table 2. Average rice yields for N treatments for a silt loam soil located at the Missouri Rice Research Farm, Qulin, MO, 2007

N rate	Urea	Urea + Agrotain®	CaTs®	CaTs® + Agrotain®	CaTs® + NSN	NSN
0	137					
35	163	172	161	160	184	153
70	181	181	167	174	173	164
105	197	183	149	188	187	186
140	204	188	182	191	188	174
Average for N rates	186	181	165	178	183	169

Silicon (Si) Content of Three Rice Cultivars

David Dunn, Gene Stevens, and Donn Beighley

Introduction

Silicon (Si) is the third most abundant element on earth after Iron and Oxygen. It comprises over 15% of the earth's mass by weight. However, it is the most abundant element in the earth's crust comprising over 59% of the earth crust. Rice is unique among crop plants in that it incorporates large amounts of Si into its tissue. This Si is used as a stiffener, giving the stems greater rigidity and durability.

There is little or no published data detailing the amount of Si contained in rice plants or if there are differences between Si content of rice varieties. Recently it has been proposed to use rice straw as a feed stock of cellulosic ethanol production. The high Si content of rice tissue may limit it's suitability for use as a bio-fuel feed stock.

A second proposed use of rice straw is as a feed stock for Si extraction and production of high purity SiO_2 for use in computer chip manufacture. Conversely, high Si content may have value as a Si source for computer chip manufacture.

This study compares the Si content of the upper portion of three rice cultivars from different genetic lines.

Methods and Materials

This study makes use of variety evaluation conducted at the University of Missouri-Delta Center in 2007. This evaluation was conducted on a Sharkey clay soil. Rice cultivars were grown under standard methods of N-P-K fertilization, water management, and weed & insect control for cultivating dry-seeded, delayed flood rice in Southeast Missouri.

Three of the cultivars in the test (*Cocodrie*, *Francis*, and *XP744*) were selected for Si content analysis. These cultivars were selected to represent a wide range of genetic backgrounds. The cultivars were planted in small plots employing a randomized complete block design with four replications. At harvest, as each plot was harvested a grab sample of the rice straw was collected from the back of the combine. This sample was dried and ground.

The resulting sample was the analyzed for mineral content by Inductively Coupled Plasma following lithium meta-borate fusion. The elements analyzed were Al, Ca, Cr, Fe, K, Mg, Mn, Na, P, Si, Ti, Ba, Nb, Sr, Y, Zn, and Zr. This analysis was conducted by SGS Mineral Services of Toronto Canada. Data was then statistically compared using SAS.

Results and Discussion

Of the 17 elements analyzed significant differences between cultivars were found only for Si SiO_2 (Table 1). Of the cultivars analyzed *Francis* had the greatest levels of SiO_2 while *Cocodrie* had the lowest. These levels were found in the upper portions of the rice plants, that portion which was processed by the combine.

This may not reflect differences in whole plant Si levels as the cultivars do not have the same growth habits. Relatively more or less leaf and/or stem may have been included in the post combine sample that was collected and analyzed for each cultivar.

If SiO_2 is more abundant in the lower stems than in leaves a taller stature rice plant would have relatively more leaf represented in a sample collected by this method. Consequently it would contain lower levels of than a smaller stature rice plant

Conclusions

This preliminary evaluation indicates that SiO_2 levels vary among rice cultivars. Given that the sampling method used may introduce bias in SiO_2 levels found these results should not be considered conclusive. More study is needed.

Table 1. Average SiO_2 levels for three rice cultivars grown on a clay soil at Portageville, MO, 2007.

Cultivar	SiO_2 (%)
XL 744	12.25
Francis	12.78
Cocodrie	11.80
LSD	0.97
CV%	6.6

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

Missouri DD-50 Rice Model

Gene Stevens, Allen Wrather, Kelly Tindall, and Matthew Rhine

Commercial Agriculture Extension Program &
University Outreach and Extension
University of Missouri-Columbia

Welcome to the Missouri Rice Degree Day 50 (DD-50) website. If you are a rice farmer in Southeast Missouri, you will be able to enter information about your field and receive a report with predictions and recommendations based on local weather. This program uses maximum and minimum daily air temperatures to predict when rice growth stages will occur in a field. The program assumes rice growth will not occur with average temperatures below 50°F. The objective of this program is to improve timeliness of rice management decisions by utilizing temperature data from the Commercial Agriculture weather stations network. DD-50 reports generated early in the season are based on long term weather averages. As the season progresses new reports can be made with updated rice growth predictions based on weather that has occurred in the season.

To generate a DD-50 report for your rice field, begin by clicking the Start at the bottom of this page. A new screen will appear with blank boxes to enter information.

1. *Field name:* Enter the field name in the appropriate box.
2. *Variety and Weather Station:* Scroll through the choices of rice varieties and weather stations by clicking on the down arrow in the right corner of each box. Some counties have more than one choice of weather stations. New rice varieties will be added to the list as calibration research is completed.
3. *Emergence date:* Enter the number of the month and day that the rice emerged. We define rice emergence as the date that 10 one-leaf rice plants per square foot are present in a field.
4. *Name and Address:* If you want to have your name and address appear on each report enter this information in the boxes on the bottom of the screen. This is an optional step. We do not use this information in the model.
5. *SUBMIT Query:* Click this button when you have completed the boxes.

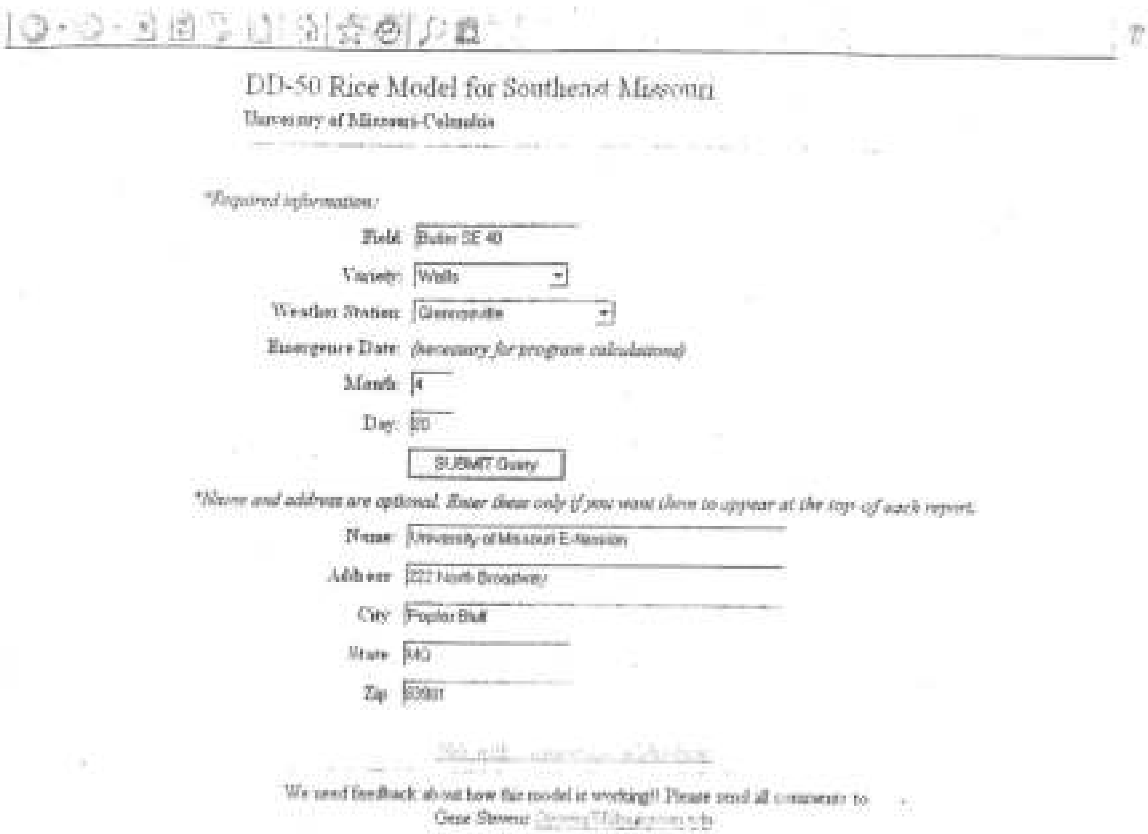
The DD-50 report will provide the following information:

- various weed control options and herbicide cut-off dates
- when to apply preflood nitrogen and flood the field (beginning tillering)
- when to check plant area for adequate nitrogen fertility at mid-tillering
- the recommended nitrogen fertilization rate and timing for the variety
- when to begin scouting for insects and diseases and control recommendations
- mid-season -- beginning jointing, time to check plant area, and time to apply mid-season nitrogen
- time of 50% heading
- when to stop pumping
- when to pull the flood and when to harvest

After you submit a query, a report will appear on your screen. To print the report use the print function of your internet browser. To submit a new field click on the "Back" button in your browser.

A precaution: The accuracy of the growth stage predictions should be verified by the grower at three times during the season ... (1) beginning tillering, (2) beginning internode elongation, and (3) at 50 % heading. To view illustrations of these growth stages, click on the blue text in your report, where available. Long term temperatures are replaced with actual measurements each day. If the actual daily temperatures are significantly hotter or colder than the long term averages in a given season, the accuracy of predictions should be improved by making new reports.

START



DD-50 Rice Model for Southeast Missouri

University of Missouri-Columbia

*Required information:

Field: Butler SE 40

Variety: Wells

Weather Station: Glennonville

Emergence Date: *(necessary for program calculations)*

Month: 4

Day: 20

SUBMIT Query

Name and address are optional. Enter these only if you want them to appear at the top of each report.

Name: University of Missouri Extension

Address: 222 North Broadway

City: Poplar Bluff

State: MO

Zip: 63901

We need feedback about how the model is working!! Please send all comments to Gene Stevens:

Missouri Rice Growth and Development Prediction
1/25/2008

University of Missouri Extension
222 North Broadway
Poplar Bluff, MO 63901
field: Butler SE 40 – variety: Wells

weather station: Glennonville

4/30 EMERGENCE - (average 10 one-leaf rice plants per square foot)

4/30 – 5/18 May need to flush field

4/30 - 5/13 The following is a list of viable herbicide options for weed control from early post emergence to preflood:

- Propanil – 3 to 4 quarts/acre for broadleaf weeds and small grass.
- Facet – 0.25 to 0.5 lb a.i./acre + crop oil concentrate (COC) 1% volume/volume (V/V).
- Duet – 4 quarts/acre + COC 1% V/V.
- Permit – ⅔ to 1 ounce/acre + COC 1% V/V or non-ionic surfactant (NIS) 0.25% V/V for control of nutsedge.
- Arrosolo – 4 to 5 quarts/acre.

4/30 - 5/13 Control armyworms by applying lambda-cyhalothrin at 0.0083-0.025 lb a.i./acre (Halexus Lambda, Karate with Zeon, Lambda T, Lambda-CY EC, Mystic Z, Silencer, Taiga Z, or Warrior with Zeon) or zeta-cypermethrin at 0.04-0.025 lb a.i./acre (Mustang or Mustang Max), gamma-cyhalothrin at 0.0125-0.02 a.i./acre (Prossaic or Proline), or esdfenvalerate at 3-18 oz/acre (Asana Direct, Asana XL, Arsenal EC, or Evoius 7%EC), or Karate at 12.5-37.5 lb/acre (Diamond and WP), or carbaryl at 1-1.5 qt/acre (Carbaryl 4L, Sevin 4L, Sevin 80S, Sevin 80WSP, Sevin XLR Plus), Bacillus thuringiensis at 1-2 lb/acre (Lepinox WDG) or pyrethrins at label rates (Evergreen EC 60-6, Pyganic EC 1.4 II, Pyganic EC 5.0 II, or Pyrellin EC). Note: armyworms usually die when fields are flooded.

