81st Annual Research Report
RICE RESEARCH STATION

Crowley, Louisiana
1989

LOUISIANA
AGRICULTURAL EXPERIMENT STATION
Kenneth W. Tipton, Vice Chancellor & Director

LOUISIANA STATE UNIVERSITY
AGRICULTURAL CENTER
H. Rouse Caffey, Chancellor

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURE RESEARCH SERVICE
COOPERATING

TABLE OF CONTENTS

INTRODUCTION

Research work at the Rice Research Station, Crowley, Louisiana, is conducted cooperatively by the Louisiana Agricultural Experiment Station and the United States Department of Agriculture, Agricultural Research Service. The 1989 rice research program included breeding, variety testing, production and distribution of foundation seed, fertilization, soil and water management, cultural practices, weed control, insect studies, disease investigations, rice drying, bird control in rice, and physiology studies. Forages and crops grown in rotation with rice were evaluated relative to increasing the efficiency of land use. The research program of the Rice Station also includes experiments in the nutrition and management of beef cattle and aquacultural experiments. The aquaculture research program places emphasis upon production practices, crawfish forages, and multi-cropping of crawfish with agronomic crops. Although most of the research work was performed by members of the Rice Station staff, several staff members from Baton Rouge conducted research at this station.

The research activities of this station include both fundamental and applied research, although the latter predominates due to the objectives of branch station work. Research accomplishments and general progress of the Rice Station during 1989 are presented in this report representing the 81st Annual Research Report of the Rice Research Station, Louisiana Agricultural Experiment Station, L.S.U. Agricultural Center.

In addition to research responsibilities of the Rice Research Station staff and cooperators, a large number of farmers, extension personnel, and others were trained and otherwise contacted during 1989. Approximately 650 persons attended the annual Rice Research Station field day to view plots and participate in discussions of research findings. Field days were also conducted in East Carroll, Morehouse, and Vermilion parishes. In addition, the staff participated in industry meetings, both on and off the station, and worked individually with farmers and others in solving immediate problems. Several thousand people received services from the Rice Research Station during 1989.

Projects at this station are conducted under the supervision of research workers from the Rice Research Station and also by cooperating personnel from certain departments of the Louisiana Agricultural Experiment Station. Following the reports, station personnel and cooperators in 1989 are listed.

MONTHLY RAINFALL DATA
RICE RESEARCH STATION -- CROWLEY, LA
1989

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Total
1	.50				.20			.53					-
2			.21			.69	.30				.64		-
3			.08			.90	.80						-
4					.37	.74	1.90						-
5		.02		.50	1.35	.13	.10		.20				-
6	.02	.05				.70	.24		1.34			.44	-
7		.03					.61		.17		.77	.85	-
8						.28	.04	.80	.02	.10	.12	.89	-
9	.01						.03				.02		-
10	.48			.10	.03								-
11	.02			.11					.10				-
12									.02			.05	-
13	.30			.05								.01	-
14	.25				.60		3.20				.35		-
15				.60		5.05	.03				2.22	.08	-
16		.04								.10	.44		-
17		.19								.13			-
18					.60			.45				.30	-
19	2.99				4.60			.20			T	.17	-
20	.49						1.22					.05	-
21	.01	.39	.14								.04	.01	-
22			1.64			.08						T	-
23			.17			.19	.30	1.60			1.30		-
24	.01					.01	.30	.03					-
25						.02		.63					-
26			.02			.02							-
27			.90			2.50	.58						-
28						3.24							-
29			1.02			.48		2.87	.01			3.3	-
30	.20		.12			.90						.20	-
31	.02									.73		.30	-
Mo. Total	5.30	0.72	4.30	1.36	7.75	15.93	9.65	7.11	1.86	1.06	5.90	6.65	67.59
1988	5.59	7.62	7.90	5.10	1.98	4.64	6.33	4.28	4.77	5.54	1.94	5.55	61.24

RICE BREEDING

DEVELOPING SUPERIOR RICE VARIETIES FOR LOUISIANA[1/]

S.D. Linscombe, F. Jodari, A.P. Fabacher, R.J. Guidry,
C.G. Gravot, H.L. Hoffpauir, R. Pollingue

The rice variety development program at the RICE RESEARCH STATION (RRS) is carried out primarily under LAES Project 2760. The objectives of this project are as follows:

1. To develop superior rice varieties for Louisiana production with emphasis on improvements in yield, quality, lodging resistance, seedling vigor, disease and insect resistance, earliness, ratoon production, and fertilizer responsiveness.

2. To develop and/or improve methods of rice breeding, selection, and evaluation.

3. To conduct genetic studies with implications for rice varietal development.

SUMMARY

The 1989 rice breeding nursery covered approximately 23 acres, including 28,970 breeding rows, 212 F_1 transplant populations, 119 F_2 bulk populations, and approximately 1700 yield plots (on station). Off-station yield testing added another 496 plots to the testing program.

The artificial hybridization program included 248 initial crosses and 37 backcrosses for varietal improvement. X_1 populations of 10 lines and X_2 populations of 15 lines were grown for selection purposes.

A strong emphasis is placed on developing lodging resistant semidwarf lines with high yield potential and superior quality and cooking characteristics. Yield testing includes both water- and drill-seeded tests. Laboratory seedling vigor and test tube milling evaluations are conducted on all advanced progeny rows.

Pest evaluation of promising selections is being conducted by cooperating research projects. Particular emphasis is being placed on trying to incorporate higher levels of disease resistance, especially to sheath blight and blast into breeding lines. In cooperation with the Rice Pathology project, advanced progency rows are evaluated for leaf blast susceptibility in the RRS blast nursery. Also, for the first time, 4000 advanced breeding rows were inoculated with the sheath blight organism (*Rhizoctonia solani*) and rated for resistance prior to selection. This screening was done in cooperation with Dr. Don Groth, Rice Pathologist.

1/ This project is supported in part by funds provided by rice producers through the Louisiana Rice Research Board.

On-farm tests of advanced experimentals were conducted in East Carroll, Morehouse, Rapides, and Vermilion (two locations) parishes. These tests provide needed information on the performance of experimental lines in different environments. Two advanced experimentals were tested in nitrogen (N) rate and timing studies at five locations by the Rice Fertilization and Cultural Management Project. These are LA 2201 and LA 2207, both of which are early maturing, semidwarf, long grains that have shown advantages over Lemont and Gulfmont.

COOPERATIVE UNIFORM REGIONAL RICE NURSERY

Description: Public rice breeders in the U.S. conduct cooperative yield nurseries in which commercial varieties and experimental lines are grown and evaluated at research stations in Arkansas, Louisiana, Mississippi, and Texas. The nurseries are grown to test adaptation of the entries in the diverse rice growing environments in the southern U.S. The entries in the 1989 nursery included material from Arkansas, California, Louisiana, Mississippi, Texas, and some cultivars from foreign countries. Information on performance characteristics is compiled and stored in the rice data bank by the Department of Experimental Statistics, Louisiana Agricultural Experiment Station, LSU Agricultural Center.

Experimental Design: The nursery contains seven test groups organized by maturity. All groups were grown in a randomized complete block design with four replications in groups I to IV and two replications in groups V to VII.

Agronomic Practices: Fertilizer was incorporated preplant at a rate of 130-60-60 lb/A total N-P_2O_5-K_2O. Experimental plots were 53 inches wide and 18 feet long. Fungicide treated, presoaked, germinating seed was hand broadcast into the water and all plots were seeded at 150 lb/A. The plots were drained to allow seedlings to anchor (peg down) and a shallow permanent flood applied until harvest. Seeding dates were as follows: groups I, II, III, V, and VI, April 10 and groups IV and VII, April 11. Visual subjective seedling vigor ratings were made as the rice emerged through the water and other agronomic data were collected during the growing season. Propanil, Basagran, Londax, and Furadan were applied at recommended rates for weed and rice water weevil control, respectively. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, each plot was trimmed to 14 feet in length and the entire remaining plot was harvested with a small plot combine. All yield results are adjusted to 12% grain moisture. Sheath blight ratings were made just prior to harvest by Dr. Don Groth.

After the first crop was harvested, 45 lb/A of N was broadcast and a shallow flood was applied on Groups 1, 3, and 5. At second crop maturity, each plot was trimmed to 14 feet in length and the entire remaining plot was harvested with a small plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications (Groups I to VI) and two replications (Groups V to VII).

Comments: Tables 1 through 7 show the mean values for the agronomic characters measured. Average daily high and low temperatures were 71°F and 53°F, respectively, for the 10 days following seeding. The 30-year average daily high and low temperatures for these same 10 days are 79°F and 59°F, respectively. Therefore, cooler than normal conditions were present following seeding and seedling vigor ratings should be indicitive of early growth and development under these conditions.

Overall average grain and milling yields were lower than in recent years. Adverse weather and severe disease problems probably had a significant contribution to these lower yields. Measurable rainfall fell each day from June 22 through July 9 with the exception of July 1. During this same period, many of the URN entries were heading. Because of the rainfall and accompanying winds, much sterility occurred and this contributed to grain yield and possibly milling yield reductions. Also, these conditions led to severe sheath blight and rotten-neck blast pressure, which also adversely affected yields. Lodging was also more severe than normal, however, much of this was a result of severe sheath blight problems.

Second crop mean yield values are presented in tables 8 to 10. Second crop yields were very good on the average, due primarily to favorable weather conditions during the fall. Entries 45, 51, 183, and 195 are the experimental lines LA 2201, LA 2207, LA 2214, and LA 2215, respectively. All of these lines are currently being considered for possible release. LA 2201 and LA 2207 are semidwarf, early, long grains. LA 2214 is a semidrawf, early, medium grain, and LA 2215 is a semidrawf, early, aromatic, long grain (Della type).

TABLE 1. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP I. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
1	L	3	75	42	8	7	5512	A	53-68
8	L	4	79	34	0	7	5274	AB	54-70
12	L	4	74	36	40	8	5264	AB	60-70
3	L	3	71	43	0	7	5211	ABC	52-68
TEBONNET	L	5	79	52	78	6	5118	ABCD	57-67
MAYBELLE	L	3	70	36	18	9	5000	ABCDE	61-70
7	L	4	75	40	0	6	4886	ABCDEF	59-70
4	L	4	73	39	0	7	4760	BCDEFG	53-69
9	L	4	71	36	18	8	4740	BCDEFG	64-72
10	L	3	76	40	3	6	4594	CDEFG	54-67
2	L	5	75	38	15	8	4571	CDEFG	51-68
11	L	5	82	36	8	8	4463	DEFG	51-66
6	L	4	72	33	10	8	4359	EFG	54-68
SKYBONNET	L	4	79	46	43	7	4354	EFG	60-69
5	L	4	75	36	18	8	4258	FG	52-69
LABELLE	L	5	73	47	83	7	4192	G	62-70
C.V.		10.6	1.2	3.4	--	8.2	8.4		4.9-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.

*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).

**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 2. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP II. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
24	M	4	84	43	68	4	6378	A	63-69
27	L	5	79	43	3	6	6181	AB	60-68
21	M	4	84	46	85	4	6162	AB	63-68
26	L	5	79	37	18	8	5623	BC	59-68
MERCURY	M	3	82	36	0	7	5458	C	63-70
MARS	M	4	84	46	68	5	5320	CD	60-66
30	M	3	85	46	83	5	5298	CD	60-67
23	L	4	75	37	58	9	5163	CD	62-69
31	L	4	76	37	5	8	4979	CDE	52-65
22	L	5	82	35	5	8	4921	CDE	53-68
32	L	4	83	43	65	6	4873	CDE	46-65
28	L	5	85	38	0	7	4594	DE	52-67
25	L	4	79	36	8	8	4558	DE	51-66
LEBONNET	L	6	84	49	53	6	4355	E	54-67
29	L	5	80	35	40	9	4252	E	51-71
REXMONT	L	5	81	34	35	9	4242	E	53-65
C.V.		10.5	1.8	2.4	--	9.9	9.0		4.3-2.4

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 3. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP III. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
43	L	4	85	37	0	6	5747	A	52-67
47	L	5	85	40	15	6	5081	B	52-65
NEWBONNET	L	4	89	45	0	5	5064	BC	59-67
45	L	5	86	36	0	8	4984	BC	51-66
50	L	4	85	43	28	7	4694	BCD	51-65
52	L	4	77	37	33	9	4651	BCD	62-69
46	L	4	84	36	8	8	4537	BCD	54-67
GULFMONT	L	5	85	38	0	7	4467	BCD	56-68
51	L	4	84	38	0	7	4397	BCD	51-65
42	L	5	85	38	0	7	4351	BCD	53-65
48	L	4	85	36	0	7	4338	CD	47-63
41	L	4	83	44	30	6	4335	CD	47-63
LEMONT	L	5	86	36	0	8	4200	DE	55-68
49	L	4	81	37	0	8	4194	DE	50-66
44	L	4	85	47	15	6	4089	DE	55-65
KATY	L	5	86	47	0	6	3602	E	50-64
C.V.		11.2	1.0	2.0	--	9.1	9.7		5.6-3.5

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 4. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP IV. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
RICO 1	M	5	89	44	83	5	5954	A	61-68
67	L	4	88	46	0	6	5810	AB	57-65
63	L	4	84	40	10	7	5663	AB	57-68
68	L	4	81	36	0	7	5428	ABC	57-69
61	L	4	82	42	15	7	5407	ABC	54-64
66	L	4	83	38	18	8	5398	ABC	58-69
TORO-2	L	4	85	43	68	6	5291	BCD	62-70
64	L	4	84	44	28	6	5263	BCD	54-67
71	L	5	85	41	0	6	5257	BCD	61-70
69	L	6	87	35	8	8	5256	BCD	60-69
72	L	4	82	38	68	9	4989	CD	56-69
62	L	4	82	37	5	8	4924	CDE	48-67
65	L	4	84	38	0	7	4758	DE	55-66
70	L	4	87	38	0	6	4732	DE	48-67
JASMINE 85	L	5	100	43	60	4	4390	EF	44-62
STARBONNET	L	4	97	49	0	6	3896	F	50-59
C.V.		7.2	1.3	2.5	--	9.4	7.3		4.7-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.

*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).

**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 5. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP V. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
95	L	5	78	35	15	7	5359	A	54-72
113	L	5	80	42	0	6	5227	AB	57-67
PECOS	M	4	80	44	55	5	5215	ABC	66-69
103	L	5	80	35	10	8	5048	ABCD	54-69
111	L	3	71	40	10	8	4955	ABCD	55-68
L-202	L	5	76	38	0	6	4953	ABCD	52-70
92	L	5	76	37	45	8	4909	ABCDE	63-71
90	L	4	74	39	25	7	4863	ABCDEF	60-69
84	L	3	78	39	0	7	4859	ABCDEF	55-70
99	L	4	76	41	50	7	4805	ABCDEF	53-69
109	L	4	80	36	0	8	4760	ABCDEFG	55-69
102	L	4	73	37	5	7	4740	ABCDEFGH	60-69
97	L	5	81	37	15	8	4729	ABCDEFGH	46-66
108	L	4	77	43	5	7	4722	ABCDEFGH	47-64
93	L	4	69	39	30	9	4680	ABCDEFGHI	50-67
81	L	5	78	42	20	8	4545	BCDEFGHIJ	57-68
88	L	5	81	39	0	7	4540	BCDEFGHIJ	53-67
112	L	5	80	37	5	7	4490	BCDEFGHIJK	48-66
115	L	5	80	38	0	7	4475	BCDEFGHIJK	48-66
85	L	5	76	37	5	8	4467	BCDEFGHIJK	51-68
104	L	4	78	40	10	8	4447	BCDEFGHIJK	59-68
82	L	4	77	37	5	7	4400	CDEFGHIJK	48-67
94	L	5	84	37	0	6	4368	DEFGHIJK	52-66
110	L	5	78	32	0	7	4338	DEFGHIJKL	57-71
CM 101	S	3	74	38	0	7	4284	DEFGHIJKL	68-72
116	L	4	78	36	0	7	4120	EFGHIJKLM	59-68
100	L	5	81	39	5	7	4120	FGHIJKLM	59-70
105	L	3	73	37	15	8	4066	FGHIJKLM	58-70
107	L	5	77	41	70	8	4057	FGHIJKLM	61-72
114	L	5	83	36	5	7	3952	GHIJKLMN	54-67
89	L	4	72	37	90	9	3927	HIJKLMN	60-70
96	L	4	71	39	10	8	3883	IJKLMN	56-69
83	L	4	74	34	15	9	3844	JKLMN	53-66

CONTINUED.

TABLE 5. CONTINUED.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
98	L	5	80	34	15	8	3825	JKLMN	54-68
S-101	S	3	68	35	90	9	3814	JKLMN	65-71
91	L	5	74	40	35	9	3798	JKLMN	59-71
106	L	5	81	38	0	7	3705	KLMN	47-65
86	L	4	75	35	45	9	3536	LMN	51-65
101	L	4	76	38	20	9	3447	MN	54-66
87	M	4	73	43	30	9	3199	N	60-68
C.V.		13.0	1.6	3.5	--	6.3	7.6		5.3-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.

*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).

**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 6. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP VI. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
148	L	4	78	42	5	6	6301	A	59-70
151	M	3	83	45	80	4	6214	AB	62-68
127	M	3	84	47	70	4	6206	AB	61-66
133	M	3	75	45	5	4	6128	ABC	66-70
124	M	3	85	46	85	4	6057	ABCD	59-66
BRAZOS	M	5	84	46	90	6	5649	ABCD	60-66
121	M	3	87	45	20	5	5647	ABCDE	60-66
126	L	5	82	38	5	8	5588	ABCDE	61-70
147	L	5	85	35	0	7	5413	ABCDEF	58-69
146	L	4	86	44	0	5	5405	ABCDEF	59-67
131	L	4	83	36	0	7	5375	ABCDEF	57-69
139	L	5	78	42	10	7	5354	ABCDEF	58-69
141	L	4	82	38	20	8	5327	ABCDEF	51-70
130	L	4	80	41	0	6	5230	ABCDEFG	56-68
132	L	6	85	40	0	8	5181	BCDEFG	49-65
144	L	4	79	36	50	8	5159	BCDEFG	53-70
128	L	4	79	35	0	7	5151	BCDEFG	57-69
135	L	5	84	35	5	8	5096	CDEFG	46-68
143	L	4	80	36	0	7	5066	CDEFGH	56-68
150	L	5	83	38	55	9	5008	DEFGH	58-70
145	L	3	75	41	30	8	4991	DEFGHI	52-70
123	L	5	83	43	0	7	4948	EFGHI	59-68
149	L	4	80	38	0	7	4888	EFGHIJ	60-69
153	L	5	84	38	0	7	4884	EFGHIJ	56-70
NEWREX	L	6	83	42	55	8	4680	EFGHIJ	57-67
140	L	4	79	37	75	9	4622	EFGHIJ	55-71
129	L	4	79	32	60	9	4604	EFGHIJ	58-70
152	L	4	80	37	70	9	4582	EFGHIJK	58-71
142	L	4	75	41	80	9	4432	FGHIJK	60-70
134	L	4	81	37	85	9	4415	FGHIJK	52-68
122	L	4	81	36	25	8	4362	FGHIJK	54-67
154	L	4	86	43	5	7	4171	GHIJKL	54-67
NATO	M	5	85	54	85	4	3997	HIJKLM	65-69

CONTINUED.