5/13 FIRST TILLER. Tillering begins. Scout for stem borers from tiller to grain filling stages. To control stem borers apply lambda-cyhalothrin at 0.03-0.04 lb a.i./acre or pyrethrin at label rates (see tradenames for chemicals above).

5/13 Apply nitrogen on dry soil. Three-way split program: apply 90 lb N/acre (200 lb urea). Single N application program: apply 120 lb N/acre (260 lb urea). Increase N in following situations: on clay soils (+30 lb N), following rice or soybean (+20 lb N), less than 10 plants/square foot (+20 lb N). If single N application program is used, be sure and check with area board at 1/2 IE.

5/13 Control insects: Foliar applications of Dimilin 2L (12-16 oz/A) or Karate 2.08CS (1.6-2.56 oz/A) should be applied within 7 to 10 days after flooding the fields to maximize control of rice water weevil infestations.

5/31 The following is a list of viable herbicide options for weed control postflood:

- Facet – 0.5 lb a.i./acre for salvage grasses.
- Regiment – 0.4 to 0.57 ounces/acre + Dyneamic 2 to 3 quarts/100 gallons)
- Grasp – 2.0 to 2.8 ounces/acre + minimum 1 quart/acre COC.
- Clincher – 13 ounces/acre + 2.5% COC V/V.
- Ricestar – 17 ounces/acre + 2.5% COC V/V.
- 2,4-D – 1 to 1 ½ pints/acre prior to ½" internode elongation.

5/26 Begin checking for any fertility deficiencies that may occur after flooding.

6/8 - 6/20 Apply Blazer if needed for broadleaf weed control at ½ to 1 pint/acre.

6/9 –

6/11 Begin checking for internode elongation.

6/21 1/2 INCH INTERNODE - If a yardstick floating between drill rows shows more than 13 numbers or a digital image taken from overhead contains less than 64% green pixels, apply 30 lbs Nitrogen/acre (66 lbs urea). Stop PROPANIL applications. Start checking for Sheath Blight and Blast. Apply QUADRIS (12.8 fl. oz./acre) during the 7-14 days after 1/2" internode elongation if needed for Sheath Blight control.

6/27 - 6/29 In a three-way N split program, apply 30 lb Nitrogen/acre (65 lb Urea). Continue to scout for Sheath Blight and Blast.

7/4 EARLY BOOT - Continue to scout for Sheath Blight and Blast.

7/20 10 percent HEADING - QUADRIS (12.8 fl. oz./acre), if needed for Blast control, when 30% of the main tillers are cracking the boot. If humid, rainy conditions develop with mild temperatures, then a second application is recommended when 80% of the main tillers have almost emerged.

7/24 [illegible]

[illegible] almost emerged.

7/24 50 percent HEADING - Stop Sheath Blight scouting or apply recommended fungicide. Begin checking for stink bug infestations once 50% of the panicles have emerged. Insecticide applications are recommended when 5 or more stink bugs are present the first 2 weeks after 50% panicle emergence. The threshold doubles to 10 or more stink bugs for the remainder of the season. If stink bugs are above thresholds apply lambda-cyhalothrin at 0.0165-0.025 lb a.i./acre (Halosis Lambda, Karate with Zeon, Lambda T, Lambda-CY EC, Mystic Z, Silencer, Taiga Z, or Warrior with Zeon) or zeta-cypermethrin at 0.04-0.05 lb a.i./acre (Mustang or MustangMax), gamma-cyhalothrin at 0.0125-0.02 a.i./acre (Prolex or Proaxis), or methyl parathion at 1.5 pt/acre (Methyl 4EC), or malathion at 8 oz/acre (Fyfanon, Malathion 5).

7/25 70 to 80 percent HEADING - End Blast scouting or apply recommended fungicide for Blast. Begin checking for stink bug infestations once 50% of the panicles have emerged. Insecticide applications are recommended when 5 or more stink bugs are present the first 2 weeks after 50% panicle emergence. The threshold doubles to 10 or more stink bugs for the remainder of the season.

7/27 100 percent HEADING - Continue checking for stink bug and other insect infestations.

7/31 Stop pumping. Stop insect scouting if insects are not present.

8/4 Drain fields (1. On CLAY soils - heads turned down - upper 1/2 head is straw colored; 2. on SILT/SANDY soils - heads turned down - upper 3/4 head is straw colored) Terminate insecticide applications for stink bugs once fields are drained.

9/21 HARVEST - 15 percent - High yields demand slow harvest speed for maximum harvesting efficiency. Also check/adjust combines several times during the day as environmental and crop conditions change.

([illegible])

A precaution: The accuracy of the growth stage predictions should be verified by the grower at three times during the season: (1) beginning tillering, (2) beginning internode elongation, and (3) at 50 % heading. To view illustrations of these growth stages, click on the blue text in your report, where available. Long term temperatures are replaced with actual measurements each day. If the actual daily temperatures are significantly hotter or colder than the long term averages in a given season, the accuracy of predictions should be improved by making new reports.

Reports based on information obtained from the [illegible] Commercial Agriculture Automated Weather Stations

University of Missouri Soil Test Recommendations for Rice Production

Gene Stevens and David Dunn

Introduction

Most of the Current University of Missouri soil test recommendations has been adopted from Arkansas. During the past 10 years a team of scientists including Dr Gene Stevens, Dr Michael Aide, Dr Paul Tracy, and David Dunn have carried out field evaluations of these recommendations. These evaluations are continuing today thanks to support from the Missouri Rice Research and Merchandising Council.

pH and soil acidity

In Missouri soil acidity is measured on the basis of Salt pH (pH_s). The pH_s indicates the need to apply lime. The lime requirement is measured by the Woodruff Buffer method. Missouri lime recommendations are given in lbs. of Effective Neutralizing Material (ENM) per acre. ENM is an estimate of how much soil acidity the lime will neutralize in a 3 year period.

Currently the University of Missouri does not recommend liming before rice is grown. Liming is necessary to maximize soybean yields in the rice-soybean rotation. Last year soybean yields were increased 25% when 1 ton/a of lime was applied before soybeans were planted at the Missouri Rice Research Farm.

Nitrogen (N)

Currently the University of Missouri recommendations for nitrogen are variety specific. These recommendations are posted on the Ag Electronic Bulletin Board at http:\\agebb.missouri.edu\rice. Table 1 gives the nitrogen recommendations for 4 popular varieties.

Table 1. Nitrogen recommendations for 4 popular rice varieties.

Variety	Total N	Preflood	Mid-season
Bengal	135	75	30+30
Cocodrie	150	90	30+30
Francis	150	90	30+30
Wells	150	90	30+30

Phosphorus (P)

Phosphorus recommendations are based on a target level of 30 lbs P/a. A rice crop will remove .30 lb of P_2O_5 per bu per acre. To account for this loss a crop removal factor is included for soils testing between 30 and 55 lb P/a. Recommendations are given in lbs of P_2O_5 per acre.

Potassium (K)

In 2003 the University of Missouri Missouri changed the target level for K fertilization. The new target level reflects recent research in Missouri. These new recommendations also reflect the higher yield potential of the rice varieties grown in Missouri. Potassium recommendations are based on a target level of 125 + 5X CEC. For silt-loam soils this is about 200 lbs K/a. For gumbo soils this number is about 225 lbs K/a. Rice yields drop off quickly when a soil tests below these levels. For low testing soils a factor for building the soil up to maximum productive levels is included in the fertilizer recommendation added in. The current recommendation package allows the producer to choose how quickly to build up the soil K levels. A rice crop removes 0.2 lb K_2O per bushel per acre. A crop removal factor is included to account for this. Recommendations are given in lbs of K_2O per acre.

2007 Missouri Rice Variety Performance Trials

Donn Beighley, Cathy Dickens, Randy Dickens, Janet Dickens,
Jim Heiser, Kelly Tyndall, Gene Stevens, David Dunn and Allen Wrather

In 2007 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.

Experimental Procedure

Location

Rice plots were established at two locations in 2007: the Missouri Rice Research Farm near Glennonville, MO and at the Delta Center Farm at Portageville, MO. The Rice Research Farm yield trial consisted of drill-seeded plots following soybeans, drill-seeded plots and water-seeded plots following rice which were planted on 19 April, 1 May and 1 May, respectively on a Crowley silt loam. The plots at the Delta Center were planted on 30 April on Sharkey clay. The seed planted in the water seeded trial were treated with Apron-Maxim-Zinc for rice water weevils. The trial consisted of 24 public, private, and experimental varieties.

Field Plot Design

All the varieties were evaluated within the same trial. The yield trial 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. The water seeded plot size was 12 foot long by 4.4 feet wide.

Entries

Seed of all public varieties were obtained from: Karen Moldenhauer – UA, Stuttgart, AR; Steve Linscombe – LSU, Crowley, LA; Anna McClung – USDA-ARS, Beaumont, TX; Dwight Kanter – MSU, Stoneville, MS, RiceTec and BASF.

Plot Management

Plots were planted with an Almaco no-till plot drill. Pre-flood fertilizer was applied at a rate of 180 lb nitrogen. No adjustments in rates were made to meet specific requirements of individual varieties. 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 Shot and ¾ lb. Facet per acre were applied prior to flooding. There were no insecticides applied. The flood was maintained throughout the growing season. The plots at the Rice Research Farm were harvested with an Almaco research plot combine while Kincaid plot combine was used at the Delta Center. The grain from the plots was weighed and moisture was determined.

Data Recorded

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 there were 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 scale of 0 to 10 with 0 indicating all plants in a plot were erect (no lodging) and 10 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 Crisp Bootheel Education Center located in Malden, MO.

Results

The Missouri Rice Variety Trials resulted in optimum yields for all four of the management practices they were tested under. The yields were higher than expected at some locations but did not fall off due to dry environmental conditions in the other locations. There were no diseases observed and no other problems were seen during the growing season.

Yield (Table 1, 2 and 3)

The yields averaged 183, 169 and 219 Bu/A respectively for the conventional drill test (MO Rice Farm), continuous rice drill test (MO Rice Farm) and conventional drill test (UM Delta Center) while the water-seeded test (MO Rice Farm) averaged 131 Bu/A. The Delta Center yields were higher than expected as the plot area was not on newly cut ground. The water-seeded trial yields were higher than expected in light of yields in previous years and may be due to the three split nitrogen application.

Long Grain Type (Table 1)

Differences among varieties were observed across all trials. The top yielding line *across* all trials was RT XL723 followed by RT XP744, Wells and Francis. In the conventional drill-seeded trial at the Missouri Rice Farm Francis was the top yielding line at 197 Bu /A followed by RT XL723, Wells and Cybonnet. In the conventional drill-seeded trial at the UM Delta Center RT XP744 was the top yielding line at 244 Bu /A followed by RT XL723, Francis and Bowman. In the continuous rice drill-seeded trial at the Missouri Rice Farm RT XP744 topped the test at 193 Bu/A followed by RU0001108, RT XL723, and RU0202195. The top yielding line in the water-seeded trial was Wells at 178 Bu /A followed by Francis, RT XL723 and CL171.

Amongst the experimental varieties RU0202195 was the top yielding line at 177 Bu/A across all locations and was #1 or #2 at each of the locations. This was followed by RU0102008.

The only new variety release was Bowman which yielded 156 Bu /A across the four trial locations.