TABLE 6. CONTINUED.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
137	L	4	86	35	0	8	3917	IJKLMN	52-65
138	L	4	77	38	90	9	3871	JKLMN	63-72
125	L	4	78	37	90	9	3534	KLMN	56-70
136	M	3	74	41	15	5	3294	LMN	62-68
156	L	3	76	36	0	8	3146	LMN	46-65
DELLA X2	L	6	89	45	0	5	3120	MN	52-63
DELLA	L	4	90	52	85	6	2898	N	56-67
C.V.		9.3	1.6	4.0	--	10.6	9.2		4.8-2.5

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 7. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP VII. CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
183	M	4	85	39	5	6	7209	A	64-69
GUI CHOW	M	5	95	43	85	4	6818	AB	58-67
194	L	4	83	42	5	6	6662	ABC	53-69
192	M	4	91	35	0	5	6377	ABCD	60-67
186	L	4	83	38	0	6	6175	ABCDE	56-69
180	L	4	85	36	0	7	5956	BCDEF	56-67
175	L	5	84	37	0	7	5625	BCDEFG	53-68
163	L	5	87	40	5	7	5622	BCDEFG	63-69
191	L	4	84	42	55	8	5589	BCDEFG	56-67
IRGA 409	L	4	96	45	85	4	5587	BCDEFG	55-66
185	L	5	90	47	70	5	5577	BCDEFGH	42-64
167	L	4	85	42	55	6	5523	CDEFGH	51-65
162	L	4	84	38	0	8	5503	CDEFGH	58-67
165	L	4	88	38	10	7	5484	CDEFGH	60-69
174	L	4	83	39	5	8	5481	CDEFGH	57-66
166	L	5	85	36	0	7	5428	CDEFGH	55-68
184	L	6	90	38	0	7	5386	CDEFGH	58-72
172	L	5	85	37	20	8	5333	DEFGH	55-70
NORTAI	S	5	94	44	80	4	5293	DEFGH	63-70
176	M	4	84	37	20	8	5277	DEFGH	65-69
189	M	4	90	36	0	7	5275	DEFGH	61-67
170	M	5	95	45	0	3	5263	DEFGH	59-66
188	L	4	83	40	0	7	5230	DEFGH	52-65
193	L	5	85	37	0	7	5207	DEFGH	59-70
182	L	4	83	43	60	9	5196	DEFGH	62-70
164	L	4	74	46	35	8	5141	DEFGH	59-68
179	L	4	87	46	80	6	5135	DEFGH	55-65
168	L	5	95	38	0	6	5107	DEFGH	49-63
178	L	5	92	38	0	7	5104	DEFGH	54-66
187	L	5	81	36	5	8	5073	DEFGH	49-68
177	L	5	86	38	10	8	5071	EFGH	52-65
196	L	5	92	35	0	6	4915	EFGH	45-69
190	L	5	86	36	0	7	4897	EFGH	56-66

CONTINUED.

TABLE 7. CONTINUED.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
169	L	4	82	36	35	8	4882	EFGH	52-69
181	L	5	82	35	25	8	4719	FGH	58-69
195	L	5	85	36	35	9	4545	GH	56-70
A-301	L	4	85	41	0	6	4428	GH	46-65
173	M	4	93	49	0	4	4375	GH	55-66
171	L	5	89	36	0	7	4336	GH	59-68
161	S	5	89	39	0	4	4261	H	60-68
C.V.		7.2	3.2	2.8	--	8.8	10.0		5.7-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 8. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP I, SECOND CROP. CROWLEY, LA.

1989 ENTRY	PLANT HGT(IN)	DAYS TO 50% HEADING	YIELD (LB/A @ 12%)	DUNCAN'S TEST*
8	25	39	3162	A
10	30	37	3126	AB
3	34	43	2996	ABC
6	26	43	2991	ABC
MAYBELLE	32	41	2911	ABC
7	31	40	2713	ABCD
2	28	44	2702	ABCD
4	31	43	2643	ABCD
1	33	42	2626	ABCD
11	27	46	2595	BCD
5	29	42	2465	CD
9	30	45	2321	DE
LABELLE	37	46	1956	EF
12	29	49	1689	F
SKYBONNET	35	41	1636	F
TEBONNET	37	48	1627	F
C.V.			12.9	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.5 LEVEL.

TABLE 9. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP III, SECOND CROP. CROWLEY, LA.

1989 ENTRY	PLANT HGT(IN)	YIELD (LB/A @ 12%)	DUNCAN'S TEST*
51	25	2497	A
48	24	2188	AB
43	25	1816	ABC
52	27	1628	BCD
49	25	1521	BCD
GULFMONT	26	1478	BCD
NEWBONNET	29	1461	BCD
KATY	31	1453	BCD
41	29	1450	BCD
46	26	1403	BCD
42	28	1398	BCD
LEMONT	26	1357	BCD
45	27	1183	CD
50	28	1028	CD
47	28	1019	CD
44	29	914	D
C.V.		34.1	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 10. AGRONOMIC PERFORMANCE OF 1989 UNIFORM RICE NURSERY, GROUP V, SECOND CROP. CROWLEY, LA.

1989 ENTRY	PLANT HGT(IN)	DAYS TO 50% HEADING	YIELD (LB/A @ 12%)	DUNCAN'S TEST*
95	28	42	3604	A
83	27	39	3324	AB
115	27	44	3101	ABC
116	28	41	3097	ABC
87	31	38	2896	ABCD
82	29	39	2872	ABCDE
110	24	38	2847	ABCDE
L-202	27	38	2819	BCDEF
106	26	45	2719	BCDEFG
96	29	36	2714	BCDEFG
104	27	41	2645	BCDEFGH
109	27	46	2567	BCDEFGH
88	28	43	2548	BCDEFGHI
113	26	46	2542	BCDEFGHI
84	31	44	2455	CDEFGHIJ
111	28	34	2433	CDEFGHIJK
CM 101	29	34	2427	CDEFGHIJK
101	28	45	2364	CDEFGHIJKL
93	32	46	2313	CDEFGHIJKL
112	27	47	2303	CDEFGHIJKL
100	28	45	2273	DEFGHIJKLM
94	25	47	2235	DEFGHIJKLM
86	26	47	2234	DEFGHIJKLM
85	28	42	2227	DEFGHIJKLM
98	30	45	2117	DEFGHIJKLM
92	30	48	2086	EFGHIJKLM
90	30	43	2029	FGHIJKLM
114	25	38	1950	GHIJKLM
81	32	45	1934	GHIJKLM
103	26	40	1887	HIJKLM
107	30	39	1866	HIJKLM
105	27	38	1745	IJKLMN
99	30	49	1729	JKLMN
91	31	47	1699	JKLMN
102	27	40	1694	JKLMN
PECOS	27	36	1646	KLMN
S-101	29	46	1626	KLMN
97	29	47	1587	LMN
108	32	45	1496	MN
89	29	49	1014	N
C.V.			14.3	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

COMMERCIAL VARIETY TESTS

Description: The rice breeding project annually conducts yield trials on commercial rice varieties grown in Louisiana. Included in the tests are the major commercial varieties and advanced experimentals in the final stages of testing before release from the cooperating public and private breeding programs.

Experimental Design: Commercial variety tests were conducted at three locations in Louisiana in 1989. The early group contained 20 entries and was grown at the RRS and in East Carroll and Vermilion parishes. The experimental design for each test was a randomized complete block with four replications. The entries AS 3510 and AS 3058 are from Alexandria Seed Company, Alexandria, LA. RAX 2003, RAX 2041, RAX 2233, and RAX 2235 are F_1 hybrids from the Ring-Around Seed Company, East Bernard, TX. CB 801, V4716, V4916, and V7817 are from Rice Tec, Alvin, TX. Maybelle is a 1989 release from the Rice Research and Extension Center, Beaumont, TX. Alan and Millie are 1990 releases from the Rice Research and Extension Center, Stuttgart, AR. LA 2201, LA 2207, 8702005, and 8702106 are advanced experimentals from the RRS, while 8603006 and 8804014 are advanced experimentals from Beaumont, TX and Stoneville, MS (Delta Branch Experiment Station), respectively.

Agronomic Practices:

RRS: Preplant fertilizer was applied and incorporated at a rate of 60-60-60 lb N-P_2O_5-K_2O/A with 100 lb/A N applied preflood. Entries were seeded at 100 lb/A (except RAX entries which were seeded at 50 lb/A). Entries were seeded April 5 and flushed April 9. The permanent flood was establish on May 9. Propanil, Londax, and Furadan were applied for weed and rice water weevil control. Plots consisted of seven rows on 8-inch centers, 16 feet in length. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, each plot was trimmed to 12 feet in length and the entire plot was harvested with a small plot combine. All yields are reported at 12% grain moisture and as means of four replications.

After the first crop was harvested, 45 lb/A of N was broadcast and a shallow flood established on the very early group. At second crop maturity, each plot was trimmed to 12 feet in length and the entire remaining plot was harvested with a small plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications.

East Carroll (Buford Perry Farm): Entries were seeded at 100 lb/A (except RAX entries which were seeded at 50 lb/A). The test was seeded May 30 and flushed June 3. Nitrogen was applied at 90 lb/A preflood and 45 lb/A at midseason. The permanent flood was established on July 12. Propanil, molinate, and Londax were applied for weed control. Furadan and methyl parathion were applied for the control of rice water weevils and stink bugs, respectively. Plots were 7 x 25 feet. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining area was harvested using an experimental plot combine. All yields are reported at 12% grain moisture and as means of four replications.

Vermilion (Bobby Trahan Farm): Preplant fertilizer was applied and incorporated at a rate of 60-60-60 lb N-P_2O_5-K_2O/A with 100 lb/A N applied preflood. The test was seeded on April 12 at a seeding rate of 100 lb/A. Adequate moisture for germination was received as rainfall on April 13. Propanil, Basagran, and Londax were used for weed control and Furadan was used for rice water weevil control. The test was flooded on May 1. Plots consisted of seven rows on 8-inch centers, 16 feet in length. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, each plot was trimmed to 12 feet in length and the entire plot harvested with a small plot combine. All yields are reported at 12% grain moisture and as means of four replications.

Comments: Performance results for the 1989 commercial variety tests are summarized in tables 11-16. The low grain and milling yields at the RRS in the first crop was due to adverse weather conditions and severe disease pressure. These conditions are discussed in detail in the Comments section of the Uniform Regional Nursery summary.

The low yields associated with the Vermilion Parish (Pine Island) location were primarily due to severe bird feeding on maturing rice.

TABLE 11. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TEST, VERY EARLY GROUP. RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
RAX 2003	L	5	81	38	58	6957	A	47-69
RAX 2041	L	5	81	44	20	6465	B	43-68
ALAN	L	3	83	42	0	5316	C	54-67
MAYBELLE	L	3	80	40	0	5270	CD	61-68
TEBONNET	L	4	87	52	3	5267	CD	58-68
MILLIE	L	3	88	41	0	5211	CD	57-67
8804014	L	4	85	44	0	5081	CD	48-64
L-202	L	4	85	38	0	4928	DE	46-64
LABELLE	L	4	86	50	5	4922	DE	60-67
SKYBONNET	L	3	88	46	0	4577	EF	60-67
8702005	L	4	88	38	0	4407	F	48-64
8702106	L	4	89	36	0	4398	F	46-63
8603006	L	4	86	36	0	4311	FG	50-63
AS 3510	L	3	74	45	0	3990	G	50-63
C.V.		10.3	1.2	3.6	--	4.6		5.1-2.2

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 12. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TEST, EARLY GROUP. RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
RAX 2233	L	5	90	47	0	7768	A	44-66
RAX 2235	L	5	96	46	0	7735	A	33-65
RICO 1	M	4	95	40	0	7011	B	63-69
MARS	M	3	92	44	0	6061	C	63-67
JASMINE 85	L	4	103	42	0	5838	C	50-62
V4916	M	4	88	41	0	5692	CD	66-70
TORO-2	L	3	93	39	0	5243	DE	60-68
AS 3058	M	4	87	42	3	5240	DE	64-68
LEMONT	L	4	93	33	0	4920	EF	58-69
NEWBONNET	L	4	95	43	0	4848	EFG	54-64
LA 2201	L	5	93	34	0	4846	EFG	50-66
V4716	M	4	90	36	0	4799	EFG	64-68
GULFMONT	L	4	91	35	0	4793	EFG	59-68
DELLA	L	4	94	51	18	4672	FG	56-67
REXMONT	L	5	91	34	3	4657	FG	54-66
MERCURY	M	3	89	34	0	4559	FGH	61-68
KATY	L	4	94	42	0	4345	GHI	53-66
V7817	L	4	102	34	0	4295	GHI	48-63
CB801	L	5	102	33	0	4048	HI	47-61
LA 2207	L	4	92	35	0	3967	I	54-65
C.V.		8.6	0.7	2.7	--	6.4		5.8-2.9

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 13. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TEST, VERY EARLY GROUP, SECOND CROP. CROWLEY, LA.

1989 ENTRY	PLANT HGT(IN)	SECOND CROP YIELD (LB/A @ 12%)	DUNCAN'S TEST*
L-202	28	3645	A
URN 14	35	3356	AB
URN 2	28	3213	BC
ALAN	33	3189	BC
8702106	26	3145	BC
MAYBELLE	32	2946	BCD
8702005	29	2858	CD
MILLIE	31	2799	CD
RAX 2041	32	2683	D
AS 3510	31	2100	E
RAX 2003	28	2067	E
TEBONNET	37	1932	E
SKYBONNET	34	1768	E
LABELLE	36	1728	E
C.V.		10.1	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 14. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TEST, VERY EARLY GROUP. EAST CARROLL PARISH, LA.

1989 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
RAX 2003	L	79	41	25	7970	A	37-71
8603006	L	84	34	0	7892	AB	57-70
8804014	L	81	45	0	7821	AB	48-69
ALAN	L	81	40	0	7543	ABC	60-70
8702106	L	86	37	0	7510	ABCD	63-71
RAX 2041	L	73	44	55	7506	ABCD	46-73
L-202	L	83	36	0	7409	BCD	57-70
TEBONNET	L	84	51	0	7400	BCD	61-70
MAYBELLE	L	77	38	0	7294	CDE	56-70
MILLIE	L	85	42	0	7072	CDE	65-72
8702005	L	84	37	0	7022	DE	58-71
SKYBONNET	L	87	48	0	6823	E	59-69
LABELLE	L	84	51	53	6269	F	62-70
AS 3510	L	61	34	0	5184	G	47-65
C.V.		1.4	3.8	--	4.3		6.8-1.4

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 15. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TESTS, EARLY GROUP. EAST CARROLL PARISH, LA.

1989 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
RICO 1	M	89	48	28	9032	A	63-71
RAX 2233	L	90	52	15	8516	B	44-69
RAX 2235	L	90	51	18	8491	B	36-68
MARS	M	88	48	0	7972	C	64-71
TORO	L	90	44	0	7809	CD	65-73
LEMONT	L	91	39	0	7770	CD	65-73
LA 201	L	91	39	0	7627	CDE	65-73
AS 3058	M	86	45	0	7536	CDE	66-71
NEWBONNET	L	91	47	0	7516	CDE	62-70
LA 207	L	91	39	0	7416	CDEF	68-73
V4916	M	86	44	0	7289	DEFG	71-73
MERCURY	M	86	39	0	7263	DEFG	67-72
GULFMONT	L	87	38	0	7145	EFGH	65-71
REXMONT	L	90	37	0	7094	EFGH	62-69
V4716	M	99	37	0	6896	FGH	71-73
V7817	L	93	37	0	6778	GHI	63-70
KATY	L	92	48	0	6772	GHI	60-69
CB801	L	93	37	0	6614	HI	63-71
JASMINE 85	L	100	50	0	6233	IJ	44-65
DELLA	L	90	56	68	5810	J	61-69
C.V.		5.5	3.8	--	4.9		4.2-2.1

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 16. AGRONOMIC PERFORMANCE OF 1989 COMMERCIAL VARIETY TESTS, EARLY GROUP. PINE ISLAND, LA.

1989 ENTRY	GRAIN TYPE	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
RAX 2235	L	5	83	46	0	5118	A	29-59
RAX 2233	L	5	82	46	0	5108	A	35-61
LA 2201	L	4	89	37	13	4803	A	46A65
GULFMONT	L	5	87	37	8	4772	A	54-68
LEMONT	L	4	88	35	10	4457	AB	56-70
V7817	L	5	95	35	0	4263	ABC	42-59
LA 2207	L	4	86	36	0	4260	ABC	47-63
REXMONT	L	6	88	36	18	3814	BCD	45-62
JASMINE 85	L	4	98	43	0	3674	BCDE	32-54
TORO-2	L	4	86	43	3	3625	BCDE	57-70
NEWBONNET	L	4	87	45	0	3620	BCDE	50-64
CB801	L	6	97	33	0	3471	CDEF	37-57
V4716	M	3	84	36	0	3221	DEF	58-66
KATY	L	3	89	46	0	2991	DEFG	40-57
RICO 1	M	5	88	43	50	2790	EFGH	50-62
AS 3058	M	5	84	42	3	2598	FGH	58-68
MERCURY	M	4	84	39	0	2191	GH	60-67
DELLA	L	3	88	50	18	2098	GHI	53-65
MARS	M	2	85	46	18	2006	HI	58-68
V4916	M	4	82	40	3	1251	I	56-67
C.V.		16.5	1.0	3.8	--	16.3		10.1-6.1

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

ADVANCED YIELD TESTS

Description: The rice breeding annually conducts on-farm testing of advanced experimental lines to complement tests conducted on-station. The goal of this activity is to sample additional environments in yield testing of new promising selections from the breeding program. These additional yield evaluations are needed to identify the performance characteristics, strengths, and weaknesses of the test entries. Multi-location and multi-year testing is essential to provide the information needed to make decisions or release new varieties.

Experimental Design: Advanced yield tests were conducted at five locations in Louisiana in 1989 in cooperation with commercial growers and the RRS fertilization and entomology projects. Eight very early maturing entries were tested at the RRS and in East Carroll and Vermilion parishes. Twenty-two early maturing entries were tested at the RRS and in East Carroll, Morehouse, Rapides and Vermilion parishes. Plots at the RRS consisted of seven rows on 8-inch centers, 25 feet in length. Plots at the other four locations were 7 x 25 feet. Experimental design was a randomized complete block with four replications.

Agronomic Practices:

RRS: Preplant fertilizer was applied and incorporated at a rate of 60-60-60 lb N-P_2O_5-K_2O /A with an additional 100 lb/A N applied preflood. The test was drill-seeded on April 16 at a seeding rate of 100 lb/A. The test was flushed on April 19. Propanil and Londax were applied for control of the rice water weevil and Furadan was applied for control of the rice water weevil. The permanent flood was established on May 9. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, each plot was trimmed to 20 feet and the entire remaining plot harvested. All yields are reported at 12% grain moisture and as means of four replications. Sheath blight ratings were made just prior to harvest by Dr. Don Groth.

Vermilion (Errol Lounsberry Farm): Preplant fertilizer was applied and incorporated at a rate of 90-60-60 lb N-P_2O_5-K_2O/A. The test was water seeded using presoaked germinating seed at a 150 lb/A seeding rate on March 20. The plots were drained on March 25 to allow seedlings to anchor (peg down) and a shallow permanent flood applied until harvest. Molinate and Londax were used for weed control and Furadan was used for rice water weevil control. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining plot was harvested using an experimental plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications.

After the first crop was harvested, 60 lb/A N was applied and a shallow flood established. At second crop maturity the entire plot was harvested with an experimental plot combine. All yield results were adjusted to 12% grain moisture and reported as means of four replications.

Rapides (Will Bollich Farm): Preplant fertilizer was applied and incorporated at a rate of 120 lb N/A with an additional 30 lb/A N applied at midseason. The test was water-seeded using presprouted, germinating seed at a 150 lb/A seeding rate on May 5. The plots were drained May 8 to allow seedlings to anchor and a shallow permanent flood applied until harvest. Propanil and Basagran were used for weed control and methyl parathion was used to control the rice stink bug. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining plot was harvested using an experimental plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications.

East Carroll (Buford Perry Farm): The test was drill seeded at a 100 lb/A seeding rate on May 30. The field was flushed on June 3. Propanil, molinate, and Londax were used for weed control and Furadan and methyl parathion were used for the control of the rice water weevil and the rice stink bugs, respectively. Ninety lb/A N was applied preflood and an additional 45 lb/A was applied at midseason. The permanent flood was established on July 12. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining plot was harvested using an experimental plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications.

Morehouse (Edmund and Kurt Zaunbrecher Farm): Preplant fertilizer was applied and incorporated at a rate of 120 lb/A N. The test was water seeded using presprouted, germinating seed at a 150 lb/A seeding rate on June 2. The plots were drained on June 4 to allow seedlings to anchor and a shallow permanent flood applied until harvest. Propanil, Basagran, and Londax were used for weed control and Furadan was used to control the rice water weevil. A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining plot was harvested using an experimental plot combine. All yield results are adjusted to 12% grain moisture and reported as means of four replications.

Comments: Tables 17-26 contain the mean values for agronomic characters measured at each location. Tables 27 and 28 contain values for the agronomic characters averaged over locations. Low grain and milling yields (first crop) at the Vermilion location were primarily due to excessive sheath blight and rotten-neck blast pressure. Several of the experimental lines look very promising. Currently 2201, 2207, 2214, and 2215 are in various stages of seed increase for later consideration for possible release. Both 2201 and 2207 are semidwarf, early long grains; 2214 is a semidwarf, early medium grain; and 2215 is a semidwarf, early, aromatic long grain (Della quality).

TABLE 19. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, VERY EARLY GROUP. VERMILION PARISH, LA.

1988 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
2225	L	3	87	34	0	8	5906	A	48-65
2226	L	3	84	36	0	9	5722	A	47-64
TEBONNET	L	4	87	52	38	7	5635	AB	51-64
MAYBELLE	L	3	77	36	5	9	5593	AB	56-69
2227	L	2	85	36	8	9	5543	AB	44-62
2223	L	3	87	34	15	9	5434	AB	43-60
2224	L	4	87	37	0	8	5083	B	41-61
2228	L	3	87	37	15	9	5019	B	32-57
C.V.		25.5	0.6	3.4	--	11.7	7.0		11.1-4.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 20. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP. VERMILION PARISH, LA.

1988 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST ****	MILLING % (WHL-TOT)
MERCURY	M	3	92	37	3	6	6302	A	60-68
RICO 1	M	3	97	45	55	5	6158	A	55-64
2214	M	3	95	36	0	6	5851	AB	55-64
2213	M	3	98	32	0	6	5628	BC	57-64
2218	M	4	98	33	0	4	5579	BC	52-61
2203	L	4	90	36	0	7	5506	BCD	49-63
2215	L	4	89	35	18	9	5257	CDE	51-65
2207	L	2	92	36	0	7	5219	CDEF	47-61
2201	L	4	91	37	13	9	5210	CDEF	45-63
2212	L	4	87	36	0	8	5102	CDEFG	36-57
2210	L	4	91	37	0	8	5016	DEFG	43-60
2217	L	4	93	35	0	8	4983	DEFG	45-62
2204	L	4	88	35	0	8	4837	EFG	39-60
LEMONT	L	4	93	37	3	9	4774	EFGH	48-64
2206	L	5	91	37	28	9	4665	FGHI	36-57
2205	L	4	88	36	0	8	4641	GHI	40-61
2202	L	3	91	36	3	9	4619	GHIJ	47-62
2208	L	4	94	36	0	8	4259	HIJ	44-61
2211	L	4	93	35	0	8	4213	IJ	38-58
KATY	L	3	94	44	3	7	4109	JK	42-59
2216	L	3	94	35	0	5	3672	KL	46-61
2209	L	3	92	43	0	7	3599	L	40-58
C.V.		13.1	1.0	3.1	--	9.8	6.8		7.8-4.2

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 21. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, VERY EARLY GROUP, SECOND CROP. VERMILION PARISH, LA.

1989 ENTRY	PLANT HGT(IN)	YIELD (LB/A @ 12%)	DUNCAN'S TEST*
2227	29	3042	A
2226	28	2998	A
2224	30	2963	A
2228	28	2871	AB
MAYBELLE	27	2729	ABC
2225	27	2630	ABC
2223	26	2533	BC
TEBONNET	35	2423	C
C.V.		8.9	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 22. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP, SECOND CROP. VERMILION PARISH, LA.

1989 ENTRY	PLANT HGT(IN)	YIELD (LB/A @ 12%)	DUNCAN'S TEST*
2211	29	2821	A
2208	29	2800	AB
2212	26	2529	ABC
2204	30	2413	BCD
2213	24	2393	BCDE
2203	25	2387	BCDE
2210	28	2383	BCDE
2206	29	2334	CDE
2202	28	2314	CDEF
2207	27	2310	CDEF
2201	27	2280	CDEF
2214	26	2245	CDEF
LEMONT	25	2241	CDEF
2217	27	2090	CDEF
2205	30	2083	DEF
2215	27	2078	DEF
2209	29	1963	EF
KATY	29	1948	EF
MERCURY	27	1887	FG
2216	23	1875	FG
2218	26	1536	G
RICO 1	28	924	H
C.V.		12.1	

* NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 23. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP. RAPIDES PARISH, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
2206	L	4	79	34	7211	A	60-69
RICO 1	M	4	83	41	7196	AB	64-70
2214	M	3	82	37	7176	ABC	66-70
2209	L	3	83	40	7088	ABCD	57-66
2212	L	3	76	35	6949	ABCDE	58-68
2204	L	4	78	35	6824	ABCDEF	62-70
2211	L	4	80	36	6814	ABCDEF	60-70
2208	L	4	80	35	6810	ABCDEF	63-71
2203	L	3	78	32	6766	ABCDEF	61-70
2213	M	3	86	33	6696	ABCDEF	61-69
2210	L	4	81	36	6687	ABCDEF	59-70
2207	L	3	81	35	6678	ABCDEF	63-70
2217	L	4	80	33	6665	BCDEF	62-70
2218	M	2	83	32	6653	CDEF	60-66
2202	L	3	81	35	6612	DEF	64-71
LEMONT	L	4	82	33	6605	DEF	65-71
2201	L	4	82	34	6569	DEF	61-70
2216	L	4	82	33	6445	EF	61-70
2205	L	4	79	33	6287	FG	61-68
KATY	L	3	81	40	5875	G	62-68
2215	L	4	76	33	5846	G	62-69
MERCURY	M	4	80	36	5813	G	68-71
C.V.		11.3	1.0	3.5	4.8		3.7-1.1

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL

TABLE 24. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, VERY EARLY GROUP. EAST CARROLL PARISH, LA.

1989 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
MAYBELLE	L	80	41	0	8221	A	64-71
2226	L	87	40	0	7998	AB	66-71
2225	L	86	38	0	7752	BC	63-71
2227	L	89	40	0	7697	BC	65-71
2224	L	89	40	0	7651	BC	63-70
2223	L	90	37	0	7542	BC	64-72
2228	L	90	39	0	7415	C	63-71
TEBONNET	L	88	56	83	6094	D	65-72
C.V.		0.8	3.4	--	3.9		2.2-1.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 25. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP. EAST CARROLL PARISH, LA.

1989 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
RICO 1	M	89	44	0	8701	A	63-74
2218	M	86	37	0	8525	A	57-68
2214	M	87	35	0	7680	B	60-74
2202	L	88	39	0	7619	BC	63-69
2204	L	85	36	0	7574	BCD	64-71
2212	L	85	36	0	7556	BCD	64-70
2208	L	89	38	0	7536	BCD	62-71
2211	L	88	37	0	7535	BCD	60-70
2206	L	87	36	5	7448	BCD	59-70
2213	M	90	33	0	7322	BCDE	63-73
2207	L	90	38	0	7252	BCDEF	65-71
2205	L	85	36	0	7243	BCDEF	66-71
2201	L	90	38	0	7200	BCDEF	67-75
2217	L	88	34	0	7162	BCDEF	63-71
LEMONT	L	90	37	0	7105	BCDEF	67-73
2215	L	86	35	0	6954	BCDEF	64-71
MERCURY	M	86	36	0	6852	CDEF	65-72
2210	L	87	36	0	6840	CDEF	62-71
2209	L	90	44	0	6798	DEF	64-70
KATY	L	90	42	0	6568	DEF	62-70
2203	L	86	34	0	6555	EF	66-73
2216	L	88	35	0	6486	F	63-73
C.V.		1.4	5.3	--	6.3		3.6-2.0

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 26. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP. MOREHOUSE PARISH, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
2218	M	3	79	34	0	9289	A	60-68
2212	L	4	73	37	0	9091	AB	60-70
2204	L	4	76	38	0	8947	ABC	63-71
2206	L	4	77	38	0	8846	ABCD	60-70
2210	L	4	78	37	0	8818	ABCD	61-70
RICO 1	M	4	81	44	28	8695	BCD	65-71
2209	L	4	80	42	0	8644	BCDE	63-69
2211	L	5	78	40	0	8618	BCDE	61-69
2208	L	4	80	40	0	8601	BCDE	60-69
2205	L	4	77	37	0	8568	BCDE	63-71
2201	L	5	81	37	0	8530	CDE	63-71
2202	L	4	79	37	0	8518	CDE	62-69
2207	L	3	79	38	0	8476	CDEF	67-72
2203	L	4	78	36	0	8342	DEF	63-71
2214	M	3	79	37	0	8338	DEF	66-71
2217	L	4	79	37	0	8315	DEF	64-71
2216	L	4	80	35	0	8131	EFG	62-70
LEMONT	L	5	82	36	0	8110	EFG	64-71
2215	L	5	74	36	0	7959	FG	62-72
KATY	L	3	79	46	0	7722	G	64-69
2213	M	3	83	33	0	6491	H	66-72
MERCURY	M	3	78	36	0	6001	H	56-70
C.V.		9.4	1.4	3.6	--	3.9		3.3-1.4

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 27. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, VERY EARLY GROUP. THREE LOCATION MEANS.

1988 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
2226	L	82	37	3	6386	A	57-68
MAYBELLE	L	76	37	5	6324	A	59-70
2225	L	83	35	3	6130	AB	55-69
2227	L	83	37	6	6057	AB	56-67
TEBONNET	L	83	53	49	6047	AB	60-69
2223	L	85	35	8	5880	AB	55-67
2228	L	84	38	8	5849	AB	50-65
2224	L	84	37	3	5667	B	53-66
C.V.		1.3	3.3	--	9.9		8.1-3.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 28. AGRONOMIC PERFORMANCE OF 1989 ADVANCED YIELD TEST, EARLY GROUP. FIVE LOCATION MEANS.

1988 ENTRY	GRAIN TYPE*	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	YIELD (LB/A @ 12%)	DUNCAN'S TEST **	MILLING % (WHL-TOT)
RICO 1	M	86	43	23	7742	A	61-69
2218	M	86	34	5	7592	A	57-66
2214	M	85	37	5	7120	B	61-69
2212	L	80	36	5	6927	BC	54-66
2206	L	83	36	15	6733	BCD	54-67
2207	L	84	36	5	6679	CDE	60-68
2204	L	81	36	5	6678	CDE	57-68
2201	L	85	36	8	6623	CDE	58-69
2203	L	82	34	5	6600	CDE	60-69
2208	L	85	37	5	6594	CDE	58-68
2211	L	84	37	5	6568	CDE	56-67
2202	L	83	36	6	6539	CDE	59-68
2217	L	84	35	5	6527	CDE	59-68
2209	L	85	42	5	6446	DEF	56-65
LEMONT	L	85	35	6	6398	DEF	60-70
2210	L	83	36	5	6379	DEFG	56-67
2213	M	88	33	5	6299	DEFG	61-68
2205	L	81	35	5	6276	DEFG	57-68
2215	L	81	35	9	6237	EFGH	56-70
MERCURY	M	83	36	6	6030	FGH	61-70
KATY	L	85	43	6	5941	GH	58-67
2216	L	86	34	5	5829	H	57-68
C.V.		1.9	4.7	--	9.6		7.3-2.8

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

PRELIMINARY YIELD TESTS

Description: The preliminary yield tests provide the first stage of replicated testing of promising experimental lines in field plots. Many of these are discarded before harvest or after laboratory evaluation. The more promising entries will be reselected and advanced for further testing.

Experimental Design: The preliminary yield tests used a randomized complete block design with two replications. The 365 entries were grouped into 15 groups by maturity and grain type. Group XXII contained aromatic experimentals, Groups XXIII and XXIV contained both grain types and were planted later than the other group as these were lines returned from the winter nursery in Puerto Rico. Each plot consisted of seven rows on 8-inch centers, 16 feet in length.

Agronomic Practices:

(Groups X - XXII): Preplant fertilizer was applied and incorporated at a rate of 60-60-60 lb N-P_2O_5-K_2O/A with an additional 100 lb/A N applied preflood. The test was drill-seeded on April 28 at a seeding rate of 100 lb/A and flushed on May 1. Propanil and Londax were applied for weed control and Furadan was applied for control of the rice water weevil. The permanent flood was established on May 24.

(Groups XXIII - XXIV): Preplant fertilizer was applied and incorporated at a rate of 60-60-60 lb N-P_2O_5-K_2O/A with an additional 60 lb/A N applied preflood. The test was drill-seeded on June 12 at a seeding rate of 100 lb/A and flushed on June 13. Molinate and Londax were used for weed control and Furadan was used for control of the rice water weevil. The permanent flood was established on July 6.

(All groups): A hand harvested milling sample was taken from each plot at approximately 20% grain moisture. At maturity, the entire remaining plot was harvested using an experimental plot combine. All yield results are adjusted to 12% grain moisture and reported as means of two replications. Sheath blight ratings were made by Dr. Don Groth just prior to maturity.

Comments: Performance of the 1989 preliminary yield entries are summarized in Tables 29 - 43. Many of the entries out-performed the check varieties. Some of these selections are being considered for the Advanced Yield and/or the Cooperative Uniform Regional Rice Nursery tests in 1990. Many of these lines still show considerable segregation. The best are being advanced, reselected, and purified.

TABLE 29. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
509	L	4	79	37	0	7	7752	A	46-69
501	L	4	80	39	0	6	7276	AB	54-68
521	L	3	80	37	0	7	7255	AB	62-71
502	L	3	82	31	0	7	6918	ABC	63-69
503	L	3	70	37	0	7	6904	ABC	66-71
518	L	4	79	38	0	7	6883	ABC	64-70
508	L	3	80	39	0	7	6841	ABCD	56-69
515	L	3	79	35	0	6	6836	ABCD	59-70
510	L	3	79	38	0	7	6785	ABCD	57-68
TEBONNET	L	3	79	53	35	6	6472	ABCDE	59-68
520	L	3	81	36	0	7	6334	BCDEF	61-69
519	L	3	80	41	0	7	6321	BCDEF	62-69
517	L	3	77	37	0	7	6249	BCDEFG	59-70
516	L	3	83	38	0	6	6239	BCDEFG	51-64
506	L	3	81	37	0	7	6173	BCDEFG	57-69
505	L	3	80	35	0	7	6149	BCDEFG	62-69
507	L	5	79	40	0	6	6145	BCDEFG	62-70
522	L	3	80	36	0	8	5969	BCDEFG	61-69
504	L	3	74	37	0	5	5872	CDEFG	59-65
511	L	3	78	38	0	7	5824	CDEFG	63-70
523	L	3	81	40	0	7	5689	CDEFG	62-68
L-202	L	3	76	36	0	7	5522	DEFG	51-65
513	L	4	77	35	0	7	5419	EFG	61-67
512	L	4	76	35	0	6	5136	FG	59-67
514	L	5	83	35	0	6	4951	G	52-61
C.V.		11.5	1.1	2.9	--	12.7	8.6		3.9-3.4

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 30. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
537	L	5	83	39	0	7	7217	A	58-68
526	L	4	81	35	0	8	7010	AB	58-67
541	L	4	82	40	0	6	6896	ABC	50-67
532	L	5	83	37	0	6	6869	ABC	57-70
TEBONNET	L	4	80	54	5	5	6807	ABCD	60-67
531	L	3	79	43	10	6	6558	BCDE	57-70
534	L	4	82	38	0	6	6496	BCDEF	55-66
540	L	4	81	38	0	8	6464	BCDEFG	64-72
544	L	5	78	37	0	8	6420	BCDEFG	65-72
529	L	4	79	34	0	7	6417	BCDEFG	56-66
539	L	4	86	37	0	6	6291	CDEFGH	65-67
545	L	3	79	35	0	8	6255	DEFGH	61-71
535	L	3	82	37	0	8	6239	DEFGH	58-66
533	L	4	82	36	0	8	6127	EFGHI	58-66
536	L	4	82	36	0	7	6109	EFGHI	61-69
543	L	4	79	37	0	8	6086	EFGHI	62-70
530	L	4	79	34	0	7	6080	EFGHI	59-67
527	L	5	84	35	0	7	6064	EFGHI	58-64
538	L	4	79	35	0	6	5926	FGHI	53-65
LABELLE	L	4	76	50	5	5	5840	GHI	63-67
528	L	4	83	35	0	7	5680	HI	53-68
547	M	3	84	37	0	8	5581	I	62-68
548	L	3	82	37	0	8	5530	I	59-67
546	L	5	87	36	0	6	4894	J	54-67
542	L	4	76	37	15	9	4799	K	64-71
C.V.		21.8	1.1	3.0	--	13.4	4.2		5.2-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 31. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, GROUP XIII, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
562	L	5	80	47	0	6	7136	A	59-68
565	L	4	79	49	5	6	7065	AB	60-68
TEBONNET	L	4	79	55	0	6	6897	ABC	60-69
572	L	4	86	39	0	7	6781	ABCD	62-69
564	L	4	81	49	0	7	6773	ABCD	59-67
573	L	5	85	39	0	6	6315	ABCDE	64-70
552	L	3	83	35	0	7	6270	ABCDE	62-70
556	L	3	82	36	0	8	6243	BCDE	58-67
571	L	6	98	37	0	6	6140	CDEF	59-70
570	L	4	89	36	0	6	6125	CDEF	59-68
554	L	3	80	34	0	7	6113	CDEF	63-71
566	L	4	79	48	15	7	6085	CDEF	59-68
559	L	3	82	35	0	8	5982	DEFG	57-67
553	L	3	82	35	0	7	5931	DEFGH	61-69
551	L	3	80	36	0	8	5824	EFGH	53-64
557	L	3	84	38	0	7	5799	EFGH	61-68
563	L	4	81	38	0	8	5626	EFGH	61-69
L-202	L	3	77	35	0	7	5516	EFGHI	47-64
567	L	4	83	35	0	8	5446	EFGHI	56-67
569	L	4	74	39	20	9	5316	FGHI	63-70
560	L	3	83	32	0	8	5194	GHI	51-65
555	L	3	84	36	0	8	5169	GHI	56-67
561	L	3	89	32	0	7	5066	HI	54-68
558	L	3	85	36	0	7	4677	IJ	59-68
568	L	5	82	45	75	9	4130	J	57-74
C.V.		9.3	4.0	2.2	--	7.9	6.3		3.4-1.9