Medium Grain Type (Table 1)

The top yielding line across all trials was RU0002146 at 195 Bu/A followed by RU9902028, Jupiter and Bengal. RU9902028 was the top line in the Missouri Rice Farm conventional drill-seeded trial (212 Bu/A) and continuous rice drill-seeded trial (192 Bu/A). Jupiter was the top line in the UM Delta Center conventional drill-seeded trial (234 Bu/A) and Missouri Rice Farm water-seeded trial (157 Bu/A).

Multiple Years (Table 2)

When comparing long grain varieties across 2006 and 2007 those drill-seeded varieties that performed well in 2007 performed well in 2006 – RT XL723, RU0202 195, Wells and Francis. Across multiple years, 2003 to 2007, Wells and Francis have been the best yielding varieties.

RU0002146 was the best medium grain variety in 2006 – 2007 in the drill-seeded trials and RU9902028 does yield significantly more than Bengal over years.

Days to Emergence (Table 3).

In 2007 the difference in number of days from planting to emergence between water-seeded (12 days) and drill-seeded emergence (11 days) was one day. There was no difference between the water-seeded and drill-seeded trials planted in the continuous rice field when planted on the same day.

The Days to 50% Heading (Table 3).

Days to 50% heading was taken in all of the Missouri Rice Farm drill-seeded trials and the water-seeded trial. The water-seeded trial required eight days less than the conventional drill-seeded trial and 11 days less than the continuous rice drill-seeded trial for days to 50% heading. In the water-seeded trial the average number of days to 50% heading was 7 days and 81 and 83 days respectively for the conventional and continuous rice drill-seeded trials. The range of the difference between the different trials was seven days to 14 days. The average number of days to 50% heading observed for the varieties in the combined trials ranged from 66 days for Spring to 90 days for Bengal.

Plant Height (Table 3)

The 2006 average plant heights for the Rice Farm drill-seeded trials were 37 inches and 34 inches for the water-seeded trial.

Lodging (Table 3)

No lodging was observed in the various trials.

Milling Quality (Table 1 and 3)

Average percent milling quality values across all trials was 74/56. The water-seeded trial had the lowest overall milling quality values at 75/49 and the UM Delta Center trial had the highest at 74/62. In 2007 the differences between the three locations for percent total rice were small but large for percent whole rice. The average values were the following: 74/57 - Rice Farm drill trial, 75/55 – continuous rice drill-seeded, 74/62 – UM Delta Center drill trial, and 75/49 – Rice Farm water-seeded trial. The percent head yield scores in the ranged from 33 to 69. Wells milling quality values were lower than expected but in a personal communication with Karen Moldenhauer she indicated that in dry years the percent whole rice values have been to be low for Wells.

The highest consist values across the different trials was observed in the medium grain types particularly the variety, Bengal. Spring had the lowest milling quality values across the different trials. This may be a result of its earliness as compared to the other varieties as it is exposed to more environmental conditions once it is mature.

Rice Disease Data

No significant disease symptoms were observed in 2007. There was some late season rice water weevil damage observed on tips of some flag leaves.

Table 1.

2007 Rice Variety Yield and Milling Quality Average

	Bushels/Acre					% Total Yield	% Head Yield	% Total Yield	% Head Yield	% Total Yield	% Head Yield	% Total Yield	% Head Yield
Variety	MO Rice Farm	UM Delta Center	Continuous Rice	Water-Seeded		MO Rice Farm		UM Delta Center		Continuous Rice		Water-Seeded	
Bowman	187	219	117	101		73	45	72	61	75	55	74	34
Cocodrie	179	207	153	146		75	57	75	63	75	64	74	47
CL171-AR	141	196	174	138		76	62	74	66	75	65	75	52
Cybonnet	191	182	152	108		74	67	74	62	74	62	74	55
Francis	197	232	161	146		74	65	74	64	74	56	74	42
Spring	162	182	157	108		73	64	72	57	73	44	73	40
Trenasse	185	217	172	95		73	49	73	58	74	50	73	51
Wells	191	205	171	178		74	41	75	58	76	44	75	33
RTXL723	194	237	183	145		75	47	74	61	75	51	74	54
RTXP744	184	244	193	135		75	50	75	61	75	52	74	50
RU0001108	174	195	191	99		74	58	75	61	76	56	76	43
RU0102008	182	206	180	133		73	60	73	61	75	58	73	53
RU0202195	185	218	183	123		75	61	74	64	76	53	76	49
STG99F5-02	176	214	179	105		74	57	74	62	75	56	75	47
Bengal	176	220	146	141		77	69	76	64	76	64	76	60
Jupiter	181	234	162	157		75	67	76	68	76	61	76	66
RU0002146	208	228	190	155		74	48	73	57	76	51	74	49
RU9902028	212	215	192	146		74	55	74	62	75	47	76	57

Table 2.

Missouri Rice Variety Trial - Multiple Year Data (Bushels / Acre)

	Drill-Seeded						Water-Seeded				
Variety	07	06-'07	05-'07	04-'07	03-'07		07	06-'07	05-'07	04-'07	03-'07
Cocodrie	180	191	195	186	180		146	118	120	122	113
Cybonnet	175	183	200	196	157		108	83	96	107	---
Francis	197	194	205	199	194		146	117	118	124	113
CL171	171	175	---	---	---		138	112	---	---	---
Spring	167	157	165	---	---		108	87	94	---	---
Trenasse	191	178	186	---	---		95	91	98	---	---
Wells	189	198	204	194	195		178	143	136	151	113
RTXL723	205	217	223	---	---		145	165	157	---	---
RU0001108	187	197	---	---	---		99	82	---	---	---
RU0102008	189	185	---	---	---		133	111	---	---	---
RU0202195	196	210	---	---	---		123	112	---	---	---
STG99F5-02-110	190	187	---	---	---		105	102	---	---	---
Bengal	181	188	200	189	184		141	107	119	123	113
Jupiter	192	205	197	---	---		157	140	139	---	---
RU9902028	206	210	212	210	209		146	133	130	143	113
RU0002146	208	210	---	---	---		155	134	---	---	---

Table 3.

2007 Rice Variety Agronomic Data - Location Average

Variety	Days to 50% Heading*	Plant Height (Inches)*	Percent Lodging*	Bushels / Acre**	% Total Yield**	% Head Yield**
Bowman	82	36	0	156	73	45
Cocodrie	79	33	0	171	75	58
CL171-AR	81	34	0	162	75	61
Cybonnet	80	34	0	158	74	61
Francis	79	36	0	184	74	57
Spring	74	38	0	152	73	51
Trenasse	74	36	0	167	73	52
Wells	79	38	0	186	75	44
RTXL723	75	39	0	190	74	53
RTXP744	75	40	0	189	75	53
RU0001108	79	37	0	165	75	51
RU0102008	79	35	0	175	75	58
RU0202195	80	35	0	177	75	55
STG99F5-02-110	83	33	0	169	74	56
Bengal	83	34	0	171	76	64
Jupiter	81	36	0	183	76	65
RU0002146	78	38	0	195	74	51
RU9902028	79	38	0	191	74	55

*- Average of Drill-seeded(MO Rice Farm, Continuous Rice) and Water-seeded trials
**- Average of Drill-seeded(MO Rice Farm, Delta Center and Continuous Rice) and Water-seeded trials

The 2007 Effect of Planting Date on Rice Varieties

Donn Beighley, Cathy Dickens, Randy Dickens, Janet Dickens
and Bruce Beck

In southeast Missouri there are a narrow range of rice varieties grown that represent the range of early short season types (Spring) to medium season types (Wells). They are planted as the weather and the field conditions permit during the period from early April to late June. However, the time of planting may vary from year-to-year based on the planting environment. Little information is being made available concerning varietal performance with respect to harvest date, yield, quality and their agronomic traits when planted at different dates between early April through wheat harvest in mid-June.

Experimental Procedure

Location

Rice plots were established at the Missouri Rice Research Farm near Glennonville, MO on a Crowley silt loam. The plots were planted on: 3 April (early April), 17 April (mid-April), 1 May (early May), 21 May (late May) and 16 June (mid to late June). At each planting date there were seven varieties that represent the major rice varieties grown in southeast Missouri. These varieties were: Cocodrie, Cybonnet, Francis, Jupiter, Spring, Trenasse, and Wells.

Field Plot Design

Each planting date was evaluated as a separate trial and all varieties were included. 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.

Entries

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

Plot Management

The drill plots were planted with an Almaco no-till plot drill. For primary weed control, 12 oz. Command was applied post plant, 2 pts. Prowl, 2 oz. Aim, 78 oz. Permit, 4 qt. RiceShot and ¾ lbs. Facet herbicides were applied prior to flooding. A pre-flood fertilizer was applied at a rate of 180 lbs N. The flood was maintained throughout the growing season. There were no insecticides applied. A single row was harvested to determine milling quality. Milling quality was determined on two replications of each variety from each planting date.

Data Recorded

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[1]. 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 scale of 0 to 100 with 0 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.

[1] The DD50 Report gives actual calendar dates that correspond to the number of days from emergence.

Results

Yield:

In 2007 when the variety yields were averaged for each planting date it was observed that the early April planting date had the highest overall yields at 202 Bu/ A. It was followed by the early May date (196 Bu/A), mid-April date (181 Bu/A), late May date (180 Bu/A) and mid-June (142 Bu/A). Table 1. In both 2004 and 2005 the early April planting date had the highest yields while the mid-June date had the lowest yields. The trend has been observed that yields are lower at the mid-April planting date than either the early April or early May planting dates.

Across all planting dates Francis and Wells were the highest yielding long grain types (188 Bu/A) while Jupiter was the highest yielding medium grain type (204 Bu/A). Table 2.

When comparing variety differences at each planting date Francis was the top yielding variety in early April (232 Bu/A) and early May (230 Bu/A) while Jupiter was the top yielding variety in mid-April (223 Bu/A) and mid-June (192 Bu/A). The variety Wells yielded well planted early April (218 Bu/A), mid-April (206 Bu/A), and late May (192 Bu/A). Table 3.

Days to Emergence

The number of days from planting to emergence ranged from 25 days at early April to 12 days at the early May planting date. Nine fewer days, on average are required for days from planting to emergence when comparing the early April date (25 day average) to the mid April date (14 day average). Due to dry soil conditions at the time of planting the late May and mid-June emergence date is not considered to be accurate or reliable.

Spring and Trenasse continue to have an emergence date that is two to four days later than the average of the varieties at the first two planting dates.

Days to 50% Heading

The average number of days to 50% heading ranged from 79 days at the early April date up to 84 days at the early May date. The average days to 50% heading increased from 79 days at the early April date to 84 days at the mid-May date across all varieties (Table 1). A similar trend was observed within varieties. Wells had the longest average period between emergence and 50% heading date (87 days at both the early May and late May dates) and Spring had the fewest (74 days at the early April date) (Table 2).

Plant Height

When averaged across all varieties the plant height decreased slightly (one to two inches) from early April (37 inches) to mid-April (35 inches) and then increased slightly at the later planted dates. Table 1. There was a similar trend for the individual varieties. Spring was the tallest varieties (41 inches) while Cocodrie and Jupiter were the shortest varieties (35 inches) when averaged across all planting dates.

Lodging

Lodging was not observed in any of the varieties in 2007.

Milling Yield / Quality

The percent head yield values for 2007 were lower than previous years and the percent total yield was about the same as observed in previous years. This may have been a result of the dry late season conditions.

The highest overall milling quality was from the late May date (75/64) and the lowest was the mid-April date (73/57). There was no clear trend toward higher or lower milling quality between early April and mid-April or for individual varieties. Table 1.

Across varieties Jupiter (77/67) had the highest average milling quality and Wells had the lowest average (76/53). The trend appears to be that the medium grain varieties consistently have the highest milling values across all planting dates and this trend is observed in most years. Table 2.

Summary

The results of the 2007 date of planting yield trials again indicates that the early April planting does consistently result in higher yields than later planting dates. Data from 2003, 2004, 2005 and 2007 indicates that there is a slight decrease in yields between the early April planting date and early May planting date and that the mid-June results in the lowest observed yields of all the planting dates.

The results of the milling quality analysis indicated that the late May date had the best values but there were no major differences trends observed between the early planting dates. The milling quality data indicate there was an observable loss in milling quality due to planting in early April or mid-April in 2007.

Table 1.

2007 Planting Date Agronomic Trait Averages							
Planting Date	Days from Planting to Emergence	Days to 50% Heading	Plant Height (Inches)	Percent Lodging	Bushels / Acre	% Milling Yield	% Head Yield
Early April	25	79	37	0	202	80	57
Mid-April	14	80	35	0	181	73	57
Early May	12	84	38	0	196	75	58
Late May	---	84	40	0	180	75	64
Mid-June	---	---	---	---	142	73	61

Table 2.

2007 Variety Averages Across Five Planting Dates						
Variety	Days to 50% Heading	Plant Height (Inches)	Percent Lodging	Bushels / Acre	% Milling Yield	% Head Yield
Cocodrie	83	35	0	166	75	61
Cybonnet	83	36	0	165	75	62
Francis	82	38	0	188	74	59
Jupiter	85	35	0	204	77	67
Spring	76	41	0	168	75	54
Trenasse	78	39	0	182	75	60
Wells	84	39	0	188	76	53

Table 3.

Grain Yield (Bu/A) Over Planting Dates and Multiple Years (2003-2005 & 2007)										
Variety	Early April		Mid-April		Early May		Late May		Mid-June	
	2007	03-'05 & 2007	2007	03-'05 & 2007	2007	03-'05 & 2007	2007	03-'05 & 2007	2007	03-'05 & 2007
Cocodrie	206	198	145	162	191	167	151	149	136	118
Cybonnet	189	190	162	167	188	182	176	154	108	105
Francis	232	231	204	202	230	216	183	157	91	105
Wells	218	210	206	190	185	181	192	166	140	127
Average	*211*	*207*	*179*	*180*	*199*	*187*	*176*	*157*	*119*	*114*

2007 RiceTec Performance Trials

Donn Beighley, Cathy Dickens, Randy Dickens,
and Janet Dickens

As rice production continues to increase in southeast Missouri new varieties are continually being tested by the rice breeding community. As part of this ongoing cooperation with those in the rice variety industry RiceTec Inc. requested we yield test some of their up and coming varieties. These trials were conducted as a service to Missouri rice producers to provide a reliable, unbiased, up-to-date source of information for comparing private and public rice varieties grown in the Southeast Missouri growing environment.

Experimental Procedure

Location

Rice plots were established at the Missouri Rice Research Farm near Glennonville, MO. The plots at the Rice Research Farm were planted on 19 April on a Crowley silt loam. The trial consisted of three RiceTec hybrid rice lines, and one Horizon AG lines.

All the varieties were evaluated within the same trial. The yield trial 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.

Plots were planted with an Almaco no-till plot drill. Pre-flood fertilizer was applied at a rate of 180 lb nitrogen. No adjustments in rates were made to meet specific requirements of individual varieties. As part of the study 1.8 oz per Acre of NewPath was applied to the entire test on 18 May. For primary weed control, 17 oz. Command applied post plant, 3 qt. Stam and ½ lb. Facet herbicides were applied prior to flooding. There were no insecticides applied. The flood was maintained throughout the growing season. The plots at the Rice Research Farm were harvested with an Almaco research plot combine. The grain from the plots was weighed and moisture was determined.

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 at the Rice Lab located at the Crisp Bootheel Education Center located in Malden, MO.

Results

The average yield of the RiceTec trial was 199 Bu/A with RiceTec CLXL729 leading the trial with 230 Bu/A. The RiceTec hybrid Clearfield lines averaged 222 Bu/A while the check lines averaged 131 Bu/A. Table 1.

Looking at the RiceTec hybrids over three years it is observed that RiceTec CLXL730 was the top yielding hybrid at 182 Bu/A followed CL161 at 151 Bu/A. Table 2.

Acknowledgements

The milling quality values for percent head yield ranged from 52% to 59% with an average of 55%. The days to 50% heading ranged from was at 79 days (RiceTec CLXP745) to 90 days for CL 161 with the test average of the trial 83 days. The percent lodging was zero across the entire test. The plant height of the lines ranged from 35 to 40 inches with an average of 38 inches. There was no disease observed during the growing season.

We would like to thank the Missouri rice producers through their Rice Check-Off contributions, Missouri Rice Research and Merchandising Council, and Southeast Missouri State University for their support in this research.

Table 1.

2007 RiceTec Yield Trial - Missouri Rice Research Farm						
Variety	Bushels / Acre	Days to 50% Heading	Plant Height (Inches)	Percent Lodging	Percent Total Rice	Percent Whole Rice
RTCLXP745	216	79	40	0	73	54
RTCLXL730	219	82	35	0	73	54
RTCLXL729	230	80	39	0	73	52
CL161	131	90	37	0	71	59

Table 2.

RiceTec Yield Trial Multiple Year Data				
Variety	2005	2006	2007	Across Year Average
RTCLXL730	202	148	195	182
CL161	184	152	118	151

The Effects of Continuous Rice Production in Missouri
'Preliminary Research Results'

Donn Beighley and David Dunn

Continuous rice production is a management practice Missouri rice producers may be faced with due to higher production costs of other crops or the inability to economically rotate crops in particular fields. The literature and producer experience indicates that rice grain yields decrease after the first year of rice production when followed by rice in the same field. The cause of the yield decrease is not known nor what management practices can be taken to maintain yields for fields in continuous rice.

As this is a practice already being used we seek to document the practice and possible solutions through a multiple year research project. The project is two fold: Determine which current rice varieties are best suited for production in a continuous rice system and secondly the best fertility practice for maintaining yields in a continuous rice system.

Experimental Procedure

Location

The two components of the study were conducted at the Missouri Rice Research Farm on a zero-grade field that had been in continuous water-seeded rice for the previous three years.

Variety Evaluation:

The variety evaluation component of the continuous rice production trial was conducted on the field previously used for water-seeded research. The field preparation for both the water-seeded and dry drill-seeded included disking and landplaning. The varieties for the test were the same as those in the Missouri Rice Variety Trial were planted on 1 May. Each drilled plot consisted of seven rows, 12 feet long, with seven-inch row spacing. A 180-0-0 pre-flood fertilizer treatment was applied on 20 June. A post-plant application of Command and an early post emergence herbicide (Stam and Facet) treatment will be applied with other weed control as necessary. The flood was applied immediately after the fertilizer was applied and then maintained throughout the growing season.

In addition to the drilled plots a water-seeded variety trial was established on 1 May as part of the Missouri Rice Variety Trial. This trial was similar to the drill trial for plot size and randomization. There were four replications of each variety. A 50-0-0 pre-flood application of fertilizer was made as well as fertilizing at emergence (50-0-0) and mid-season (50-0-0). Herbicides were used for weed control as necessary.

Fertility Study:

The fertility evaluation component of the continuous rice production trial was conducted on part of the field previously used for water-seeded research. The field preparation for both the water-seeded and dry drill-seeded included disking and use of a land plane. The test was arranged in a split plot design with nine fertilizer treatments (Listed in Table 1) and four replications. Each drilled plot was 21' x 10' with CL171. A post plant application of Command and an early post emergence herbicide (Stam and Facet) treatment was applied with other weed control measures as necessary. No NewPath herbicide was applied. The permanent flood was applied on 20 June and maintained throughout the growing season.

Treatments:

- Urea Standard – single 180 lbs. urea pre-flood application
- Urea Split Application – 50 lbs urea preplant and 130 lbs urea preflood
- StarterN&P –Liquid 11-37-0 (N-P-K)
- Scott-0 Sulfur coated urea single lbs. pre-flood application
- Scott-5050 lbs preplant and 130 lbs preflood
- Environmentally Smart Nitrogen –Agrium (ESN) - 180 lbs N preflood
- Polymer coated urea that physically blocks the urea from going into solution
- Environmentally Smart Nitrogen –Agrium (ESN) – 50 lbs. pre-plant with 130 lbs preflood
- Ammonium sulfate - 180 lbs N preflood
- Ammonium sulfate – 50 lbs preplant and 130 lbs preflood
- Conventional N treatment = 180 lbs N preflood
- Starter N&P Liquid N (11-37-0) pre-plant with 180 lbs N preflood
- 100% Sulfur Treated N pre-plant with 180 lbs N preflood
- 50% -50% mixtures of Sulfur Treated N and urea pre-plant with 180 lbs N preflood
- Environmentally Smart Nitrogen –Agrium (ESN) pre-plant with 180 lbs N preflood
- Ammonium sulfate pre-plant with 180 lbs N preflood

The plots were harvested with an Almaco plot combine. The data collected included emergence date, panicle initiation if possible, days to 50% heading, plant height, lodging, yield and milling quality.

Results and Discussion

Variety Evaluation (Table 1)

Yield differences were observed between the drill-seeded and water-seeded trials following continuous rice. The twelve variety average for the drill-seeded was 162 Bu/A across and the water-seeded trial was 133 Bu/A. The top yielding varieties for the drill-seeded trial were RiceTec XP744, RiceTec XL723, CL171, Trenasse and Wells while for the water-seeded trial they were Wells, Jupiter, RiceTec XL723, Francis and Cocodrie. The top yielding varieties across seeding type following continuous rice were Wells, RiceTec XL723, RiceTec XP744, Jupiter and CL171.

We also compared the least difference between drill-seeded and water-seeded varieties and observed that Bengal and Wells had the smallest differences. However, it is more important to see the least difference between the seeding types based upon the highest yielding lines in both tests. In this case Wells and Jupiter were the highest yielding lines and still had the smallest difference between the two yield trials. Other high yielding lines across both trials were the two RiceTec varieties, CL171, Francis and Cocodrie.

With regard to other agronomic traits the water-seeded trial averaged 12 days earlier reaching days to 50% heading and three inches shorter in plant height. There was no difference in percent lodging.

There was observed a seven percentage point head yield average difference between the water-seeded and drill-seeded trials. The differences ranged from no difference for Trenasse to a high of 17 percentage points for Cocodrie. In most, not all, cases the higher percent head yield was observed in those lines grown in the drill-seeded continuous rice.

Fertility Study (Table 2)

The highest yielding treatment in the continuous rice fertility study was the Starter N&P at 144 Bu/A which was not significantly different from the standard preflood 180 lb urea treatment, ESN-50 and the split application of urea treatments, respectively.

When comparing the two urea treatments the pre-plant + preflood urea treatment (127 Bu/A) did not result in significantly higher yields than the standard preflood urea fertilizer treatment (139 Bu/A).

The fertilizer treatments with starter fertilizer averaged 118 Bu/A compared to the no-starter fertilizer at 115 Bu/A.

Comparing fertilizer treatments utilizing pre-plant applications the Starter N&P treatment with 144 Bu/A was the best, followed by ESN-50, pre-plant urea, AmSul-50 and Scotts-50.