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 32. AGRONOMIC PERFORMANCE OF 1989 PERLIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
589	L	4	82	38	0	7	6595	A	56-68
592	L	3	84	40	0	8	6586	A	56-66
588	L	4	81	39	0	6	6570	A	55-67
579	L	4	86	36	0	7	6406	AB	57-67
581	L	4	81	41	0	7	6372	AB	51-65
576	L	4	83	37	0	7	6318	AB	43-64
586	L	4	82	35	0	8	6156	ABC	58-67
582	L	4	81	40	0	7	6110	ABCD	57-67
593	L	4	83	37	5	8	6107	ABCD	60-69
590	L	4	83	36	0	5	6079	ABCD	55-67
584	L	4	83	37	0	6	6011	ABCDE	52-66
591	L	4	85	34	0	9	5942	ABCDE	61-69
587	L	4	82	36	0	7	5814	ABCDE	55-67
585	L	4	83	37	0	8	5806	ABCDE	48-62
597	L	4	87	38	0	6	5700	ABCDEF	56-66
LEMONT	L	3	84	36	0	8	5544	ABCDEF	56-64
578	L	4	80	38	40	8	5421	BCDEF	48-66
KATY	L	3	86	45	0	5	5407	BCDEF	45-59
580	L	4	82	39	0	8	5344	BCDEF	49-66
594	L	4	86	41	0	8	5333	BCDEF	53-67
598	L	4	87	37	0	7	5205	CDEF	53-63
596	L	4	87	37	0	8	5194	CDEF	57-67
577	L	5	86	39	0	4	5022	DEF	52-66
595	L	4	88	38	0	8	4966	EF	60-68
583	L	4	95	39	0	7	4700	F	41-58
C.V.		14.0	1.1	4.7	--	7.2	7.8		6.4-3.4

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 33. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, GROUP XV, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
613	L	3	86	37	0	6	7201	A	57-67
606	L	5	82	40	0	7	6949	AB	47-64
616	L	5	85	40	0	7	6787	ABC	49-63
614	L	4	86	37	0	7	6629	ABCD	63-68
601	L	5	83	38	0	7	6583	ABCD	53-68
617	L	3	84	41	0	8	6538	ABCD	61-67
608	L	3	83	42	0	8	6527	ABCD	56-65
622	L	6	81	40	0	7	6523	ABCD	48-63
602	L	4	81	36	5	9	6505	ABCD	57-66
618	L	4	85	42	0	8	6458	ABCDE	51-65
609	L	3	85	36	0	7	6418	ABCDE	64-70
603	L	4	82	37	5	8	6377	BCDEF	59-67
LEMONT	L	3	83	37	0	9	6313	BCDEF	58-67
GULFMONT	L	3	82	36	0	8	6246	BCDEFG	59-68
604	L	4	82	38	0	9	6234	BCDEFG	49-63
612	L	3	86	36	0	6	6198	BCDEFG	62-69
605	L	4	81	38	0	7	6124	CDEFGH	56-66
607	L	4	82	38	0	8	5954	DEFGH	54-66
610	L	3	87	35	0	8	5697	EFGHI	61-69
620	L	4	89	41	0	7	5592	FGHI	53-64
623	L	3	88	36	0	7	5590	FGHI	52-67
619	L	3	83	40	0	8	5477	GHI	58-68
621	L	3	87	43	0	8	5410	HI	47-59
611	L	3	86	36	0	8	5091	I	56-67
615	L	4	88	40	0	7	4953	I	54-64
C.V.		14.3	1.0	2.6	-	9.6	5.3		4.8-2.7

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 34. AGRONOMIC PERFORMANCE OF 1989 PERLIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
641	L	5	85	38	0	7	6965	A	50-63
646	L	3	82	38	0	8	6773	AB	50-65
633	L	3	81	45	0	7	6606	ABC	49-69
628	L	4	82	35	0	8	6520	ABCD	54-65
645	L	4	82	38	20	9	6496	ABCD	58-69
630	L	5	84	43	0	7	6409	ABCD	62-70
640	L	3	87	36	0	8	6285	ABCD	61-70
638	L	5	85	38	0	6	6263	ABCD	55-67
627	L	4	80	38	0	8	6213	ABCD	53-67
643	L	4	84	33	0	8	6089	ABCDE	48-67
636	L	4	85	39	0	7	6086	ABCDE	59-69
648	L	4	84	34	0	8	6071	BCDE	52-67
LEMONT	L	3	83	37	0	8	6052	BCDE	60-69
631	L	4	84	40	0	6	6048	BCDE	49-63
634	L	4	86	40	0	7	6018	BCDE	62-68
647	L	4	88	33	0	7	5962	BCDE	53-67
629	L	4	81	35	0	8	5949	BCDE	58-68
637	L	4	82	35	0	7	5893	BCDE	57-70
639	L	5	80	33	0	8	5811	CDE	54-69
644	L	3	84	33	0	8	5795	CDE	48-67
632	L	4	79	36	0	7	5772	CDE	59-68
635	L	4	82	38	0	8	5668	DE	61-67
KATY	L	3	86	46	0	6	5660	DE	50-61
642	L	4	83	38	0	8	5306	E	47-63
626	L	4	82	34	0	9	3815	F	48-56
C.V.		13.7	1.7	2.9	--	9.4	6.1		4.6-3.0

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 35. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST ***	MILLING % (WHL-TOT)
670	L	4	84	37	0	8	6984	A	55-67
669	L	4	87	38	0	8	6974	A	55-67
671	L	4	84	39	0	8	6857	AB	63-71
654	L	3	80	40	0	7	6844	AB	57-68
666	L	4	86	37	0	8	6572	ABC	54-67
658	L	4	81	40	10	8	6465	ABCD	59-70
672	L	4	86	38	0	8	6372	ABCDE	60-70
665	L	3	80	39	0	8	6352	ABCDE	53-66
667	L	4	87	38	0	8	6337	ABCDE	45-59
668	L	5	85	38	0	8	6276	ABCDE	58-68
GULFMONT	L	3	82	37	0	9	6119	ABCDE	57-67
661	L	3	80	36	0	8	6029	BCDE	58-68
LEMONT	L	4	85	38	0	8	6019	BCDE	61-70
659	L	4	85	37	5	9	5961	BCDE	54-69
664	L	4	84	38	0	8	5855	CDE	55-67
653	L	2	86	38	0	8	5847	CDE	44-62
660	L	3	82	36	0	8	5803	CDE	57-66
662	L	4	87	38	0	8	5746	CDE	45-60
655	L	4	90	40	0	7	5713	CDE	52-67
663	L	3	86	35	0	8	5579	DEF	58-69
673	L	4	85	38	10	9	5530	DEF	60-70
657	L	3	76	42	0	8	5513	EF	45-68
652	L	4	86	33	0	6	5458	EF	46-66
656	L	3	90	42	0	8	4801	F	52-65
651	L	4	85	38	0	8	3511	G	30-54
C.V.		10.1	1.1	2.1	--	6.9	6.4		5.9-2.6

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 36. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
679	L	5	92	41	0	7	7543	A	60-68
677	L	4	84	38	0	7	7323	AB	58-69
681	L	5	93	39	0	6	7234	ABC	58-65
684	L	4	87	40	0	8	6983	ABCD	57-68
696	L	3	90	38	0	8	6904	ABCDE	55-66
689	L	4	86	37	0	8	6703	BCDE	52-67
688	L	4	86	39	0	8	6648	BCDE	58-67
686	L	4	86	38	0	8	6641	BCDE	61-69
691	L	4	84	37	0	9	6524	CDEF	54-65
676	L	4	86	39	0	6	6435	DEFG	61-69
687	L	3	87	38	0	8	6429	DEFG	60-69
693	L	5	87	35	0	7	6404	DEFG	59-67
695	L	4	88	39	0	7	6392	DEFG	55-67
LEMONT	L	3	85	37	0	9	6381	DEFG	59-68
678	L	4	86	39	0	7	6352	DEFG	61-70
690	L	3	85	37	0	8	6292	DEFG	59-67
682	L	4	86	41	0	8	6269	DEFGH	61-68
692	L	4	84	38	0	8	6257	DEFGH	55-67
694	L	5	85	33	0	8	6216	DEFGH	63-70
683	L	4	88	39	0	7	6147	EFGHI	63-69
680	L	4	87	36	0	7	5822	FGHI	63-69
KATY	L	3	88	45	0	7	5728	GHIJ	51-61
697	L	5	83	33	0	8	5523	HIJ	61-69
698	L	5	82	32	0	8	5444	IJ	60-68
685	L	4	89	36	0	7	5047	J	60-68
C.V.		12.1	1.2	2.6	--	8.3	5.0		4.5-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 37. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
702	L	4	81	35	0	8	6669	A	63-69
GULFMONT	L	3	81	37	0	9	6483	AB	56-66
705	L	5	84	40	0	7	6449	AB	57-68
701	L	4	86	35	0	7	6405	AB	61-69
714	L	3	82	38	0	8	6376	AB	55-68
708	L	4	82	39	0	8	6375	AB	55-65
713	L	3	82	40	0	8	6359	ABC	57-68
710	L	4	82	38	0	9	6355	ABC	57-68
707	L	5	82	39	0	8	6296	ABC	59-68
704	L	5	83	39	0	8	6257	ABC	58-69
706	L	5	83	39	0	9	6161	ABCD	60-69
709	L	4	82	38	0	9	6127	ABCD	59-69
711	L	5	83	38	0	8	6125	ABCD	55-66
LEMONT	L	3	84	37	0	9	6114	ABCD	60-69
719	L	3	85	38	0	8	5929	ABCDE	60-72
712	L	3	81	34	0	8	5743	BCDEF	49-65
723	L	3	85	38	0	6	5736	BCDEF	53-67
703	L	3	87	36	0	8	5557	CDEF	56-67
722	L	3	81	34	0	8	5456	DEFG	55-67
715	L	3	87	38	0	8	5330	EFG	54-66
716	L	3	89	38	0	8	5215	EFG	56-68
720	L	3	88	34	0	7	4997	FGH	58-69
717	M	2	83	47	5	7	4980	FGH	56-65
721	L	3	89	35	0	7	4721	GH	59-69
718	M	2	83	48	55	7	4368	H	55-63
C.V.		12.2	1.0	1.9	--	8.3	5.7		4.2-2.0

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 38. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
747	L	5	89	42	65	4	7535	A	60-69
743	L	6	94	38	0	5	6750	AB	42-61
726	L	3	86	37	0	8	6455	ABC	54-68
740	L	4	85	44	10	5	6210	BCD	41-70
727	L	4	85	37	0	8	6172	BCDE	56-67
730	L	3	84	36	0	8	6116	BCDE	57-68
729	L	3	84	36	0	8	6109	BCDE	55-68
738	L	3	82	37	0	8	5936	BCDE	54-66
LEMONT	L	3	84	38	0	8	5930	BCDE	55-67
735	L	3	80	50	20	8	5840	BCDE	58-68
734	L	4	85	37	0	8	5806	BCDEF	59-69
728	L	3	84	35	0	8	5717	BCDEF	59-70
737	L	3	82	36	15	9	5714	BCDEF	59-67
739	L	3	82	38	10	9	5637	BCDEF	56-68
736	L	3	81	51	35	8	5514	BCDEFG	59-69
748	L	3	86	45	90	8	5381	CDEFGH	43-70
733	L	3	79	49	10	8	5324	CDEFGH	46-57
745	L	3	98	42	40	5	5310	CDEFGH	59-68
KATY	L	3	85	46	0	7	5227	CDEFGH	50-62
731	L	3	82	37	10	9	5173	DEFGH	52-67
744	L	4	93	38	0	7	4966	DEFGH	58-67
732	L	3	81	48	0	7	4949	EFGH	46-59
746	L	3	84	34	0	9	4572	FGH	57-69
742	L	4	93	43	0	7	4292	GH	45-65
741	L	4	95	43	10	7	4216	H	47-67
C.V.		7.9	1.2	2.3	--	9.6	9.1		5.9-2.0

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 39. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
RICO1	M	4	83	45	10	4	7724	A	67-71
765	M	4	91	45	40	3	7158	AB	45-69
770	M	3	81	36	0	5	6214	BC	64-70
753	M	3	78	35	0	7	6155	BCD	45-67
756	M	4	78	38	0	5	6088	BCDE	60-68
MARS	M	3	83	48	0	5	5966	CDEF	61-65
761	M	4	82	37	0	6	5909	CDEFG	66-69
759	M	3	80	32	0	6	5877	CDEFG	66-70
758	M	4	78	37	0	5	5703	CDEFG	57-68
757	M	4	79	37	0	5	5639	CDEFG	56-64
755	M	3	80	40	0	5	5555	CDEFG	58-63
763	M	4	81	36	0	4	5381	CDEFG	65-68
760	M	4	82	37	0	7	5321	CDEFG	63-68
752	M	3	78	36	0	7	5281	CDEFG	51-66
762	M	4	83	33	0	5	5241	CDEFG	60-67
767	M	4	83	37	0	7	5109	CDEFG	63-68
764	M	4	81	37	0	5	5091	CDEFG	65-69
751	M	3	75	38	0	5	5001	CDEFG	58-66
766	M	3	74	37	0	5	4898	DEFG	58-66
754	M	3	80	33	0	5	4838	EFG	65-68
MERCURY	M	3	80	35	0	6	4834	EFG	54-64
768	M	4	85	41	0	5	4771	FG	61-67
769	M	3	82	37	0	5	4653	G	62-68
C.V.		14.9	0.7	2.1	--	18.2	9.2		5.4-2.1

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 40. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
RICO1	M	5	85	43	0	-	7138	A	66-70
776	M	3	81	42	15	-	6712	AB	67-71
793	M	4	85	39	0	-	6524	AB	57-66
790	M	3	81	44	5	-	6464	ABC	64-67
780	M	3	85	36	0	-	6343	ABCD	64-68
779	M	3	81	38	0	-	6181	ABCDE	63-69
789	M	3	81	46	0	-	6084	BCDE	60-65
782	M	4	82	37	0	-	6065	BCDE	64-69
MARS	M	3	81	48	0	-	6063	BCDE	61-66
788	M	3	81	44	0	-	5975	BCDE	63-67
786	M	3	83	48	0	-	5720	BCDE	59-64
778	M	4	83	48	0	-	5522	CDEF	60-66
777	M	4	83	49	0	-	5494	CDEFG	58-64
785	M	3	82	46	5	-	5482	CDEFG	58-65
781	M	3	82	36	0	-	5457	CDEFG	62-68
794	M	3	86	35	0	-	5335	DEFG	63-67
787	M	3	80	37	0	-	5265	EFG	60-67
783	M	3	83	34	0	-	5188	EFG	62-67
791	M	3	90	42	0	-	4925	FG	59-67
792	M	3	91	42	0	-	4704	GH	61-67
MERCURY	M	3	80	36	0	-	4601	GH	56-65
784	M	3	80	36	0	-	3951	H	46-63
774	M	4	84	30	0	-	3926	H	64-67
775	M	4	83	30	0	-	3873	H	61-67
C.V.		13.0	1.0	2.3	--	-	7.5		4.4-2.3

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 41. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
JASMINE 85	L	3	94	47	0	4	6947	A	58-67
803	L	4	84	37	0	6	6354	B	51-71
806	L	4	86	38	0	8	6202	BC	59-70
815	L	4	88	41	0	7	6171	BC	49-63
801	L	5	85	39	0	8	6140	BC	55-69
814	L	5	89	41	0	8	6010	BCD	61-68
818	L	4	82	39	0	9	6003	BCD	58-70
805	L	4	90	38	0	7	5986	BCD	51-64
810	L	5	89	38	0	8	5959	BCDE	53-65
817	L	4	79	42	0	8	5868	BCDE	48-67
819	L	4	81	40	0	5	5859	BCDE	61-69
LEMONT	L	4	87	37	0	8	5685	BCDEF	56-69
812	L	4	92	40	0	8	5670	CDEF	61-68
807	L	4	87	42	0	8	5621	CDEFG	50-65
809	L	5	87	43	0	7	5616	CDEFG	52-68
808	L	5	88	42	0	7	5423	DEFGH	53-69
800	L	4	89	38	0	8	5400	DEFGH	55-66
802	L	4	86	38	0	8	5388	DEFGH	50-69
804	L	4	86	36	0	6	5362	DEFGH	55-68
823	L	6	83	41	0	7	5355	DEFGH	56-66
813	L	5	92	36	0	8	5307	EFGH	57-66
798	L	5	82	41	0	8	5302	EFGH	57-70
799	L	3	81	36	0	9	5138	FGH	46-66
DELLA	L	4	86	55	15	6	4957	GH	55-67
816	L	4	80	37	0	9	4920	H	50-68
811	L	4	91	37	0	8	4869	H	52-66
DOMSIA	L	4	77	66	45	4	3534	I	45-69
BASMATI	L	4	87	55	40	2	-	I	42-58
C.V.		15.2	1.4	1.4	--	8.9	5.0		7.9-2.9

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.
** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.
*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).
**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 42. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
840	M	4	73	32	0	6	4980	A	63-67
839	M	4	74	32	0	7	4674	A	62-66
838	M	4	73	31	0	7	4473	AB	62-66
841	M	4	74	34	0	7	4429	AB	61-65
829	M	5	73	35	0	6	4418	AB	50-66
832	M	4	69	33	0	8	4389	ABC	62-69
835	M	4	69	33	0	8	4024	BCD	62-69
833	M	4	69	33	0	8	3989	BCD	61-69
836	M	4	69	33	0	8	3919	BCD	59-67
830	M	5	73	35	0	6	3894	BCD	52-65
828	M	4	73	36	0	6	3863	BCD	53-65
837	M	4	70	31	0	8	3781	CD	61-68
826	L	3	72	38	0	8	3767	CD	29-63
834	M	4	69	33	0	8	3749	D	61-68
L-202	L	4	65	30	0	8	3679	D	46-65
LEMONT	L	5	74	34	0	8	3596	DE	47-64
MERCURY	M	4	69	32	0	7	3591	DE	58-69
842	M	3	67	31	0	8	3035	F	57-65
827	L	4	78	40	0	7	2911	F	41-56
831	L	4	80	35	0	7	2568	F	45-63
C.V.		13.4	0.6	2.3	-	5.2	6.8		4.8-1.8

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.