Comparing fertilizer treatment effects on agronomic traits it was observed that there were differences in plant height and milling quality percent head yield but not on percent lodging depending on the treatment.

The urea and StarterN&P treatments averaged 40 inch plant height while the other treatments averaged 35 inch plant height.

The highest percent head yield treatment was Scotts-0 followed by AmSul-50 and ESN-50 while the lowest was the StarterN&P treatment.

Summary

Preliminary research indicates there are observable differences between how varieties respond when grown in a rice – rice rotation whether it is a drill-seeded or water-seeded management system. Drill-seeded continuous rice across varieties yielded 29 Bu/A better than water-seeded continuous rice across varieties with Wells having the highest overall yield and a low differential between the two trials. A percent head yield effect was observed within varieties from drill-seeded to water-seeded continuous rice.

Differences were observed between the different fertilizer treatments and when comparing treatments with starter fertilizer to no starter fertilizer both for yield and percent head yield. The highest yielding treatment but the lowest percent head yield was the StarterN&P.

Table 1

Agronomic Traits of Continuous Rice Trials

	Bushels/Acre		Days to 50% Heading		Plant Height (Inches)		Percent Total Yield		Percent Head Yield	
	Drill-Seeded	Water-Seeded	Drill-Seeded	Water-Seeded	Drill-Seeded	Water-Seeded	Drill-Seeded	Drill-Seeded	Water-Seeded	Water-Seeded
Bengal	146	141	85	77	35	33	76	76	64	60
Cocodrie	153	146	84	71	35	32	75	74	64	47
CL171-AR	174	138	84	74	34	33	75	75	65	52
Cybonnet	152	108	84	75	35	33	74	74	62	55
Francis	161	146	84	71	36	34	74	74	56	42
Jupiter	162	157	84	75	37	34	76	73	61	40
Spring	157	108	83	66	38	35	73	76	44	66
Trenasse	172	95	81	67	37	32	74	73	50	51
Wells	171	178	81	73	38	37	76	75	44	33
RTXL723	183	145	80	68	40	36	75	74	51	54
RTXP744	193	135	80	68	40	38	75	74	52	50
Bowman	117	101	90	76	39	34	74	74	38	34

Table 2.

Agronomic Trait Response of Different Fertility Treatments Applied to Continuous Rice

Fertilizer Treatment	Pre-plant Applied (lbs / A)	Pre-flood Applied (lbs/A)	Plant Height (Inches)	Percent Lodging	Bushels / Acre	Percent Total Yield	Percent Head Yield
Urea STD	0	180	39	0	139*	75	56
Urea	50	130	39	0	127*	75	55
Starter N&P	2 Gal/A	180 Urea	41	0	144*	75	46
Scotts-0	0	180	33	0	87	75	65
Scotts-50	50	130	35	0	81	74	55
ESN-0	0	180	36	0	114	74	52
ESN-50	50	130	38	0	135*	74	62
AmSul-0	0	180	35	0	119	75	59
AmSul-50	50	130	36	0	107	74	64

- \- Not significantly different

RiceTec Hybrid Rice Update

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Hybrid rice is gaining in popularity across the southern rice production region. Hybrids were grown on approximately 15 to 18% of the rice acres in Missouri in 2007. Hybrid rice is unique from other varieties of rice in that it requires different management, such as lower seeding rates, different nitrogen management, and typically does not require a fungicide. Below is a table that includes the seeding rates of the RiceTec hybrid products available in 2008. RiceTec recommends planting after April 1 and when the soil temperature is at least 65 F.

Table 1. Seeding Rates for RiceTec Hybrid Rice.

Hybrid Product	Seeding Rate (seeds/Acre)*
XL723	600,000
XP744	600,000
CLEARFIELD® XL730	600,000
CLEARFIELD® XL729	600,000
CLEARFIELD® XL745	600,000
CF Hybrid Rice Blend	600,000
CF Silver Rice Blend	1,200,000
CF Bronze Rice Blend	1,200,000
CF Diamond Rice Blend	1,200,000

* 600,000 seed will be approximately 29 to 31 lbs/A, but will vary based on seed size and hybrid. Proper drill calibration is required.

Nitrogen fertilizer is also managed differently with hybrid rice. For all of southeast Missouri, the standard recommendation is 120 lb of N preflood followed by 30 lb of N at boot-split/early heading. No midseason N is recommended unless the crop is short of nitrogen at that time, at which point 30 lb of N is recommended in addition to the base recommendation. Some producers have had success with higher rates of preflood N, especially on heavy clay soils east of Crowley's Ridge in a continuous rice rotation. Phosphorous and potassium levels should be managed based on soil test recommendations.

When using the CLEARFIELD® production system, the maximum allowable rate of Newpath herbicide is two-4 oz applications (or one 4 oz application of Clearpath before or after Newpath). Beyond can be used for salvage red rice control; however the cutoff for Beyond in CLEARFIELD® hybrid rice is ½" internode elongation, or panicle initiation. University and RiceTec data indicate that a Beyond application made after ½" internode can result in yield reductions.

Hybrids have the most complete disease package on the rice seed market today. All hybrids are rated as moderately resistant or resistant to blast disease. Similarly, hybrids are rarely treated for sheath blight; however, RiceTec recommends scouting closely and treating when necessary.

Hybrids are easy to thresh; therefore, harvest should begin when grain moisture reaches 18-20%.

Dermacor™ X-100 a New Seed Treatment for Control of Rice Water Weevil

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The Severity of the Rice Water Weevil as a Pest of Rice

Rice water weevil begin emerging from overwintering sites in early spring and fly to rice fields, where they feed on young rice leaves. This form of injury is not considered economically important. Egg-laying begins when standing water is present in a field that is infested with adults. After larvae hatch from eggs, they feed under water on rice roots and pupate in approximately 30 days. Feeding on roots results in decreases in above-ground growth and tillering of rice plants in the vegetative stage, and in reductions in panicle densities and grain weights at harvest. Research conducted in Louisiana indicates that one rice water weevil larvae on a young rice plant can result in a yield loss of approximately 0.4% to 1.0%. Research also concluded that early-flooding can increase yield losses associated with rice water weevil; however, delaying floods can sacrifice weed control.

The MO Department of Agriculture submitted paperwork to the Environmental Protection Agency (EPA) for a Section 18 to have a new insecticide Dermacor™ X-100 available for the 2008 growing season. We hope to have the EPA's comments back by mid-February. This article describes this potential new means of rice water weevil control.

Efficacy of Dermacor™ X-100

Dermacor™ X-100 has been evaluated for efficacy against the rice water weevil for three years in Texas and Louisiana and in one year in Missouri (Figures 1 and 2), Mississippi and Arkansas. Weevil pressure in Missouri was not as high as the researcher would have liked; however, control was good. The efficacy of Dermacor™ X-100 was compared to a foliar application of Karate® at 7 days after flood establishment. Control in the high rates of Dermacor™ X-100 was slightly better than an application of Karate®. All treatments increased yields and the greatest increase was found with Dermacor™X-100. Similar results with Dermacor™ X-100 have been obtained in trials conducted in Arkansas, Louisiana, Mississippi, and Texas. Moreover, prior experience with Icon, another seed treatment, suggests that Dermacor™ X-100 will be more effective at controlling the rice water weevil in commercial fields. Also, improper timing of insecticide applications is not an issue with a seed treatment, as it is with the pyrethroids. Also, the use of a seed treatment generally results in less damage to young rice plants because the delivery of the insecticide to the pest is more efficient (i.e., the insecticide is delivered via uptake by the plant). Greenhouse experiments conducted in Louisiana suggest that Dermacor™ X-100 reduces rice water weevil densities in treated plants primarily by killing first-instar weevils soon after they eclose from eggs.

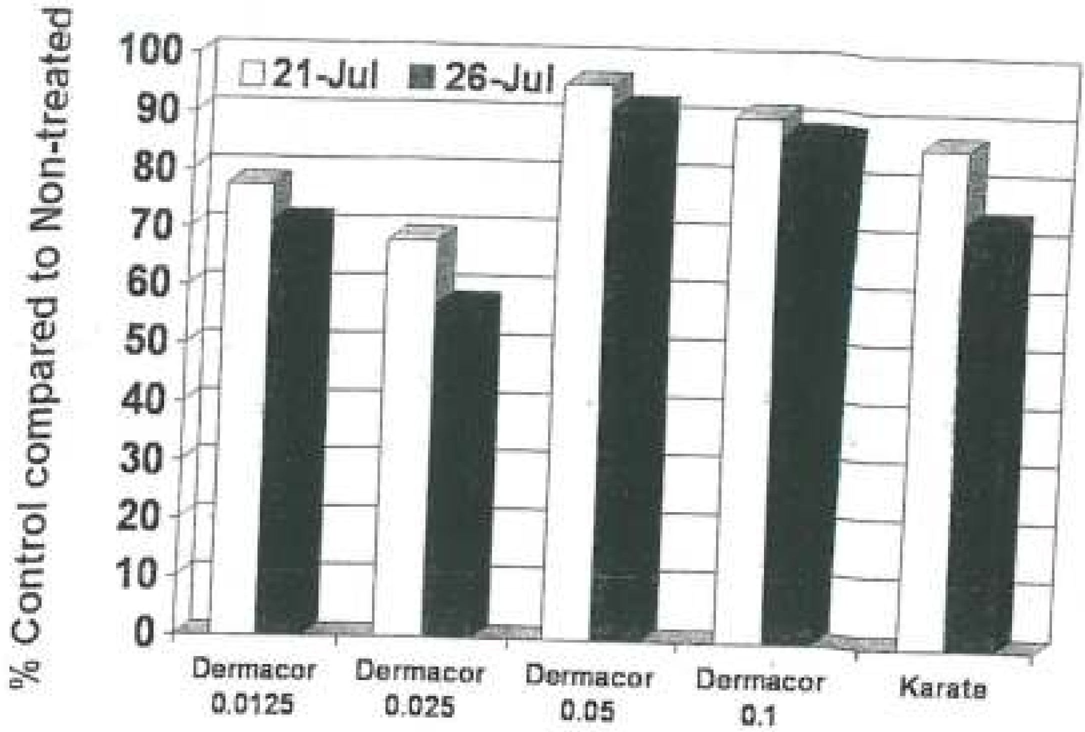

Figure 1. Percent control of rice water weevil larvae from two sampling dates from a small-plot evaluation of Dermacor™ X-100 conducted at Glennonville, Missouri in 2007.

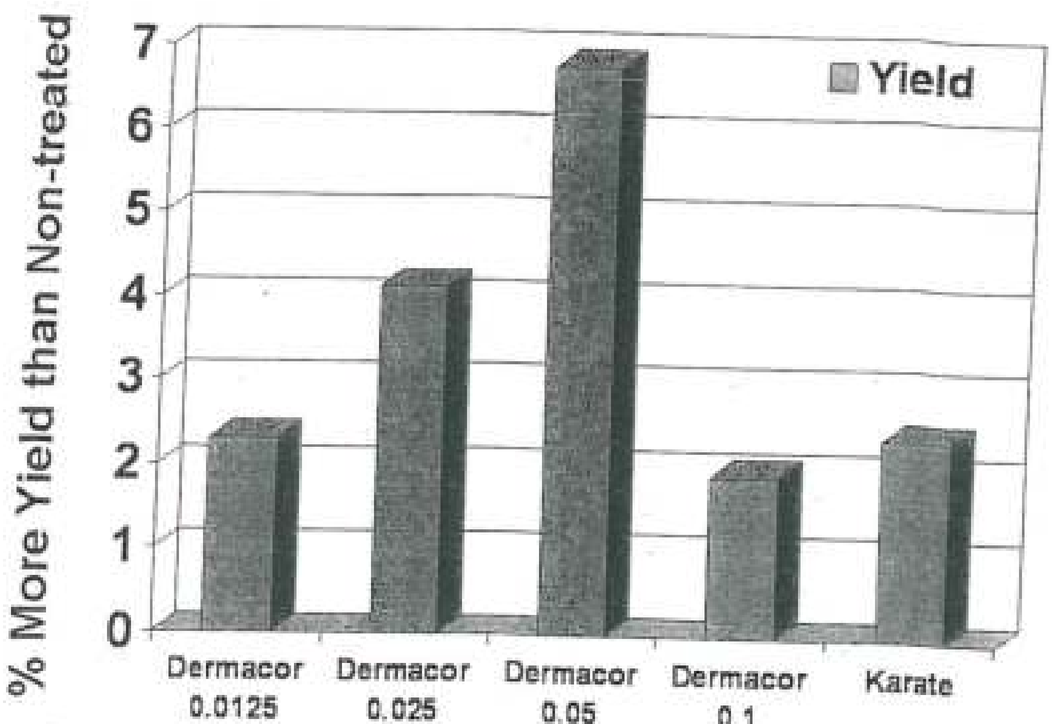

Figure 2. Percent increase of yield from the small-plot evaluation of Dermacor™ X-100 conducted at Glennonville, Missouri in 2007.

Potential for Incidental Control of Other Rice Pests

The rice water weevil is the most ubiquitous and most damaging early season pest of rice in Missouri and is the primary target for Dermacor™ X-100 treatment. However, early season rice in Missouri can be attacked by many other arthropod pests, like armyworms, grape colaspis and rice seedling midge. They occur only sporadically, but can cause losses when severe populations occur. Because Dermacor™ X-100 will be used as a seed treatment, and because it is, to some extent, systemic, it has the potential to partially control these other leaf and root-feeding pests. Data obtained in greenhouse studies in Louisiana showed that Dermacor™ X-100-treated rice plants (three to four leaf stage) caused 100% mortality of larvae. Researchers are hopeful that Dermacor™ X-100 will prevent stand losses from the grape colaspis; however, currently there is no data to support this statement. Data from Texas has also shown promise in reducing stem borer damage later in the season.

Usage of Dermacor™ X-100

Dermacor™ X-100 may be applied to dry rice seed, including conventional, Clearfield, and hybrid seed varieties, which will be drilled or broadcast. DuPont anticipates having enough chemical to treat 250,000 acres this year, provided that the EPA approves the Section 18. Application rates will vary based on the seeding rate, with the highest rate being 0.13 lb ai/acre = 150 g ai/ha.

Poultry Litter as an Alternative Nitrogen and Phosphorus Source in Rice

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ABSTRACT

Poultry litter (manure from *Gallus domesticus*) is an inexpensive and recurring resource shown to be an effective fertilizer in upland cropping systems. The usage of poultry litter provides nitrogen, phosphorus, potassium, sulfur and micronutrients; however, excessive application of poultry litter raises the specter for excessive soil phosphorus levels. A rice field trial evaluating urea, triple superphosphate and composted poultry litter was conducted at the Missouri Rice Research and Demonstration Farm in 2006 and 2007. The trials demonstrated that mineralization (decomposition) of the poultry litter was inhibited by subtoxic soil conditions imposed by flood irrigation. The application of supplemental urea was needed for profitable yields. A substantial soil buildup of Bray-1 phosphorus during two years of field application of the poultry litter is noted. Poultry litter is deemed an acceptable alternative for triple superphosphate.

Introduction

Plant-available nitrogen (PAN) is the amount of nitrogen that is potentially available for plant uptake during the period of root-uptake activity. In the Mid-South region, poultry litter amendments are commonly applied to freshly-graded rice fields (Kellogg et al., 2000); however, PAN recommendations for poultry litter for rice production are not well understood. Phosphorus is a major essential nutrient that promotes plant growth and development, especially root growth. In the Mid-South, poultry (*Gallus domesticus*) and rice are common agricultural enterprises. The production of poultry litter, frequently in association with rice hulls as a bedding material, is added as a soil amendment (manure). Application rates for poultry litter are commonly based on the nitrogen content of the poultry litter. Plant uptake rates for nitrogen are substantially greater for nitrogen than phosphorus, resulting in a buildup of soil phosphorus after continuous poultry litter applications (Slaton et al., 2004; Akhtar et al., 2005).

The increasing cost of nitrogen and phosphorus fertilizers is becoming a concern to the producer. Therefore, a rice trial was conducted at the Rice Research and Demonstration Farm to compare the N availability from poultry manure and urea and phosphorus availability from poultry litter and triple superphosphate. The objectives were: (1) to test whether poultry manure is an acceptable nitrogen and phosphorus alternative, (2) to compare poultry manure with urea (N) and triple superphosphate (P) in a side-by-side test, (3) to investigate the potential for poultry manure to increase soil phosphorus concentrations to excessive levels.

Results and Discussion

Plant Tissue Analysis for the Nitrogen x Phosphorus Trial

Plant tissue analysis from the nitrogen x phosphorus trial demonstrated that the nitrogen content slightly increased progressively from the control to the highest nitrogen rate in both 2006 and 2007 (Table 1). In 2006 phosphorus did not show any significant differences because of phosphorus treatments within the nitrogen treatments;

Materials and Methods

Field Design, Field Methods, and Sampling

A nitrogen-phosphorus field trial, and a poultry litter field trial using the rice variety 'Wells' were performed using randomized complete block designs at the Missouri Rice Research Farm. A soil of the poorly-drained and very slowly permeable Crowley silt loam series was drill-seeded, with 10 cm flood application delayed until the 5^{th} leaf stage.

For the nitrogen x phosphorus field trials, the main treatment consisted of three rates of nitrogen (0, 75 and 120 lbs of N / acre applied as urea (45-0-0)) and the secondary treatment consisted of three rates of phosphorus (0, 45, and 90 lbs P / acre applied as concentrated superphosphate (0-45-0)). In 2007 the plot designed was superimposed on top of the previous design so that each plot received exactly the same treatment in both years, thus facilitating the evaluation of soil phosphorus accumulation. The 2006 poultry litter field trail consisted of three rates of poultry manure equivalent to 0, 75 and 120 lbs of N / acre (0, 2200, and 4400 lbs litter product/acre) applied and soil incorporated 15 days before planting. The 2007 poultry litter field trial consisted of three rates of poultry manure equivalent to 0, 150 and 240 lbs of N / acre (0, 4400, and 8800 lbs litter product/acre) applied and soil incorporated 25 days before planting. Additionally in 2007, a separate set of field plots, identical to those just described for the poultry litter field trial, were established with the added treatment of 60 lbs N/acre as urea applied just prior to flood. All field trials had four replications.

Final yields were determined by using a plot combine, followed by weighing the seed and testing seed moisture content. Analysis of the poultry litter in 2006 was 10.49% moisture, 1.58 % Kjeldahl nitrogen, 0.93% P and 1.72% K, whereas in 2007 the poultry litter analysis was 26.5% moisture, 2.7% Kjeldahl nitrogen, 0.95% P and 2.81% K. however, in 2007 phosphorus concentrations were greater in the high nitrogen plots receiving phosphorus.

Plant Tissue Analysis for the Poultry Litter Trial

For the poultry litter study in 2006 nitrogen concentrations were significantly greater for the high litter rates (Table 1). In 2006 nitrogen concentrations in rice amended with the highest quantity of poultry litter where largely equivalent to the control group of the nitrogen x phosphorus trial, suggesting that the poultry litter contributed only marginal nitrogen amounts. In 2007 tissue nitrogen concentrations from litter-amended plots not receiving additional urea were only slightly greater than the control plots. The poultry litter-amended nitrogen tissue concentrations were roughly similar to those of the control group in the nitrogen x phosphorus trial, inferring that the nitrogen contribution from the poultry litter was minimal. In 2007, the poultry litter and supplemental urea-treated rice tissue nitrogen concentrations were not significantly different and ranged from 3.7 to 4.2% nitrogen, indicating nitrogen sufficiency.

Phosphorus concentrations in poultry amended rice were largely equivalent to those of the nitrogen x phosphorus trial, suggesting either that (1) the soil reduced available phosphorus concentrations to a greater degree than soil testing indicated, or (2) the phosphorus associated with the poultry litter did not sufficiently mineralize to render it to a plant-available status. Phosphorus concentrations in tissues from plots receiving supplemental nitrogen were not significantly different from plots not receiving supplemental nitrogen.

Table 1. Mean nutrient tissue concentrations at panicle differentiation.

	N	P		N	P
		----------Percent----------			
Synthetic N x P Trial (2006)			**Synthetic N x P Trial (2007)**		
N/P rate			N/P rate		
0/0	2.4	0.24	0/0	3.2	0.32
0/1	2.4	0.23	0/1	3.1	0.33
0/2	2.6	0.23	0/2	3.6	0.34
1/0	2.7	0.22	1/0	4.5	0.33
1/1	2.7	0.23	1/2	4.6	0.33
1/2	2.7	0.25	1/2	4.4	0.36
2/0	3.0	0.22	2/0	4.9	0.30
2/1	3.5	0.24	2/1	5.0	0.39
2/2	3.5	0.25	2/2	4.7	0.39
Poultry Litter Rates (2006)			**Poultry Litter Rates (2007)**		
Litter rate			Litter/urea rate		
0/	2.2	0.23	0/0	2.8	0.30
1/	2.1	0.22	1/0	3.0	0.32
2/	2.3	0.23	2/0	3.5	0.29
			0/60 lbs urea	4.1	0.28
			1/60 lbs urea	3.7	0.34
			2/60 lbs urea	4.2	0.33

(Each value is the mean of four observations)

Yield Components for the Urea x Triple Superphosphate Trial

In 2006 and 2007 panicle weight was not substantially influenced by (1) the nitrogen treatments, and (2) phosphorus treatments nested in the nitrogen treatments. Seed weight was not different because of the N treatments or the phosphorus treatments nested within the nitrogen treatments.

Rice yields in 2006 and 2007 from the nitrogen x phosphorus trial reflected nitrogen management (Figures 1 and 2). In 2006, rice yields significantly increased from the control plots to the nitrogen treated plots, with no significant yield differences between the low and high nitrogen-treatments. In 2007 rice yields increased from the control to the lower nitrogen rate. The rice yields of the higher nitrogen rate were equivalent to the control, a feature partially attributed to lodging in some of the high nitrogen-rate plots.

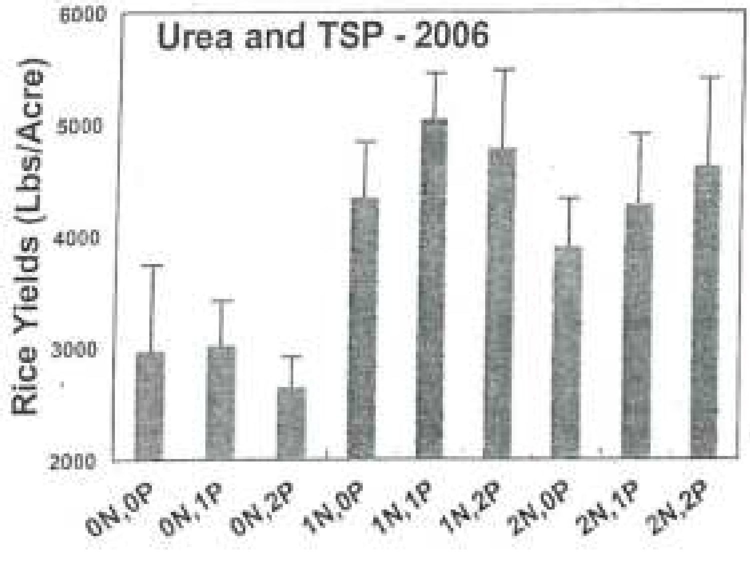

Figure 1. The Yields from the nitrogen x phosphorus trial in 2006 (Error bars represent standard deviations).