*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).

**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

TABLE 43. AGRONOMIC PERFORMANCE OF 1989 PRELIMINARY YIELD TEST, RICE RESEARCH STATION, CROWLEY, LA.

1989 ENTRY	GRAIN TYPE*	SEEDLING VIGOR**	DAYS TO 50% HEADING	PLANT HGT(IN)	LODGING (%)	SHEATH*** BLIGHT	YIELD (LB/A @ 12%)	DUNCAN'S TEST****	MILLING % (WHL-TOT)
RICO 1	M	5	75	41	0	6	6246	A	64-69
853	M	3	69	39	0	7	5424	B	57-68
863	M	4	73	37	0	6	5262	B	59-69
847	M	4	70	34	0	7	4728	C	62-68
862	M	4	73	32	0	7	4689	CD	67-71
861	M	4	73	33	0	7	4579	CDE	66-70
854	L	3	70	35	0	8	4446	CDE	50-65
855	M	3	68	31	0	8	4326	CDE	56-69
851	L	5	78	34	0	5	4272	CDEF	53-63
852	L	5	76	35	0	6	4257	CDEF	57-62
856	M	3	72	34	0	7	4226	CDEF	61-69
849	L	5	77	36	0	6	4163	DEFG	52-61
850	L	5	78	32	0	5	4160	DEFG	57-63
848	L	5	77	36	0	5	4134	DEFG	45-58
857	M	4	71	33	0	8	4056	EFG	57-70
KATY	L	4	75	40	0	7	3761	FGH	51-63
858	M	3	69	33	0	8	3672	GH	59-67
846	M	3	70	30	0	9	3507	H	64-69
860	L	4	72	31	0	9	2910	I	48-67
859	L	4	72	30	0	9	2531	I	51-68
C.V.		7.4	0.6	2.0	-	6.4	5.4		2.9-2.5

* L = LONG GRAIN, M = MEDIUM GRAIN, S = SHORT GRAIN.

** SUBJECTIVE RATING 1 TO 9, WHERE 1 = EXCELLENT, 9 = POOR.

*** SHEATH BLIGHT SEVERITY SCALE (0-9; 0 = NO DISEASE, 9 = DEAD PLANT).

**** NUMBERS FOLLOWED BY THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT AT THE 0.05 LEVEL.

MULTIPLE GENERATION RICE BREEDING NURSERY[1/2/]

S.D. Linscombe, F. Jodari, A.P. Fabacher, and L. Aviles

INTRODUCTION

A winter nursery is an essential and integral feature of a modern rice breeding program. The nursery allows the production of additional generations of breeding material per year, thus decreasing the time required to develop new varieties. The winter nursery also permits an opportunity to practice disruptive selection in another environment and the growing of elite selections of germplasm not adapted to the Louisiana environment.

The agricultural experiment stations of Arkansas, Louisiana, Texas, and Puerto Rico have a cooperative agreement to operate a year-round rice nursery on the Puerto Rico Experiment Station located at Lajas for the purpose of advancing and seed increase of breeding lines. This cooperative venture has made possible nursery facilities, equipment, and labor and is allowing these rice breeding programs to grow a large number of breeding lines to expedite the development and release of improved rice varieties for the southern United States.

1989-90 ACTIVITIES

The January 1989 nursery included 3,000 rows of Louisiana lines which included 1,500 breeding lines from F_3 - F_5 generations of promising populations. In addition, 15 bulk F_3 populations were in this nursery that had been turned over from the nursery planted in September 1988. There were also small headrow seed increases from 30 advanced experimental lines. This nursery was harvested in late May and returned to the Rice Research Station for an early June planting.

Adverse weather conditions prevented planting the fall 1989 nursery until December 1. This nursery contained a total of 4,500 rows, including 2,500 rows of advanced lines from the breeding nursery and bulk plantings from 15 F_1 populations. Also included were large seed increases from advanced experimentals LA 2201 and LA 2207 which are currently being considered for release.

1/ Cooperative investigations, Louisiana Agricultural Experiment Station, Crowley, LA; University of Puerto Rico Agricultural Experiment Station, Lajas, PR; Texas Agricultural Experiment Station, Beaumont, TX; and Arkansas Agricultural Experiment Station, Stuttgart, AR.

2/ This research is supported in part by funds provided by rice producers through the Louisiana Rice Research Board.

YIELD AND MILLING QUALITY STABILITY OF ADVANCED RICE BREEDING LINES

F. Jodari, S.D. Linscombe, and P.K. Bollich

There is increasing emphasis among rice breeding programs on the genotype (G) by environment (E) interaction. Certain rice varieties and advanced breeding lines show considerable instability of performance among different environments, which is due to the GXE interaction. Even though instability for yield or other traits can be detected by comparing the means of a genotype over a range of environments, the degree and significance of the instability need to be measured and tested. Varieties or lines that are consistent and have a wider range of adaptability are more desirable than the ones that have a narrow adaptability provided yield and milling performance are acceptable. Even though the range of adaptability or stability during a variety development process can be changed to gain higher yields or better qualities, there needs to be an acceptable level of stability in a rice variety.

The objectives of this study were to select a suitable stability statistic and evaluate the stability of grain and head rice yields of some of the advanced experimental lines that have potential for possible release.

Procedures:

The stability of grain yield and milling yield of seven genotypes, which included five experimental lines and two varieties, were tested. All seven genotypes had been tested in a total of 24 environments over a 3-year period. Environments were separated in two groups of statewide trials (AY) and regional trials (URN). Locations for AYs included the Rice Research Station (RRS) and Vermilion Parish in 1987, and RRS, Vermilion, Rapides, Morehouse, and East Carroll parishes in 1988 and 1989. Regional trials were located at the rice experiment stations in Arkansas, Louisiana, Mississippi, and Texas in 1987 through 1989. Agronomic practices used for AYs are described in the RRS annual reports. Regional trials for Louisiana are also reported in the annual reports. Other states use a drill seeding method and slightly different agronomic practices for the URN. Regional trials, however, are a cooperative project and maintain a certain level of uniformity among locations.

For statistical analysis, the stability variance estimates of Shukla (2) were used. This procedure partitions the GXE interaction variance into stability variance components (σ_i^2) assignable to each genotype. Another stability variance statistic partitions the GXE interaction term into each genotype (σ_i^2) after removing the heterogeity due to a covariate which in this case was the environmental index. A basic program developed by Kang (1) was used to determine the stability variances. A combined analysis of variance was performed over all environments and the pooled error term was used to test the significance of stability variances.

Results:

Means of genotypes over all environments for grain and head rice yield (Table 1) show that four of the experimental lines had higher yields than Lemont and Mercury in the AY group. The Louisiana experimental line '201' produced the highest yield in the regional trials. When averaged over all 24 environments, the LA 201 produced 340 lb/A higher grain yield and 1.3% lower head rice yield than Lemont.

Stability variance (σ_i^2) for the regional trials (Table 2) were considerably higher than the statewide trials. All genotypes showed considerably higher stability in the statewide trials. Genotypes LA 201, LA 205, and Lemont showed highly stable grain yields in this group. Head rice stability was highest for LA 201 and LA 210 in the AY group. The head rice yield of LA 201 was also the most stable in regional trials. The head rice yield of Lemont on the other hand was considerably unstable in both groups of trials.

The s_i^2 stability variance statistics following removal of the covariate (Table 3) showed slightly different variances for each genotype. The differences, however, were not large enough to change the significance levels of any of the genotypes.

Means of environments over all genotypes (Table 4) showed considerable differences in performances among years and locations. The main effects of environments, however, removes most of this variability. Severe sheath blight at the Vermilion location in 1989 caused reductions in grain yield and milling yield. Removal of such locations from the data set and recalculation of stability variances may change the stability estimates of certain genotypes and identify the factors that contribute to instability of certain genotypes.

Results from this study indicate that the stability statistic of Shukla works well with the statewide trials. Distinct differences in the stability observed among genotypes show that the procedure has enough sensitivity to detect differences among genotypes with a fairly high level of confidence. Relatively high levels of instability in the regional trials is due either to lack of uniformity among regional trials or large environmental differences that cause differential performances by genotypes. Integrating the stability estimates with means from uniform performance trials will provide useful criterion for selecting improved and consistent rice varieties.

REFERENCES

1. Kang, M.S. 1988. Interactive BASIC program for calculating stability variance parameters. Agron. J. 80:153.

2. Shukla, G.K. 1972. Some statistical aspects of partitioning genotype-environment components of variability. Heredity 29:237-245.

Table 1. Means of genotypes over all environments for grain yields. Rice Research Station, Crowley, LA. 1989.

Genotype	AY Grain yield (lb/A)	AY Milling yield (%)	URN Grain yield (lb/A)	URN Milling yield (%)	Combined Grain yield (lb/A)	Combined Milling yield (%)
LA 201	6940	58.1	6752	58.5	6851	58.3
LA 204	7065	59.9	6467	59.4	6770	59.7
LA 205	6538	59.5	6253	59.8	6396	59.6
LA 210	6940	58.1	6360	56.9	6645	57.5
LA 211	7011	60.0	6030	59.0	6521	59.5
Lemont	6770	59.7	6253	59.5	6512	59.6
Mercury	6761	62.3	5762	60.3	6262	61.3
LSD (0.05)	144	1.3	214	1.2	134	0.9

Table 2. Partitioning of GXE interaction into components (σ_i^2) assignable for each genotype for grain yield and head rice yield. Rice Research Station, Crowley, LA. 1989.

Genotype	AY Grain yield[1/] (lb/A)	AY Milling yield (%)	URN Grain yield (lb/A)	URN Milling yield (%)
LA 201	0.02	6.0	0.46**	8.5
LA 204	0.08*	11.1*	0.24**	30.7**
LA 205	0.02	10.1*	0.30**	12.3*
LA 210	0.21**	4.5	0.44**	31.1**
LA 211	0.24**	21.5**	0.82**	23.3**
Lemont	0.03	22.4**	0.21**	35.0**
Mercury	1.18**	62.2**	1.72**	120.8**

1/ Mean squares determined with grain yields as tons/A.
*,** Significant at 0.05 and 0.01 levels of probability, respectively.

Table 3. Partitioning of GXE interaction into components (s_i^2) assignable to each genotype for grain yield and head rice yields. Rice Research Station, Crowley, LA. 1989.

	Mean square			
	AY		URN	
Genotype	Grain yield[1/]	Milling yield	Grain yield	Milling yield
LA 201	0.04	7.0	0.35**	9.4
LA 204	0.10*	9.5*	0.28**	33.7**
LA 205	0.01	11.7*	0.34**	12.1*
LA 210	0.13**	5.7	0.50**	34.5**
LA 211	0.26**	22.2**	0.56**	21.9**
Lemont	0.05	21.3**	0.24**	36.9**
Mercury	0.83**	48.1**	1.82**	128.5**

1/ Mean squares determined with grain yields as tons/A.
*,** Significant at 0.05 and 0.01 levels of probability, respectively.

Table 4. Means of environments over all genotypes for grain yield and head rice yield. Rice Research Station, Crowley, LA. 1989.

	Grain yield			Milling yield		
	1987	1988	1989	1987	1988	1989
	(lb/A)			(%)		
AY						
Rice Res. Stn.	6779	6511	5218	59	64	57
Vermilion	7154	6619	4995	55	52	45
Rapides	----	7769	6485	--	63	62
Morehouse	----	8572	8215	--	64	62
East Carroll	----	7181	7181	--	66	64
LSD (0.05)		187			1.7	
URN						
Stuttgart, AR	6922	6628	5629	53	63	61
Crowley, LA	6949	7136	4781	61	62	54
Stoneville, MS	6190	6895	6092	54	63	61
Beaumont, TX	6440	5432	6226	61	51	61
LSD (0.05)		277			1.6	

FISSURING SUSCEPTIBILITY OF CURRENT RICE VARIETIES

F. Jodari and S.D. Linscombe

Milling quality or whole grain milling yield in a rice variety is perhaps as important as its yield potential. Milling yield is affected by several factors, including the susceptibility to fissuring. Rice fissuring structurally weakens the kernel making it very susceptible to breakage during milling and handling operations. Even though the environments in the southern rice growing regions are not as inducive to fissuring as the dry and fluctuating California environments, the range of humidity fluctuations is wide enough to cause considerable fissuring in certain varieties. Figure 1 shows the hourly temperature and humidity changes in a typical harvest day at the Rice Research Station. There is a 50% change in relative humidity from early morning to early afternoon hours. This would be more than enough to cause fissuring in low moisture rice (<17%) in the field.

Studies were continued in 1989 to identify varieties and some experimental lines with susceptibilities to fissuring and correlate some of the grain characteristics with fissuring. Eighteen varieties and two experimental lines were tested in 1989 at three initial grain moisture levels. Milling samples were taken at optimum harvest moisture to minimize exposure to severe temperature and humidity fluctuations. After slowly drying the samples to 12% moisture, milling yields were determined using the standard milling procedures. Subsamples in the form of rough and brown rice were then dried to three different moisture contents of 16, 13, and 11 percent. Using a controlled chamber, samples were exposed to saturated static humidity conditions at 28°C for 18 hours for rough rice and 45 minutes for brown rice. Grain length, width, and length/width ratios of brown rice were determined. Small samples were also sent to USDA rice quality laboratory for amylose content determinations.

Most long-grain varieties with 16% grain moisture content exposed to saturated humidity conditions did not show considerable fissuring except for Leah and Lebonnet (Figure 2). Significant fissuring activity among most varieties was observed at 13% or lower. Larger differences among varieties were seen with Leah, Lebonnet, and Lemont being the most susceptible and L202, Labelle, and Newbonnet the most resistant. The Louisiana experimental line 2207, which is a cross between Lemont and L202, showed high resistance to fissuring even at low grain moisture contents. Most of the medium grains had higher levels of fissuring over all three moisture levels (Figure 3). Varieties Gui Chow and S201 were the most susceptible and Nato was the most resistant.

A significant correlation of -0.48 for long grains and -0.55 for medium grains was found between the milling yields of unfissured rice and fissuring (Table 1). Grain amylose content and fissuring was only significant among the medium-grain group. Positive correlation was also observed between grain width and fissuring among the long-grain group. Grain length, L/W ratio, and % hull were not correlated with fissuring.

Means of milling yield, amylose content, and fissuring among long-, medium-, and short-grain varieties are shown in Tables 2 and 3. With the exception of Lemont and L202, long-grain varieties with higher milling yield tended to show higher resistance to fissuring. The susceptibility of Lemont to fissuring (41% for rough rice and 68% for brown rice) seems to be mainly contributed to its wide grain size. The variety L202 has a source of resistance to fissuring which is not clear at this point. The Louisiana experimental line 2207 seems to have inherited both the high milling yield and fissuring resistance from its parents, Lemont and L202. Although grain dimension and amylose content can partly explain some of the varietal differences, other factors need to be identified and correlated with fissuring to better explain varietal differences. Such information can be used to incorporate fissuring resistance and higher milling quality into rice breeding lines.

Table 1. Correlations between milling yield, grain size, hull ratio, and fissuring of rough rice. Rice Research Station, Crowley, LA. 1989.

	Fissuring	
	Long grain	Medium grain
Milling yield	-0.48 0.02*	-0.55 0.03
Amylose	0.02 0.94	0.60 0.01
Grain length	0.13 0.55	-0.39 0.13
Grain width	0.48 0.02	0.31 0.24
L/W ratio	-0.41 0.05	-0.39 0.14
% Hull	0.08 0.71	0.65 0.01

* Significance probability of pearson correlation.

Table 2. Milling yield, amylose content, and fissuring of long-grain rice cultivars. Rice Research Station, Crowley, LA. 1989.

Cultivar	Milling yield	Amylose content	Fissuring: Rough rice	Fissuring: Brown rice
	(%)			
Lemont	64	23	41	68
Labelle	62	22	10	35
Tebonnet	55	23	26	37
Newbonnet	62	23	7	27
Toro 2	63	17	12	19
Rexmont	57	25	30	62
Irga 409	62	27	11	25
L-202	50	26	8	3
Lebonnet	64	23	14	47
Leah	50	23	73	72
2207	63	23	10	44
2225	57	23	34	64
CV, %	3.6	1.2	16.2	13.0
LSD (0.05)	3.4	0.6	8.1	10.3

Table 3. Milling yield, amylose content, and fissuring of short- and medium-grain rice cultivars. Rice Research Station, Crowley, LA. 1989.

Cultivar	Milling yield	Amylose content	Fissuring: Rough rice	Fissuring: Brown rice
	(%)			
Mars	66	16	57	55
M-202	67	15	26	35
Mercury	65	15	66	52
Nato	68	16	16	34
Nortai	69	17	86	86
S-101	63	18	37	53
S-201	60	18	76	73
Gui Chow	50	27	94	97
CV, %	2.3	2.7	7.7	13.1
LSD (0.05)	3.3	1.1	10.1	14.7

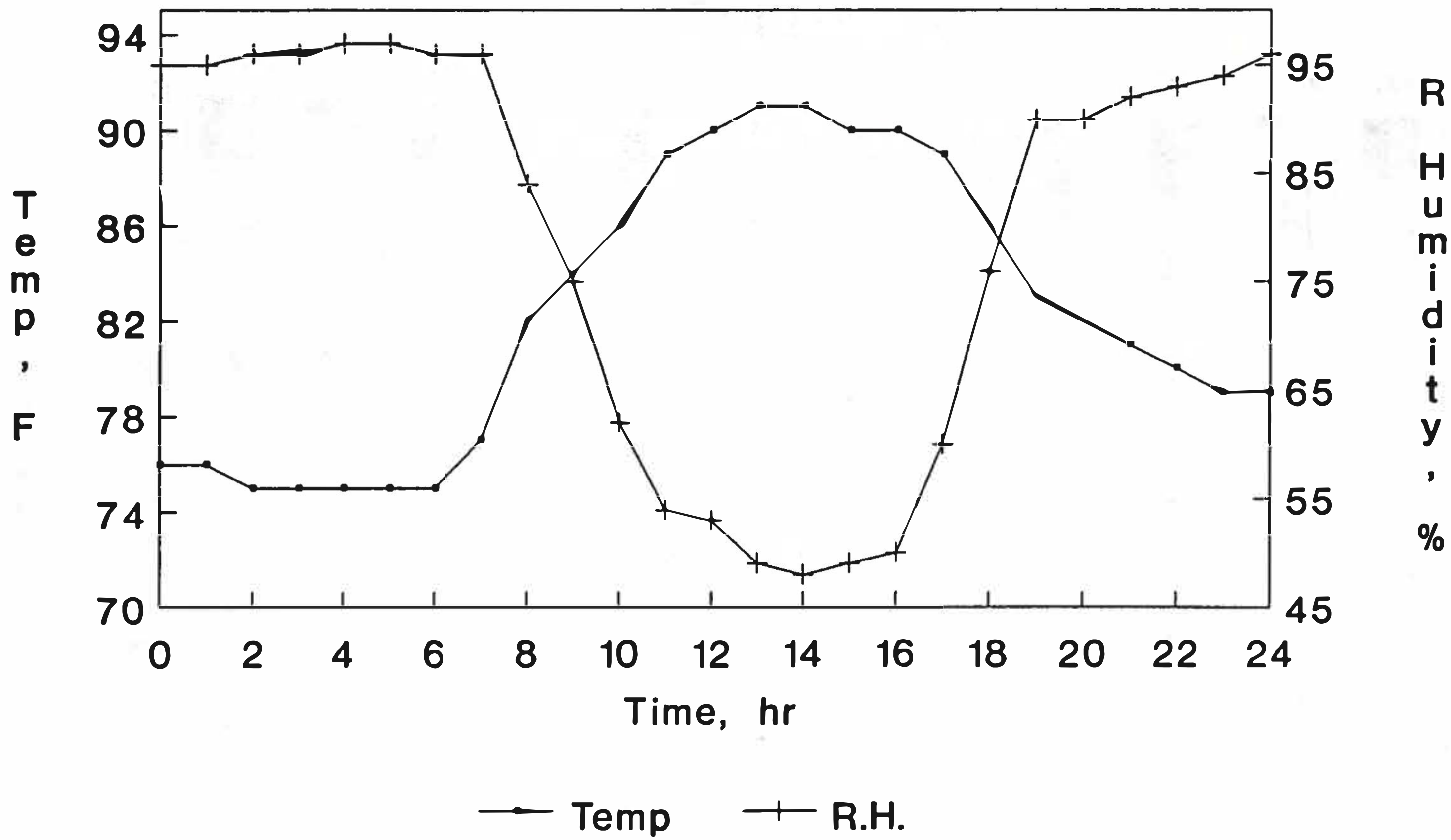


Figure 1. Hourly temperature and relative humidity changes. August 19, 1988. Rice Research Station, Crowley, LA.