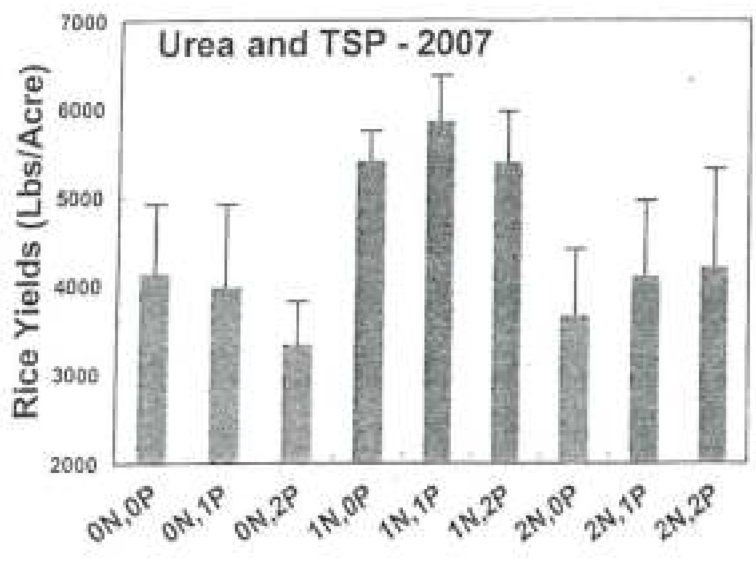

Figure 2. The Yields from the nitrogen x phosphorus trial in 2007 (Error bars represent standard deviations)

Yield Components for the Poultry Litter Trial

Poultry litter treatments did not influence panicle development. The rice yields from the poultry trial were substantially smaller than those of the nitrogen x phosphorus trial (Figures 3 and 4). In 2006 and 2007, poultry litter amendments did not demonstrate a significant yield increase relative to the control. Yield differences between the low and high rates of poultry litter were not significantly different. Thus, in 2006, poultry litter as a nitrogen source was inferior to that of urea.

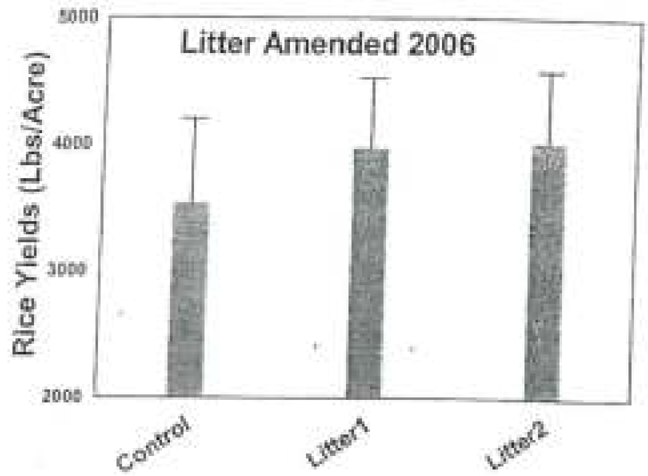

Figure 3. The yields from the litter trial in 2006 (Error bars represent standard deviations).

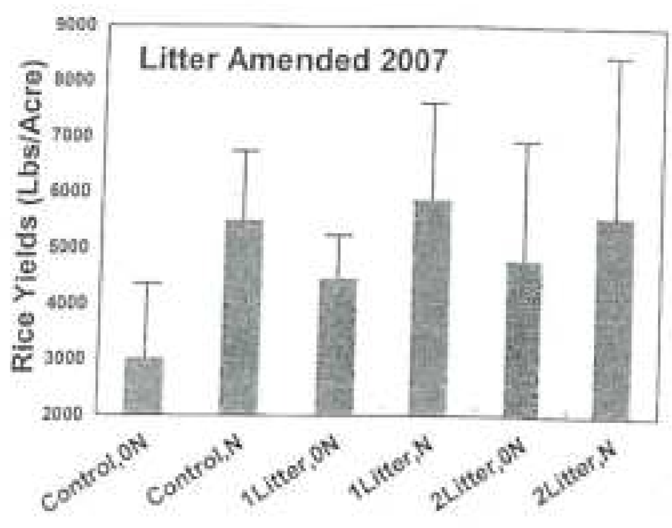

Figure 4. The yields from the litter – nitrogen trial in 2007 (Error bars represent standard deviations).

Soil Phosphorus Accumulation Assessment in the Nitrogen x Phosphorus Field Trial

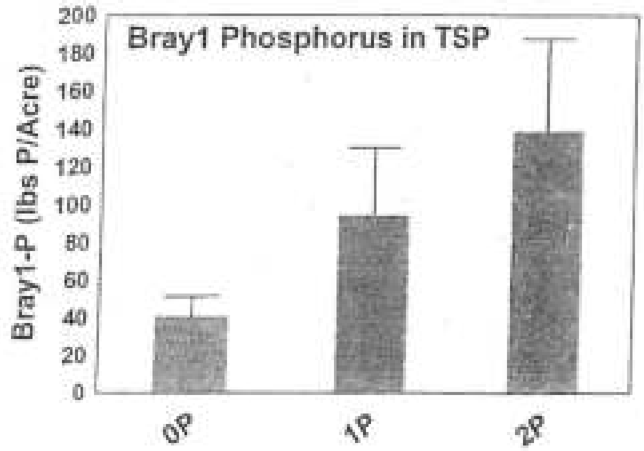

Figure 5. Bray1 soil phosphorus pooled across the nitrogen treatments and sampled after harvest in 2007.

Bray1 phosphorus soil concentrations reflect the addition of triple superphosphate, showing a progressive increase in the phosphorus soil availability with increasing triple superphosphate application rates (Figure 5). Both the low and high triple superphosphate rates resulted in substantially greater Bray1 phosphorus concentrations than commonly assumed for profitable rice production. Typically, rice production requires a Bray1 phosphorus concentration of 30 lbs P / acre.

Soil Phosphorus Accumulation Assessment in the Poultry Litter Field Trial

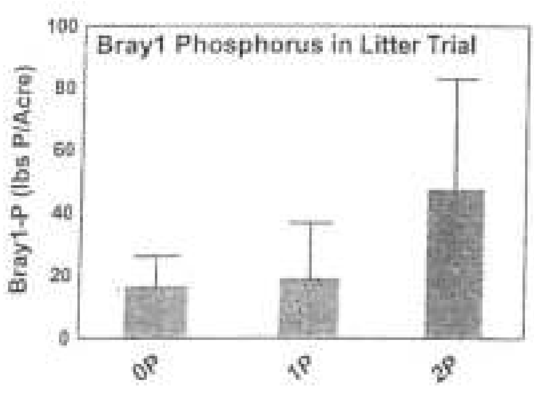

Figure 6. Bray1 soil phosphorus pooled across the nitrogen treatments and sampled after harvest in 2007.

Bray1 phosphorus concentrations are smaller in magnitude than the triple superphosphate Bray1 phosphorus concentrations (Figure 6). For the poultry litter trial, the Bray1 phosphorus concentrations are not significantly different because of the poultry-litter application rates; however, the high litter rate (2P) is substantially greater, as is its standard deviation.

Conclusions

Poultry litter was not sufficiently able to mineralize (decompose) in the delayed flood system of rice. Typically, organic matter decomposition and the subsequent release of ammonium requires microbial activity in aerobic soils. The flooding of rice dramatically excludes oxygen and dramatically hinders the release of ammonium from poultry litter sufficient to negatively impact rice growth and development. Poultry litter mineralization prior to flood should produce ammonium, which then subsequently oxidizes to nitrate via the nitrification process (Figure 7). Both ammonium and nitrate are capable of uptake by rice; however, the brief time span between planting and the 5th leaf stage and the small root system of rice during this interval limits nutrient uptake.

Once the delayed flood in imposed, subtoxic soil conditions limit the further mineralization of the poultry litter and encourages denitrification. The consequence of these processes is a reduced nitrogen uptake rate and rice tillering habit. These factors are responsible for the low yields if rice nitrogen fertilization is primarily derived from poultry litter.

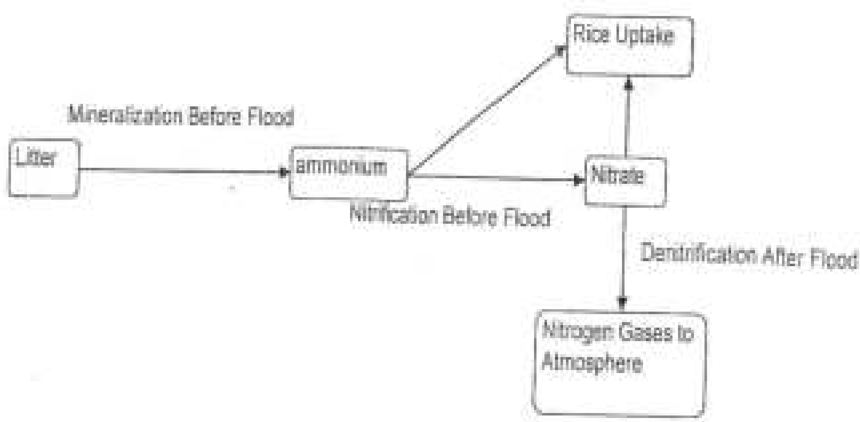

Figure 7. Idealized schematic illustrating the nitrogen pathways for poultry litter in rice.

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University of Missouri Extention Southeast Missouri Crop Budget
2008 Hybrid Rice
Budget

Variable Cost	Number of Units	Units	Cost $/Unit	Total Cost/Acre
Seed	30	Pounds	2.75	82.50
Nitrogen	150	Pounds	0.50	75.00
Phosphate	30	Pounds	0.42	12.60
Potash	40	Pounds	0.28	11.20
Limestone	0	Tons	21.00	0.00
Zink	3	Pounds	2.75	8.25
Sulfur	0	Pounds	0.00	0.00
Fungicide	0	Ounces	0.00	0.00
Pre-Emerge	1	Acre	12.00	12.00
Post-Emerge	1	Acre	40.00	40.00
Insecticide	0	Acre	0.00	0.00
Drying(Custom/Bushel)*	180	Bushels	0.30	54.00
Hauling & Transportation*	180	Bushels	0.16	28.80
Miscellaneous Overhead	1	Acre	10.00	10.00
Machinery Fuel	1	Acre	28.00	28.00
Machinery Repairs	1	Acre	14.00	14.00
Irrigation Fuel	1	Acre	55.00	55.00
Irrigation Repairs	1	Acre	9.00	9.00
Labor	1	Acre	21.00	21.00
Scout	1	Acre	8.00	8.00
Irrigation Labor	1	Acre	5.00	5.00
Custom Application	2	Acre	5.50	11.00
Subtotal		Acre		$485.35
Interest (1/2 year @ 8.0%)	0.5	Acre	8.00%	19.41
Total Variable		Acre		$504.76
Fixed Machinery Cost	1	Acre	58.00	58.00
Fixed Irrigation Cost	1	Acre	62.00	62.00
Total (ExcludingLand)		Acre		$624.76
Land Real Estate Taxes		Acre	0.30%	7.53
Land Interest	2511	Acre	4.00%	100.44
Total Cost		Acre		$732.74