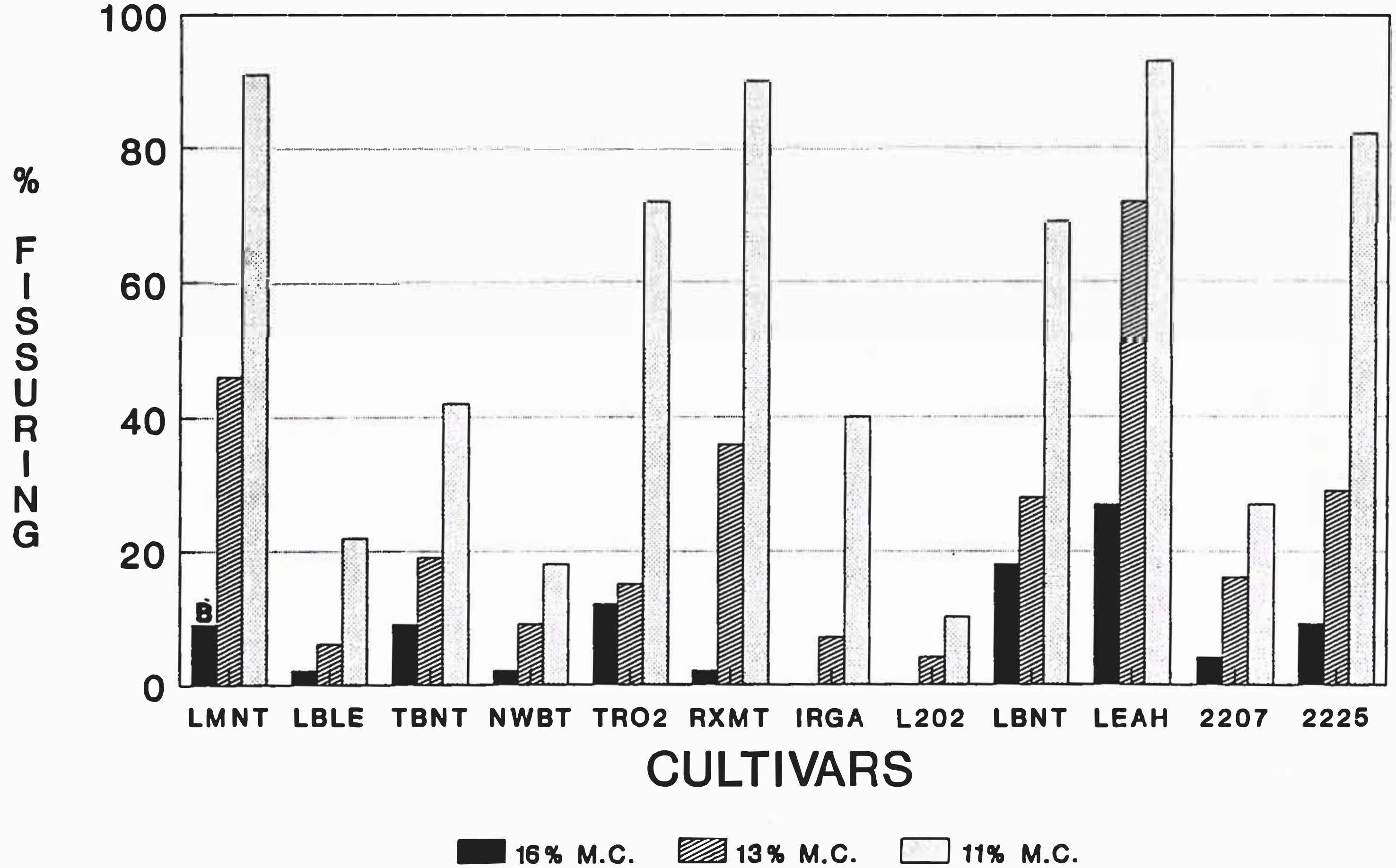


Figure 2. Fissuring of long-grain rice cultivars exposed to high humidity conditions after three drying levels. Rice Research Station, Crowley, LA. 1989.

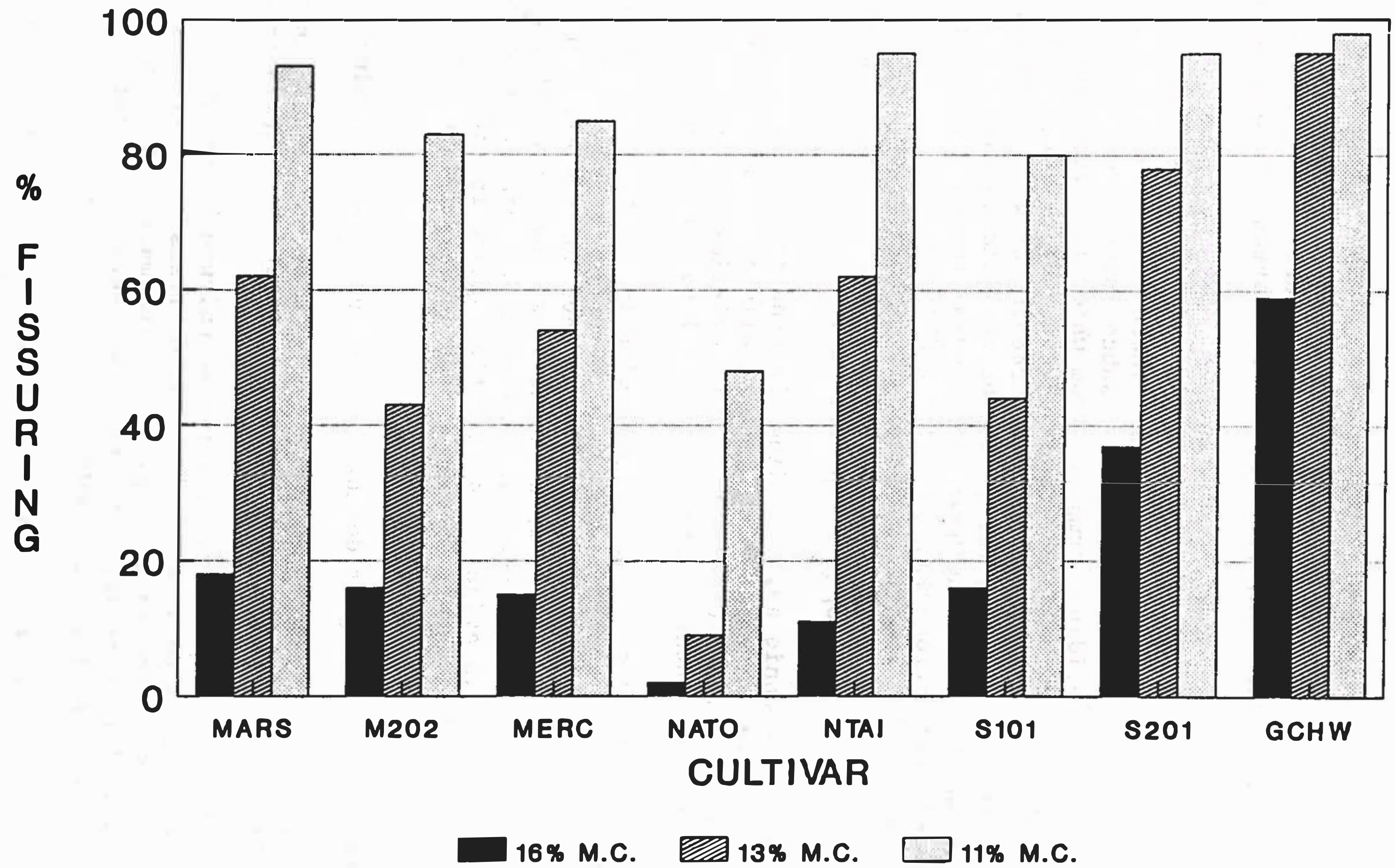


Figure 3. Fissuring of medium-grain rice cultivars with different moisture contents exposed to high humidity conditions. Rice Research Station, Crowley, LA. 1989.

CEREAL CROPS BIOTECHNOLOGY RESEARCH

RICE AND WHEAT IMPROVEMENT THROUGH BIOTECHNOLOGY

T.P. Croughan, Q.R. Chu, M.M. Meche, R.P. Regan, D.B. Trumps,
S.D. Linscombe, S.A. Harrison, D.E. Groth, J.M. Jaynes, and S.S. Quisenberry

Biotechnology offers a set of laboratory techniques applicable to the genetic improvement of crop plant species. These techniques involve the manipulation of plants at the cellular and subcellular level to produce new genetic variability, providing germplasm from which improved varieties may be developed. Complementary to established conventional techniques such as hybridization, mutation breeding, and the screening of world collections, biotechnology offers techniques for producing new mutants through tissue culture (somaclones), developing homozygous lines from segregating populations (anther culture), and introducing into plants DNA from unrelated species coding for specific new traits (genetic engineering). The focus of this project is the application of these techniques to the enhancement of rice and wheat germplasm for varietal development applications.

Tissue culture techniques, including the production of somaclones and anther culture-derived material, have successfully contributed to cereal crop improvement. In China, approximately 50 new varieties of rice and wheat have been developed through anther culture and somaclonal variation since 1975.

Genetic engineering of cereal crop species is progressing rapidly. Approximately two years ago rice was regenerated from protoplasts for the first time. In the last year, several laboratories have successfully introduced foreign DNA into rice, including work conducted at the L.S.U. Rice Research Station. While progress with wheat and other small grains lags behind that achieved with rice, it is evident that genetic engineering of cereal crops for crop improvement objectives offers significant potential in the foreseeable future.

Activities in this project during 1989 included the following:

1) Approximately 450,000 anthers were plated from rice and wheat breeding program materials and over 20,000 plants regenerated from rice anther culture.

2) A total of 36,000 rows of rice tissue culture lines were planted and sprayed with herbicides to screen for herbicide resistance. Approximately 20 showed improved resistance to Roundup, and approximately 100 lines showed elevated resistance to Pursuit. Resistant rows were transplanted from the field to the greenhouse for seed production.

3) A total of 10,000 new anther culture derived rice lines were planted for field evaluation.

4) Approximately 1,700 yield plots were planted to further evaluate rice tissue culture lines previously identified as promising.

5) Approximately 4,000 new rice somaclones were planted and evaluated in the field in 1989.

6) A total of 8,000 somaclonal lines were planted by this project in a collaborative effort with the plant pathology project to evaluate tissue culture lines for improved disease resistance. Dr. Groth identified several entries in the testing which showed improved disease resistance, including some lines which showed resistance over two years of testing.

7) In 1989, the rice breeding project selected 700 promising lines from among the 10,000 new anther culture lines developed and planted by the tissue culture project.

8) Approximately 375 new anther culture lines were harvested and supplied to the entomology project for further evaluation for rice water weevil resistance. These lines include in their parentage the germplasm line CI11048, a rice water weevil resistant material.

9) A total of 197 wheat somaclonal lines were evaluated in yield plots by this project and 8 promising lines were selected for further evaluation. Approximately 3,500 new somaclonal lines were planted in headrows, and 77 of these were selected for further evaluation in yield plots.

10) In collaboration with Dr. Jesse Jaynes, a plasmid containing a gene for disease resistance was employed in attempts to genetically engineer disease resistant rice. Preliminary results indicate that this gene has been introduced into rice cells through electroporation, a first step in developing genetically altered plants through this approach.

11) In collaboration with Dr. Steve Harrison, wheat somaclonal lines developed in our program were yield tested by the wheat breeding project in Baton Rouge. Seven check varieties and 21 somaclonal wheat lines were evaluated. The two highest yielding entries in the test were somaclonal lines. The highest yielding entry, R3-69, had no leaf rust and only a low level of glume blotch and bacterial streak. Sixteen regenerated wheat lines were selected by the wheat breeding project for evaluation in more advanced yield trials. An additional 180 new somaclonal lines were evaluated in single rows by Dr. Harrison. A total of 39 lines were selected as promising and harvested for further evaluation.

THE RELATIONSHIP BETWEEN HARVEST MOISTURE AND MILLING YIELD FOR COMMERCIAL AND EXPERIMENTAL RICE LINES

M.F. Miller, S.D. Linscombe, and F. Jodari

INTRODUCTION

For the past several years this project has been conducted in cooperation with the rice breeding program at the Rice Research Station, Crowley, LA. Recent varietal releases and experimental lines were used in this work. Usually there is little information available relating to the optimum harvest moisture versus optimum head yield. Grain checking due to drying, wetting by rain and dew, and redrying of the rice kernel in the field is another factor that effects head yield. By harvesting over a wide range of harvest moistures and different atmospheric conditions, milling data was obtained relating to these variables.

MATERIALS AND METHODS

Two experimental lines, 201 and 207, and one recent release, Rico-1, were sampled at varying grain moisture levels. Lines 201 and 207 are typical long-grain rices. Rico-1 is a medium size grain. Harvesting was done by hand at grain moisture increments of approximately 2.0%. The highest harvest moisture was 26.0%. Sampling was continued until the moisture was down to near 17.0%. Samples were dried with forced air to a level of 11.5 to 12.5% moisture. They were then cleaned and stored in sealed glass jars for about 6 weeks before milling. USDA approved procedures were used to obtain yield data.

RESULTS AND DISCUSSION

The curve for experimental line 201, shown in Figure 1, is a composite of 3 years milling data. Line 207 is for 1 year. Rico-1 was not plotted due to the small amount of data. Maximum head yield for 201 appears to occur when the harvest moisture was near 22.0%. Head yield for experimental line 207 peaks at approximately 19.0 to 20.0%. The rough data for Rico-1 indicates a maximum head yield at about the same percentage. It's head yield was slightly higher at all harvest moisture levels than the other two lines. Harvest moisture did not seem to have as much effect on the head yield of Rico-1 as it did on 201 and 207. There also appears to be a variation of optimum harvest moisture from year to year for line 201. Experimental line 207 and Rico-1 will be evaluated again next year.

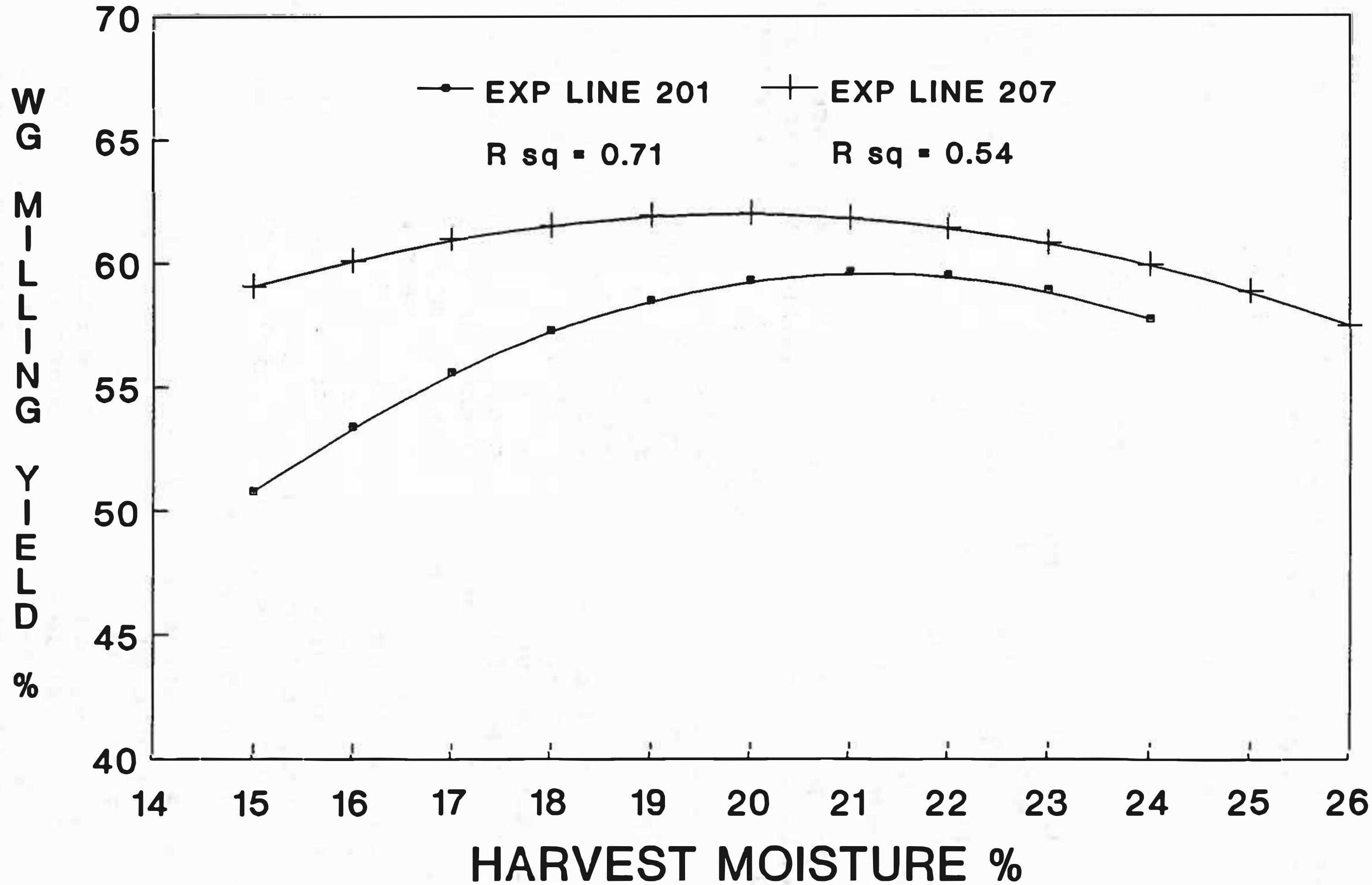


Figure 1. Response of whole grain milling yield to harvest moisture for experimental line numbers 201 and 207. 1989.

RICE FERTILIZATION AND CULTURAL MANAGEMENT[1/]

EFFECT OF N RATE AND TIMING ON AGRONOMIC PERFORMANCE OF SELECTED RICE VARIETIES AND EXPERIMENTAL LINES IN LOUISIANA RICE PRODUCING AREAS

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Fertilizer nitrogen (N) is required on virtually all of the rice acreage in Louisiana for optimum production. Efficiency and uptake of applied N are influenced by factors such as placement, rate, and timing in relation to water management. Growing a suitable rice variety coupled with management practices that conserve applied N generally increase the chance of profitable rice production.

The placement and timing of fertilizer N are dependent upon the cultural system used. In Louisiana, rice is grown in water- and dry-seeded cultural systems. In the water-seeded, permanently flooded system, the optimum N rate should be placed 2 to 3 inches below the soil surface within 5 to 7 days of establishing the flood. In the dry-seeded system, the optimum N rate should be broadcast onto a dry soil surface prior to establishing the permanent flood. There is generally no advantage to applying multiple applications of fertilizer N in either cultural system provided there is precision in N application and placement and sound water management. Split applications may be desirable if the optimum N rate is not known, if the farmer is unfamiliar with a field, or if a variety is susceptible to lodging. When applying split applications, it is important to apply an adequate amount of basal N to maintain the rice plant through tillering and into early reproductive growth. Generally, a split application consists of two-thirds of the estimated total N requirement applied preplant in water-seeded rice and preflood in dry-seeded rice, followed by a topdressing of the remaining one-third at either panicle initiation, panicle differentiation, or when deficiency symptoms appear.

Rice varieties may differ in their response to the amount and timing of applied N. Maximum or optimum yields of many varieties may occur over a wide range of N rates, depending on such factors as lodging, disease susceptibility, and inherent N utilization efficiency. Environmental influences such as soil type, growing conditions, pest pressure, and weather may affect varietal performance. Conducting field research in the major

1/ This research supported in part by funds provided by rice producers through the Louisiana Rice Research Board.

rice producing areas of Louisiana provides valuable information for developing fertilization and management strategies for new varieties.

The objectives of these variety evaluations are to 1) determine yield potential and agronomic performance of new rice varieties and advanced experimental lines in different environments, and 2) determine the optimum N rate for each variety.

MATERIALS AND METHODS

Twenty rice varieties and/or advanced experimental lines were grouped by maturity for testing:

1. Very early: Tebonnet (TBNT), Skybonnet (SKBT), Maybelle (MBLE), 3083, 1084, 3006, 1105

3. Early: Lemont (LMNT), Gulfmont (GFMT), Mars, Mercury (MERC), Katy, 2201, Rico 1 (RICO), V4716, V7817, CB801, V4916, 2207, Jasmine 85 (JSMN)

Tebonnet is a tall variety developed in Arkansas. It has displayed high yield potential and is susceptible to lodging. Skybonnet, a Texas variety, is later maturing and has displayed somewhat less yield potential than Tebonnet in previous tests. Skybonnet is shorter than Tebonnet, has better lodging resistance, and has excellent second crop yield potential. Maybelle is a very early maturing long-grain variety developed in Texas, and was released in 1989. This variety matures approximately 8 to 10 days earlier than Tebonnet. Maybelle is short in stature, possesses good straw strength, and has excellent second crop potential.

The remaining entries in the very early group are advanced experimental lines. Lines 3083 and 3006 are semidwarf long grains developed in Texas. Lines 1084 and 1105 are tall long grains developed in Arkansas.

The early group includes the Texas semidwarf varieties Lemont and Gulfmont. Lemont has consistently shown excellent yield potential, is resistant to lodging, and responds well to high levels of fertilizer N. Gulfmont is very similar to Lemont in growth habit and is 2 to 3 days earlier. It has yield potential similar to Lemont and has slightly greater second crop yield potential than does Lemont. CB801 is a Ricetec (Alvin, TX) mid-season semidwarf variety that is resistant to lodging and appears to have very good yield potential, responding to high levels of fertilizer N. The variety V7817 was also developed by Ricetec and is very similar in characteristics to CB801. These two varieties mature later than Lemont and are shorter in height. Katy was developed in Arkansas and was released in 1989. It is a tall long-grain variety that possesses good straw strength and stands well. Katy will lodge, however, if over-fertilized. Its yield potential is somewhat less than that of Lemont. Jasmine 85 is a long-grain variety released from Texas in 1989. It is considered to be a special purpose rice, since it possesses aromatic properties and a low amylose content. Jasmine 85 has poor straw strength, is of medium height, and will lodge at high levels of N.

Mars is a tall, early season, medium-grain variety with good yield potential that was developed in Arkansas. It is lodging susceptible, especially at high rates of N fertilization. Mercury is a semidwarf medium grain released from the breeding program in Louisiana in 1987. Straw strength of Mercury is similar to that of Mars but is more resistant to lodging at high N rates, due mainly to its shorter height. Yield potential of Mars and Mercury appear to be similar, with each displaying good second crop potential. Rico 1 is a tall mid-season medium grain released from the breeding program in Texas in 1987. It is susceptible to lodging, but appears to have higher yield potential than either Mars or Mercury. The variety V4716 is a short stature medium grain released from Ricetec in 1987. First and second crop yield potential appear to be similar to that of Mars and Mercury. The variety V4916 is a somewhat taller medium grain released from Ricetec in 1989. Preliminary data indicate its yield potential to be similar to V4716.

Advanced experimental lines 2201 and 2207 were developed in the Louisiana breeding program. Both lines are long-grain semidwarfs that possess good lodging resistance and have displayed yield potential in the first and second crops comparable to Lemont. Height and maturity are similar to that of Lemont and Gulfmont.

Varieties and advanced experimental lines were tested in five different locations, however, not all materials were included in each test. Experiments were water-seeded at all locations except East Carroll Parish. Entries were tested at four N rates ranging from 60 to 150 lb/A in 30 lb/A increments, with N being applied as single applications.

Fertilizer N was banded approximately 2 inches deep 1 to 2 days prior to flooding in the water-seeded experiments. In soils requiring P and K, approximately 60 lb/A P_2O_5 and K_2O were also banded with N as ammonium sulfate. In drill-seeded experiments, basal N treatments were applied as a broadcast application prior to establishment of the permanent flood.

Water-seeded experiments were seeded at the rate of 150 lb/A with presoaked seed. After 3 to 4 days, the experiments were drained briefly to promote seedling anchorage. A permanent flood was established 2 to 4 days after drainage, never allowing the soil to dry. In drill-seeded experiments, varieties were seeded at 100 lb/A and flushed periodically until the permanent flood was established (4 to 5 weeks after planting).

Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, lodging, grain moisture, grain yield, and milling yield were measured. Milling samples were hand-harvested at 20-22% moisture ($5ft^2$) for each entry at a 90 lb N/A rate only (average of 4 replications).

Second crop data were generated in the Vermilion Parish and Rice Research Station variety evaluations. Following main crop harvest, 60 lb N/A were broadcast into the dry stubble, and a shallow flood was established within 2 to 3 days after N application. Individual whole plots were combine-harvested at field maturity. Grain moisture and grain yield were determined.

Plant growth stages were determined for all varieties at each location for use in updating or establishing predictions in the DD50 Rice Management Program (Tables 14-18).

SUMMARY AND CONCLUSIONS

Field experiments were conducted at the Rice Research Station and at four off-station locations to determine N response and agronomic performance of commercial varieties and advanced experimental lines when grown in different environments. Agronomic data are shown in Tables 1-12.

Seedling vigor was generally very good for the water-seeded, medium-grain varieties Mars and Mercury at the Rice Research Station and in Vermilion Parish. Vigor was fair to poor for the other medium-grain entries. Many of the long grains were considered to be fair to poor in seedling vigor when water seeded. The varieties Maybelle and Katy and experimental line 2207 emerged through the water much faster than the other long-grain entries. Cool temperatures at planting resulted in slow early-season growth for most entries at these two locations. Moderate to severe bronzing appeared soon after the rice emerged through the water, requiring a foliar application of zinc chelate. The water-seeded experiments in Rapides and Morehouse Parishes were planted during much warmer temperatures, and differences in seedling vigor among the entries were less noticeable. The drill-seeded experiments in East Carroll Parish were also planted during warm conditions, and all entries emerged over a 3 day period.

Lodging was moderate to severe for many of the taller entries at high rates of N, especially in the water-seeded evaluations. Lodging also occurred in some of the semidwarf entries at higher rates of N and was attributed to sheath blight. The varieties Mars, Rico 1, and Tebonnet were more likely to lodge at higher rates of N than were Skybonnet and Katy. Severe lodging generally resulted in lower grain yields, especially in the water-seeded experiments.

Nitrogen rates ranging from 90 to 120 lb/A were considered to be optimum for most entries at the Rice Research Station. Experimental lines 3083 and 3006 did not respond to N rates above 60 lb/A, and this was probably due to an increase in disease incidence as N increased. Jasmine 85 also required 60 lb N/A for optimum grain yield, although, the lack of response to higher rates was not associated with disease incidence or lodging. Tebonnet, Maybelle, and experimental line 1084 of the very early group yielded over 7000 lb/A. Experimental line 3083 was affected by rotten neck blast and was the lowest yielding entry in the group. The semidwarf entries Lemont, Gulfmont, 2201, and 2207 required a N rate of 150 lb/A for maximum grain yields and were the highest yielding long grains in the early variety experiment. Average yields for these entries ranged from 7000 to 7400 lb/A. The medium-grain variety Rico 1 was the highest yielding entry in the early variety group and yielded over 8400 lb/A. Mercury was affected by blast and yielded significantly less than the other entries.

Nitrogen requirements ranged from 90 to 150 lb/A for optimum grain yields in East Carroll Parish, even for the taller, lodging susceptible varieties. Optimum grain yields generally resulted when slightly more N was applied than that required at the Rice Research Station. Inclement weather conditions caused a delay in the application of preflood N and the permanent flood, and resulted in a higher requirement of N for optimum grain yields. Yields of some varieties were probably decreased as a result of delayed N application. Tebonnet required only 90 lb N/A for optimum grain yield and lodged at higher rates. Other entries in the very early group required 120 to 150 lb N/A. Maybelle and experimental lines 3083 and 3006 produced the highest yields in this group. The early varieties Lemont, Gulfmont, Mars, V7817, 2201, and 2207 yielded above 7000 lb/A, while Rico 1 yielded over 8000 lb/A.

Nitrogen requirements were generally lower in Vermilion Parish. Heavy sheath blight pressure had a significant influence on grain yields of many of the entries, and inclement weather during pollination caused sterility. Moderate to severe lodging occurred in many entries when N was applied in excess of 60 lb/A. Severe sheath blight contributed to lodging in the semidwarf entries. With the exception of CB801, a N rate of 60-90 lb/A was necessary for optimum grain yields in each experiment. Tebonnet, Maybelle, Mercury, 2201, and Rico 1 yielded over 6000 lb/A, while yields of Katy, V4716, and V4916 were below 5000 lb/A.

More N was required for optimum grain yields in Rapides Parish than at the other locations, with most entries responding to 150 lb N/A. Problems with water management resulted in some loss of preplant N, and higher rates of N were necessary to produce adequate grain yields. No lodging was observed for even the taller, more susceptible varieties, indicating poor utilization of the applied N. Lemont, Gulfmont, Rico 1, 2201, and 2207 yielded above 7000 lb/A, while yields of Mars, Mercury, Katy, CB801, and V4916 ranged between 6600 and 6900 lb/A. The varieties V4716 and V7817 yielded below 6000 lb/A.

The highest grain yields in 1989 for all entries tested in the early maturity group were produced in Morehouse Parish. Mercury and V7817 were the only varieties that required 150 lb N/A for optimum yield. The semidwarf entries Lemont, Gulfmont, and 2201 and the medium grain Rico 1 responded negatively to rates of N higher than 60 lb/A. Grain yields for Mercury, V4716, V7817, and CB801 ranged from 7400 to 7700 lb/A, while all other entries yielded above 8300 lb/A. Rico 1 yielded 9600 and 9800 lbs/A at N rates of 60 and 90 lb/A, respectively, with yields decreasing at higher rates of N due to severe lodging. Experimental line 2207 yielded in excess of 9200 lb/A at a N rate of 90 lb/A. Grain yields were also excellent for Lemont, Gulfmont, Mars, Katy, 2201, and V4916.

Second crop grain yields were determined at the Rice Research Station and in Vermilion Parish. The yields were generally higher in Vermilion Parish, although main crop yields at this location were lower. The earlier planting date in Vermilion Parish also resulted in better growing conditions for the second crop. Tebonnet, Skybonnet, Maybelle, Gulfmont, 2201, and 2207 produced excellent second crop yields and averaged over 2400 lb/A. Yield of Rico 1 was much lower, averaging 1400 lb/A and was probably due to severe lodging in the main crop and decreased regrowth of the tillers. Grain yields of V7817 and CB801 were also reduced by stand loss that was attributed to sheath blight damage in the main crop.

Maybelle, 3083, and 3006 were the highest yielding second crop entries at the Rice Research Station, yielding over 2500 lb/A. Grain yields of Skybonnet, 1084, Gulfmont, Mercury, V4716, 2207, and Jasmine 85 ranged between 1900 and 2300 lb/A. Grain production was lowest in Katy with an average yield of less than 1500 lb/A. The main crop of Jasmine 85 was the last to mature, however, the second crop of this variety matured much earlier than all other entries in either maturity group. This variety does not appear to possess any cold tolerance and was completely killed by low temperatures prior to harvest, causing the second crop to lodge.

Main crop milling yields for the very early and early varieties and advanced experimental lines from each location are shown in Table 13.

Experiment: Very early variety x nitrogen trial

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.3; O.M.: 1.21%; extractable nutrients (mg/kg): P-., Na-62, K-78, Ca-1002, Mg-221, Zn-0.20, S-6.51, As-2.72, Fe-55.30

Variety/Seeding Rate: TBNT, SKBT, MBLE, 3083, 1084, 3006, 150 lb/A

Planting Method/Date: Water-seeded, Apr 10

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate; second crop, 60 lb N/A; 0.54 lb ai/A Zinc chelate, Apr 18

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: 1084, Apr 18; MBLE, 3006, Apr 19; TBNT, SKBT, 3083, Apr 20

Water Management: Flooded, Apr 7; drained, Apr 17; reflooded, Apr 20; harvest drainage, July 24; second crop flooded, Aug 11; harvest drainage, Oct 24

Herbicides: 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 28; 1.2 oz ai/A Londax, May 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 11, June 6; 1.0 lb ai/A Sevin (carbaryl), July 12, July 27

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20

Harvest: Main crop, Aug 8; second crop, Oct 30

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: MBLE, 1084, and 3006 displayed very good seedling vigor, while vigor of other entries was fair. Lodging was severe for 1084 and TBNT at high rates of N (Table 1). Blast was quite noticeable in MBLE and 3083, and probably reduced yields. There was also heavy sheath blight pressure in 3006. A N rate of 90 to 120 lb/A resulted in optimum grain yields for all entries except 3083, which responded to only 60 lb/A, probably due to increased incidence of rotten neck blast at higher N (Table 2).

Second crop grain yields were highest for 3006, 3083, and MBLE. Other entries yielded about 500 lb/A less.

Table 1. Effect of N rate on agronomic performance of water-seeded very early rice varieties and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Tebonnet	69	72	74	77	73	117	123	128	134	126	38/2	65/2	75/3	80/3	6788	7006	6801	6140	6684
Skybonnet	70	72	75	77	73	103	111	116	118	112	15/2	22/3	15/2	52/2	6647	6714	7278	6729	6842
Maybelle	62	62	62	63	62	83	87	90	95	89	10/1	10/1	10/2	10/3	5355	6419	6686	6748	6302
3083	64	65	66	66	65	73	78	81	84	79	0/0	0/0	0/0	0/0	5801	5573	5015	4605	5248
1084	64	64	65	65	65	88	93	95	102	95	0/0	10/1	22/2	77/2	6984	6983	7313	6900	7045
3006	68	69	71	72	70	75	83	84	90	83	0/0	0/0	0/0	0/0	6558	6583	6428	6286	6464
N																			
Mean	66	67	69	70		90	96	99	104						6355	6546	6587	6235	
C.V., %			1.77					3.83									5.46		
LSD (0.01):																			
Nitrogen			1					3									ns		
Variety			1					3									330		
V within N			2					ns									660		
V across N			2					ns									840		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Table 2. Effect of N rate in main crop on grain yields of water-seeded very early rice varieties and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

	Main crop grain yield at 12% moisture					Second crop grain yield at 12% moisture					Total grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	Mean
	(lb/A)														
Tebonnet	6788	7006	6801	6140	6684	2073	1990	1856	2004	1981	8861	8996	8657	8144	8665
Skybonnet	6647	6714	7278	6729	6842	1901	1935	2085	2107	2007	8548	8650	9363	8835	8849
Maybelle	5355	6419	6686	6748	6302	2442	2606	2396	2621	2516	7796	9024	9081	9369	8818
3083	5801	5573	5015	4605	5248	2341	2676	2440	2589	2512	8142	8249	7455	7194	7760
1084	6984	6983	7313	6900	7045	2135	2075	1833	1712	1939	9119	9058	9147	8612	8984
3006	6558	6583	6428	6286	6464	2587	2991	3105	3082	2941	9145	9575	9533	9367	9405
N															
Mean	6355	6546	6587	6235		2247	2379	2286	2352		8602	8925	8873	8587	
C.V., %			5.46					11.19					5.34		
LSD (0.01):															
Nitrogen			ns					ns					ns		
Variety			330					244					439		
V within N			660					ns					878		
V across N			840					ns					1150		

Experiment: Early variety x nitrogen trial

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.2; O.M.: 1.16%; extractable nutrients (mg/kg): P-., Na-48, K-86, Ca-963, Mg-218, Zn-0.20, S-6.20, As-2.72, Fe-52.53

Variety/Seeding Rate: LMNT, GFMT, MARS, MERC, KATY, 2201, RICO, V4716, V7817, CB801, V4916, 2207, JSMN, 150 lb/A

Planting Method/Date: Water-seeded, Apr 11

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate; second crop, 60 lb N/A; 0.54 lb ai/A Zinc chelate, Apr 18

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, RICO, 2207, MERC, Apr 18; V4916, KATY, Apr 19; JSMN, 2201, LMNT, GFMT, V7817, Apr 20; CB801, Apr 21

Water Management: Flooded, Apr 7; drained, Apr 17; reflooded, Apr 20; harvest drainage, Aug 1; second crop flooded, Aug 11; harvest drainage, Oct 24

Herbicides: 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 28; 1.2 oz ai/A Londax, May 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 11, June 6; 1.0 lb ai/A Sevin (carbaryl), July 12, July 27

Fungicides: 0.28 lb ai/A Tilt (propiconazol), June 30

Harvest: Main crop, Aug 10; second crop, Nov 16

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: MARS, MERC, and KATY displayed very good seedling vigor, while vigor of other entries was fair to poor. Lodging was severe for MARS and RICO at high rates of N (Table 3). Blast was quite noticeable in MERC, V4716, and V4916. A N rate of 90 to 150 lb/A resulted in optimum grain yields for most entries (Table 4).