*Drying & Transportation Costs Change with Yields

Breakeven Price in $/Bushel

Yield Bu/Acre	Variable Cost	Total Cost Including Land	Total Cost	Yield Bu/Acre	Variable Cost	Total Cost Including Land	Total Cost
120	$3.98	$4.98	$5.88	190	$2.68	$3.31	$3.88
130	$3.71	$4.63	$5.46	200	$2.57	$3.17	$3.71
140	$3.47	$4.33	$5.10	210	$2.47	$3.04	$3.55
150	$3.27	$4.07	$4.79	220	$2.38	$2.92	$3.41
160	$3.10	$3.85	$4.52	230	$2.29	$2.82	$3.29
170	$2.94	$3.65	$4.28	240	$2.22	$2.72	$3.17
180	$2.80	$3.47	$4.07	250	$2.15	$2.63	$3.06

University of Missouri Extention Southeast Missouri Crop Budget
2008 Rice Budget -
Clearfield

Variable Cost	Number of Units	Units	Cost $/Unit	Total Cost/Acre
Seed	85	Pounds	0.53	45.05
Nitrogen	150	Pounds	0.50	75.00
Phosphate	30	Pounds	0.42	12.60
Potash	40	Pounds	0.28	11.20
Limestone	0	Tons	21.00	0.00
Zink	3	Pounds	2.75	8.25
Sulfur	0	Pounds	0.00	0.00
Fungicide	12.3	Ounces	2.00	24.60
Pre-Emerge	8	Acre	4.00	32.00
Post-Emerge	1	Acre	10.00	10.00
Insecticide	0	Acre	0.00	0.00
Drying(Custom/Bushel)*	160	Bushels	0.30	48.00
Hauling & Transportation*	160	Bushels	0.16	25.60
Miscellaneous Overhead	1	Acre	10.00	10.00
Machinery Fuel	1	Acre	28.00	28.00
Machinery Repairs	1	Acre	14.00	14.00
Irrigation Fuel	1	Acre	55.00	55.00
Irrigation Repairs	1	Acre	9.00	9.00
Labor	1	Acre	21.00	21.00
Scout	1	Acre	8.00	8.00
Irrigation Labor	1	Acre	5.00	5.00
Custom Application	4	Acre	5.50	22.00
Subtotal		Acre		464.30
Interest (1/2 year @ 8.0%)	0.5	Acre	8.00%	18.57
Total Variable		Acre		$482.87
Fixed Machinery Cost	1	Acre	58	58.00
Fixed Irrigation Cost	1	Acre	62	62.00
Total (ExcludingLand)		Acre		$602.87
Land Real Estate Taxes		Acre	0.30%	7.53
Land Interest	2511	Acre	4.00%	100.44
Total Cost		Acre		$710.85

*Drying & Transportation Costs Change with Yields

Breakeven Price in $/Bushel

Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost	Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost
120	$4.55	$5.75	$6.83	190	$2.87	$3.57	$4.21
130	$4.18	$5.27	$6.25	200	$2.73	$3.40	$4.00
140	$3.87	$4.87	$5.77	210	$2.61	$3.25	$3.81
150	$3.61	$4.53	$5.36	220	$2.51	$3.11	$3.65
160	$3.38	$4.24	$5.01	230	$2.41	$2.98	$3.49
170	$3.19	$3.99	$4.71	240	$2.32	$2.87	$3.36
180	$3.02	$3.77	$4.44	250	$2.24	$2.76	$3.23

University of Missouri Extention Southeast Missouri Crop Budget
2008 Rice Budget-Wells
Variety

Variable Cost	Number of Units	Units	Cost $/Unit	Total Cost/Acre
Seed	96	Pounds	0.22	21.12
Nitrogen	150	Pounds	0.50	75.00
Phosphate	30	Pounds	0.42	12.60
Potash	40	Pounds	0.28	11.20
Limestone	0	Tons	21.00	0.00
Zink	3	Pounds	2.75	8.25
Sulfur	0	Pounds	0.00	0.00
Fungicide	12.3	Ounces	2.00	24.60
Pre-Emerge	1	Acre	12.00	12.00
Post-Emerge	1	Acre	40.00	40.00
Insecticide	0	Acre	0.00	0.00
Drying(Custom/Bushel)*	160	Bushels	0.30	48.00
Hauling & Transportation*	160	Bushels	0.16	25.60
Miscellaneous				
Overhead	1	Acre	10.00	10.00
Machinery Fuel	1	Acre	28.00	28.00
Machinery Repairs	1	Acre	14.00	14.00
Irrigation Fuel	1	Acre	55.00	55.00
Irrigation Repairs	1	Acre	9.00	9.00
Labor	1	Acre	21.00	21.00
Scout	1	Acre	8.00	8.00
Irrigation Labor	1	Acre	5.00	5.00
Custom Application	4	Acre	5.00	22.00
Subtotal		Acre		$450.37
Interest (1/2 year @ 8.0%)	0.5	Acre	8.00%	18.01
Total Variable		Acre		$468.38
Fixed Machinery Cost	1	Acre	58.00	58.00
Fixed Irrigation Cost	1	Acre	62.00	62.00
Total (ExcludingLand)		Acre		$588.38
Land Real Estate Taxes		Acre	0.30%	7.53
Land Interest	2511	Acre	4.00%	100.44
Total Cost		Acre		$696.36

*Drying & Transportation Costs Change with Yields

Breakeven Price in $/Bushel

Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost	Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost
120	$4.41	$5.61	$6.69	190	$2.78	$3.49	$4.12
130	$4.05	$5.14	$6.12	200	$2.65	$3.32	$3.92
140	$3.75	$4.75	$5.65	210	$2.54	$3.17	$3.74
150	$3.50	$4.42	$5.25	220	$2.43	$3.03	$3.57
160	$3.28	$4.14	$4.91	230	$2.34	$2.91	$3.43
170	$3.09	$3.89	$4.61	240	$2.25	$2.80	$3.29
180	$2.93	$3.68	$4.35	250	$2.18	$2.70	$3.17

University of Missouri Extention Southeast Missouri Crop Budget
2008 Hybrid Rice Budget-
Clearfield

Variable Cost	Number of Units	Units	Cost $/Unit	Total Cost/Acre
Seed	30	Pounds	3.80	114.00
Nitrogen	150	Pounds	0.50	75.00
Phosphate	30	Pounds	0.42	12.60
Potash	40	Pounds	0.28	11.20
Limestone	0	Tons	21.00	0.00
Zink	3	Pounds	2.75	8.25
Sulfur	0	Pounds	0.00	0.00
Fungicide	0	Ounces	2.00	0.00
Pre-Emerge	8	Acre	4.00	32.00
Post-Emerge	1	Acre	10.00	10.00
Insecticide	0	Acre	0.00	0.00
Drying(Custom/Bushel)*	180	Bushels	0.30	54.00
Hauling & Transportation*	180	Bushels	0.16	28.80
Miscellaneous Overhead	1	Acre	10.00	10.00
Machinery Fuel	1	Acre	28.00	28.00
Machinery Repairs	1	Acre	14.00	14.00
Irrigation Fuel	1	Acre	55.00	55.00
Irrigation Repairs	1	Acre	9.00	9.00
Labor	1	Acre	21.00	21.00
Scout	1	Acre	8.00	8.00
Irrigation Labor	1	Acre	5.00	5.00
Custom Application	3	Acre	5.50	16.50
Subtotal		Acre		512.35
Interest (1/2 year @ 8.0%)	0.5	Acre	8.00%	20.49
Total Variable		Acre		$532.84
Fixed Machinery Cost	1	Acre	58.00	58.00
Fixed Irrigation Cost	1	Acre	62.00	62.00
Total (ExcludingLand)		Acre		$652.84
Land Real Estate Taxes		Acre	0.30%	7.53
Land Interest	2511	Acre	4.00%	100.44
Total Cost		Acre		$760.82

*Drying & Transportation Costs Change with Yields

Breakeven Price in $/Bushel

Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost	Yield Bu/Acre	Variable Cost	Total Cost including Land	Total Cost
120	$4.21	$5.21	$6.11	190	$2.83	$3.46	$4.03
130	$3.92	$4.84	$5.68	200	$2.71	$3.31	$3.85
140	$3.67	$4.53	$5.30	210	$2.60	$3.17	$3.69
150	$3.46	$4.26	$4.98	220	$2.51	$3.05	$3.54
160	$3.27	$4.02	$4.70	230	$2.42	$2.94	$3.41
170	$3.11	$3.81	$4.45	240	$2.34	$2.84	$3.29
180	$2.96	$3.63	$4.23	250	$2.26	$2.74	$3.17

Annual Weather Summary for the Bootheel 2007

Annual precipitation was highly variable across the Bootheel during 2007 with below normal rainfall generally falling across far southern sections of the region and near to above normal precipitation elsewhere. Heavier rainfall occurred over localized spots with Charleston and New Madrid reporting 54.50 and 53.29 inches, respectively. Lighter precipitation amounts occurred over portions of Dunklin and Pemiscot counties where 40-45 inches were more common. Overall, annual precipitation averaged 4-5 inches below normal, but much above normal rainfall in January, October and December masked the severe drought conditions that impacted the region during much of the growing season.

Preliminary numbers indicate it was the 6th warmest year in the Bootheel since 1895 with above normal temperatures reported for 9 of the 12 months. Unseasonably mild conditions were experienced in March and resulted in the 2nd warmest March on record. Additionally, record heat occurred in August where temperatures in some locations reached the century mark for 9 days during the month. The monthly temperature during August was nearly 7 degrees above normal and went down as the hottest August on record, surpassing even the record breaking heat that occurred in August 1936, 1947 and 1980.

An unusual weather pattern shift in early April led to some significant crop losses across the region due to record cold temperatures that immediately followed an extended warm period in March. The average temperatures during the latter half of March were much above normal and acted to spur vegetative growth. This set the stage for a major disaster to sensitive vegetation as record cold temperatures, which had been bottled up in northern Canada and Alaska for weeks, poured southward and encompassed the eastern half of the United States. Thousands of acres of corn had to be replanted in southeastern Missouri due to the damage incurred by the freeze.

Dry conditions evolved during the spring and continued throughout the summer. Below normal precipitation was reported for seven consecutive months beginning in March and the rainfall deficit for the period exceeded 11 inches by the end of September. Historical climate records indicate it was the second driest March through September period in 113 years for the Bootheel. According to the National Drought Mitigation Center's Drought Monitor map, severe to extreme drought conditions were affecting all of the Bootheel by the end of August.

Wetter conditions during October and December acted to mitigate the drought situation and provide much needed recharge to water resources above and below the ground.

The growing season came to an end during the first week of November when temperatures dropped to the upper 20's and lower 30's across the region.

2007 Weather Summary for the Missouri Bootheel

Precipitation (in.)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2007	6.65	3.53	1.88	3.75	2.86	2.73	3.18	0.33	2.62	6.90	2.54	7.44	44.41

Precipitation Departure from Normal (in.)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2007	3.32	-0.06	-2.85	- 1.09	-1.94	-1.35	-0.73	-2.69	-0.54	3.44	-2.23	3.02	-3.70

Average Temperature (°F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2007	37.9	35.1	57.4	56.5	72.5	77.8	77.9	84.6	74.3	62.2	48.7	39.1	60.3

Temperature Departure from Normal (°F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2007	4.1	-4.2	9.0	-1.5	5.1	1.8	-2.2	6.8	4.0	3.2	0.7	1.3	2.3