Second crop grain yields were highest for JSMN and V4716, and lowest for Katy. Other entries ranged from 1600 to 2000 lb/A.

Table 3. Effect of N rate on agronomic performance of water-seeded early rice varieties and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						(cm)									(lb/A)				
Lemont	76	78	80	80	79	71	79	81	83	79	0/0	0/0	0/0	0/0	6247	6906	7146	7810	7027
Gulfmont	74	77	76	78	76	76	84	85	86	83	2/1	0/0	2/1	2/1	6982	7284	7235	7703	7301
Mars	77	79	81	83	80	98	106	108	109	105	0/0	37/2	20/1	50/4	6766	7297	7355	7327	7186
Mercury	71	72	72	73	72	77	86	85	90	84	0/0	0/0	0/0	0/0	5339	6215	6275	6195	6006
Katy	75	77	78	80	78	91	101	100	104	99	0/0	2/1	12/2	20/2	6357	6864	6859	7021	6775
2201	73	77	76	77	76	72	78	83	85	80	2/1	0/0	7/1	0/0	6321	7537	7689	7849	7349
Rico 1	81	83	84	84	83	93	103	103	105	101	0/0	32/1	27/1	87/4	8096	8995	8688	7980	8440
V4716	74	74	75	75	75	78	86	91	92	87	0/0	0/0	0/0	0/0	5907	6831	6805	7003	6636
V7817	83	83	84	84	84	74	79	79	82	79	0/0	0/0	0/0	0/0	6574	7425	6887	6785	6918
CB801	84	85	84	84	84	76	77	80	78	78	0/0	0/0	0/0	0/0	6448	6647	6827	6668	6647
V4916	70	71	74	75	73	84	95	99	100	95	0/0	0/0	0/0	22/2	6187	7043	6886	7093	6802
2207	73	75	76	78	75	76	84	83	85	82	0/0	0/0	0/0	12/1	7258	7400	7307	7686	7413
Jasmine 85	86	86	88	90	88	86	91	94	93	91	0/0	0/0	0/0	10/1	7360	7187	7226	6326	7025
N																			
Mean	77	78	79	80		81	89	90	92						6603	7202	7168	7188	
C.V., %			1.21					4.40									6.37		
LSD (0.01):																			
Nitrogen			1					4									593		
Variety			1					4									414		
V within N			2					ns									830		
V across N			2					ns									989		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Table 4. Effect of N rate in main crop on grain yields of water-seeded early rice varieties and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

	Main crop grain yield at 12% moisture					Second crop grain yield at 12% moisture					Total grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	Mean
	(lb/A)														
Lemont	6247	6906	7146	7810	7027	1807	1700	1357	1682	1637	8054	8606	8503	9492	8664
Gulfmont	6982	7284	7235	7703	7301	2125	1857	1907	2178	2017	9106	9141	9142	9880	9317
Mars	6766	7297	7355	7327	7186	1872	1686	1723	1765	1762	8638	8983	9078	9092	8948
Mercury	5339	6215	6275	6195	6006	2018	2126	2048	2183	2094	7358	8342	8323	8378	8100
Katy	6357	6864	6859	7021	6775	1647	1439	1361	1454	1475	8004	8303	8219	8475	8251
2201	6321	7537	7689	7849	7349	1849	1631	1594	1906	1745	8170	9168	9282	9756	9094
Rico 1	8096	8995	8688	7980	8440	1897	1723	1612	1274	1627	9993	10718	10300	9255	10067
V4716	5907	6831	6805	7003	6636	2159	2305	2302	2352	2280	8066	9137	9107	9355	8916
V7817	6574	7425	6887	6785	6918	2075	1672	1599	1181	1632	8649	9096	8485	7966	8549
CB801	6448	6647	6827	6668	6647	2017	1797	1564	1768	1786	8464	8444	8391	8436	8434
V4916	6187	7043	6886	7093	6802	1842	1900	1847	1980	1892	8029	8943	8733	9074	8695
2207	7258	7400	7307	7686	7413	2046	1966	1944	2136	2023	9304	9366	9251	9822	9436
Jasmine	7360	7187	7226	6326	7025	2553	2054	2582	1837	2257	9913	9241	9808	8163	9282
N															
Mean	6603	7202	7168	7188		1993	1835	1803	1823		8596	9038	8971	9011	
C.V., %			6.37					16.26					6.36		
LSD (0.01):															
Nitrogen			593					ns					ns		
Variety			414					280					522		
V within N			830					ns					1047		
V across N			989					ns					1395		

Experiment: Very early variety x nitrogen trial

Location: East Carroll Parish, Buford Perry Farm

Soil Type/Analysis: Sharkey clay; pH: 6.7; O.M.: 2.34%; extractable nutrients (mg/kg): P-., Na-51, K-474, Ca-5918, Mg-1255, Zn-6.11, S-6.61, As-9.24, Fe-90.20

Variety/Seeding Rate: TBNT, SKBT, MBLE, 3083, 1084, 3006, 1105, 100 lb/A

Planting Method/Date: Drill-seeded, May 30

Fertilization: Nitrogen source, urea

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: TBNT, MBLE, 3083, 1084, 3006, 1105, June 10; SKBT, June 11

Water Management: Flushed, June 3, June 20; flooded, July 12; harvest drainage, Sep 14

Herbicides: 5.0 lb ai/A Stam (propanil), July 6; 4.0 lb ai/A Ordram (molinate), July 18; 1.2 oz ai/A Londax (bensulfuron-methyl), July 22

Insecticides: 0.6 lb ai/A Furadan (carbofuran), Aug 7; 0.25 lb ai/A Methyl (methyl parathion), Aug 26

Fungicides: 0.5 lb ai/A Benlate (benomyl), Aug 21, Sep 7

Harvest: Oct 9

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: No differences in emergence were observed. Lodging was severe for TBNT at high rates of N (Table 5). A N rate of 120 to 150 lb/A resulted in optimum grain yields for most entries. High rates of N were required since application of fertilizer N and establishment of the permanent flood were delayed due to poor weather conditions.

Table 5. Effect of N rate on agronomic performance of drill-seeded very early rice varieties and advanced experimental lines. Buford Perry Farm, East Carroll Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Tebonnet	74	74	77	78	76	110	116	127	126	120	0/0	0/0	25/3	50/3	6730	7391	7295	6568	6996
Skybonnet	75	78	79	80	78	99	109	114	116	110	0/0	0/0	0/0	0/0	6227	6408	6860	6903	6599
Maybelle	67	68	69	70	68	74	79	84	89	81	0/0	0/0	0/0	0/0	6127	6687	7487	8000	7075
3083	71	73	74	75	73	73	73	78	80	76	0/0	0/0	0/0	0/0	6543	7043	7874	7896	7339
1084	70	71	72	73	72	82	90	96	100	92	0/0	2/1	0/0	7/1	6676	7056	7465	7242	7110
3006	73	75	75	77	75	73	78	82	85	80	0/0	0/0	0/0	0/0	6976	7700	8216	7823	7671
1105	73	75	76	78	76	82	91	98	107	95	0/0	0/0	0/0	2/1	5879	6651	7177	7525	6808
N																			
Mean	72	74	75	76		85	91	97	100						6451	6987	7482	7422	
C.V., %			1.15					3.64									4.58		
LSD (0.01):																			
Nitrogen			1					4									344		
Variety			1					3									303		
V within N			ns					6									608		
V across N			ns					7									657		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Experiment: Early variety x nitrogen trial

Location: East Carroll Parish, Buford Perry Farm

Soil Type/Analysis: Sharkey clay; pH: 6.2; O.M.: 1.16%; extractable nutrients (mg/kg): P-., Na-55, K-436, Ca-5644, Mg-1226, Zn-6.01, S-6.58, As-8.70, Fe-85.19

Variety/Seeding Rate: LMNT, GFMT, MARS, MERC, KATY, 2201, RICO, V4716, V7817, CB801, V4916, 2207, 100 lb/A

Planting Method/Date: Drill-seeded, May 30

Fertilization: Nitrogen source, urea

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, V4916, V4716, 2207, MERC, June 10; GFMT, KATY, 2201, V7817, June 11; LMNT, RICO, CB801, June 12

Water Management: Flushed, June 3, June 20; flooded, July 12; harvest drainage, Sep 19

Herbicides: 5.0 lb ai/A Stam (propanil), July 6; 4.0 lb ai/A Ordram (molinate), July 18; 1.2 oz ai/A Londax (bensulfuron-methyl), July 22

Insecticides: 0.6 lb ai/A Furadan (carbofuran), Aug 7; 0.25 lb ai/A Methyl (methyl parathion), Aug 26

Fungicides: 0.5 lb ai/A Benlate (benomyl), Aug 21, Sep 7

Harvest: Oct 10

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: Little difference was observed in emergence. MARS and RICO lodged severely at 150 lb N/A (Table 6). A N rate of 90 to 150 lb/A resulted in optimum grain yields for all entries. High rates of N were required since application of fertilizer N and establishment of the permanent flood was delayed due to poor weather conditions. RICO was the highest yielding entry at all rates of N.

Table 6. Effect of N rate on agronomic performance of drill-seeded early rice varieties and advanced experimental lines. Buford Perry Farm, East Carroll Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Lemont	78	79	81	82	80	79	89	85	88	85	0/0	0/0	0/0	0/0	6101	7019	6870	7031	6755
Gulfmont	76	77	78	80	78	76	82	85	87	83	0/0	0/0	0/0	0/0	6391	6876	6976	7295	6885
Mars	75	77	78	79	77	91	102	104	104	100	0/0	10/1	5/1	60/4	6332	7108	7523	6864	6957
Mercury	75	75	76	77	76	76	84	87	91	84	0/0	0/0	0/0	0/0	5295	6175	6511	6744	6181
Katy	78	80	82	83	81	89	103	101	115	102	0/0	0/0	0/0	0/0	5591	6263	6540	6357	6188
2201	78	79	81	82	80	75	78	82	86	81	0/0	0/0	0/0	0/0	6202	6819	7141	7219	6845
Rico 1	74	75	77	78	76	86	95	106	109	99	0/0	0/0	20/2	67/4	7685	8211	8477	8535	8227
V4716	76	77	77	79	77	74	76	81	86	79	0/0	0/0	0/0	0/0	5307	6080	6653	6836	6219
V7817	80	80	82	83	81	78	79	81	85	81	0/0	0/0	0/0	0/0	5974	6648	6675	7118	6604
CB801	80	80	82	83	81	74	83	82	83	81	0/0	0/0	0/0	0/0	5512	6099	6744	6728	6271
V4916	75	75	77	78	76	87	95	98	101	95	0/0	0/0	0/0	0/0	5551	6317	6496	6923	6322
2207	78	80	81	82	80	77	83	85	88	83	0/0	0/0	0/0	0/0	6158	6858	6819	7209	6761
N																			
Mean	77	78	79	81		80	87	90	94						6008	6706	6952	7072	
C.V., %			0.97					5.01									4.87		
LSD (0.01):																			
Nitrogen			1					2									332		
Variety			1					4									301		
V within N			ns					8									ns		
V across N			ns					8									ns		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Experiment: Very early variety x nitrogen trial

Location: Vermilion Parish, Errol Lounsberry Farm

Soil Type/Analysis: Crowley silt loam; pH: 5.1; O.M.: 1.26%; extractable nutrients (mg/kg): P-., Na-40, K-58, Ca-838, Mg-136, Zn-0.81, S-10.93, As-2.72, Fe-106.55

Variety/Seeding Rate: TBNT, SKBT, MBLE, 150 lb/A

Planting Method/Date: Water-seeded, Mar 20

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate; second crop, 60 lb N/A; 0.54 lb ai/A Zinc chelate, Apr 18

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MBLE, Mar 28; TBNT, Mar 30; SKBT, Mar 31

Water Management: Flooded, Mar 17; drained, Mar 25; reflooded, Mar 28; harvest drainage, July 12; second crop flooded, Aug 5; harvest drainage, Oct 3

Herbicides: 3.5 lb ai/A Ordram (molinate), Mar 15; 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 13, Apr 28

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 6

Fungicides: 0.22 lb ai/A Tilt (propiconazol), June 2, June 17

Harvest: Main crop, July 28; second crop, Oct 24

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: MBLE displayed good emergence through the water while vigor of other entries was poor. Lodging was moderate for TBNT at high rates of N (Table 7). A N rate of 60 lb/A resulted in optimum grain yields for TBNT and SKBT, while MBLE required 90 lb/A (Table 8).

Second crop grain yields were high for all entries, with MBLE producing the highest total grain yield.

Table 7. Effect of N rate on agronomic performance of water-seeded very early rice varieties and advanced experimental lines. Errol Lounsberry Farm, Vermilion Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Tebonnet	78	80	82	82	80	109	117	119	116	115	5/1	17/3	40/3	60/3	6469	5640	5044	4002	5289
Skybonnet	78	79	80	83	80	95	106	103	105	102	0/0	0/0	0/0	0/0	5697	5529	5249	4660	5284
Maybelle	69	70	70	73	71	81	90	86	86	86	0/0	2/1	2/1	2/1	5430	6050	5385	5635	5625
N																			
Mean	75	76	78	79		95	104	103	102						6451	6987	7482	7422	
C.V., %			1.01					2.76									7.76		
LSD (0.01):																			
Nitrogen			1					ns									840		
Variety			1					3									ns		
V within N			1					ns									828		
V across N			2					ns									1076		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Table 8. Effect of N rate in main crop on grain yields of water-seeded very early rice varieties and advanced experimental lines. Errol Lounsberry Farm, Vermilion Parish, LA. 1989.

	Main crop grain yield at 12% moisture					Second crop grain yield at 12% moisture					Total grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	Mean
								(lb/A)							
Tebonnet	6469	5640	5044	4002	5289	2776	2637	3021	2745	2795	9245	8277	8065	6747	8084
Skybonnet	5697	5529	5249	4660	5284	3243	2879	2633	3006	2940	8940	8408	7882	7665	8224
Maybelle	5430	6050	5385	5635	5625	3110	2886	2768	3155	2980	8540	8936	8153	8790	8605
N															
Mean	6451	6987	7482	7422		3043	2800	2807	2969		8909	8540	8033	7734	
C.V., %			7.76					6.20					5.52		
LSD (0.01):															
Nitrogen			840					ns					951		
Variety			ns					178					454		
V within N			828					356					907		
V across N			1076					461					571		

Experiment: Early variety x nitrogen trial

Location: Vermilion Parish, Errol Lounsberry Farm

Soil Type/Analysis: Crowley silt loam; pH: 4.9; O.M.: 1.18%; extractable nutrients (mg/kg): P-., Na-22, K-58, Ca-614, Mg-86, Zn-0.92, S-9.45, As-2.72, Fe-130.85

Variety/Seeding Rate: LMNT, GFMT, MARS, MERC, KATY, 2201, RICO, V4716, V7817, CB801, V4916, 2207, 150 lb/A

Planting Method/Date: Water-seeded, Mar 20

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate; second crop, 60 lb N/A; 0.54 lb ai/A Zinc chelate, Apr 18

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, MERC, Mar 28; 2207, Mar 29; 2201, KATY, V7817, V4916, V4716, Mar 30; LMNT, GFMT, RICO, CB801, Mar 31

Water Management: Flooded, Mar 17; drained, Mar 25; reflooded, Mar 28; harvest drainage, July 12; second crop flooded, Aug 5; harvest drainage, Oct 3

Herbicides: 3.5 lb ai/A Ordram (molinate), Mar 15; 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 13, Apr 28;

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 6

Fungicides: 0.22 lb ai/A Tilt (propiconazol), June 2, June 17

Harvest: Main crop, Aug 2; second crop, Oct 23

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: MARS, MERC, and KATY displayed good seedling vigor, while vigor of other entries was fair to poor. Lodging was moderate to severe for RICO at all rates of N (Table 9). Lodging also occurred in the semidwarf entries LMNT, GFMT, 2201, and 2207 as the result of severe sheath blight. A N rate of 60 lb/A resulted in optimum grain yields for most entries (Table 10). Higher rates resulted in yield reductions.

Second crop grain yields ranged from 2100 to 2650 lb/A for all entries except RICO, V7817, and CB801, which yielded significantly less.

Table 9. Effect of N rate on agronomic performance of water-seeded early rice varieties and advanced experimental lines. Errol Lounsberry Farm, Vermilion Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Lemont	81	82	83	85	83	77	81	85	86	82	5/1	17/2	27/2	52/3	5678	5375	5067	4962	5270
Gulfmont	79	80	81	84	81	79	83	83	83	82	7/1	15/2	35/3	35/3	5358	5213	5228	4897	5174
Mars	86	87	88	89	87	98	102	109	106	104	10/1	7/1	47/4	62/4	5838	5997	4985	4264	5271
Mercury	82	83	84	85	84	79	84	86	87	84	0/0	0/0	2/1	0/0	6201	6390	6023	5731	6087
Katy	81	82	85	87	84	93	99	102	104	100	0/0	0/0	27/3	67/4	4728	4903	4447	3791	4467
2201	80	80	81	83	81	77	79	84	82	80	7/1	22/2	20/2	42/4	6024	5763	5390	5035	5553
Rico 1	84	85	87	88	86	94	96	99	97	96	20/2	62/3	85/5	82/5	6804	6620	5243	4407	5769
V4716	82	82	83	84	83	80	82	86	85	83	0/0	0/0	0/0	0/0	4534	4758	4802	4516	4653
V7817	91	90	90	90	90	75	76	78	78	77	0/0	10/1	0/0	0/0	5614	5304	4992	4898	5202
CB801	90	91	90	92	91	77	77	78	78	78	0/0	0/0	0/0	0/0	5086	5004	5478	4927	5124
V4916	81	80	81	82	81	83	86	91	93	88	0/0	0/0	0/0	0/0	3824	4547	4229	4401	4250
2207	82	83	85	86	84	78	79	81	85	81	0/0	0/0	2/1	27/3	5592	5601	5316	5104	5403
N																			
Mean	83	84	85	86		82	85	89	89						5440	5456	5100	4745	
C.V., %			1.01					3.68									8.99		
LSD (0.01):																			
Nitrogen			1					4									439		
Variety			1					3									431		
V within N			2					ns									863		
V across N			2					ns									934		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Table 10. Effect of N rate in main crop on grain yields of water-seeded early rice varieties and advanced experimental lines. Errol Lounsberry Farm, Vermilion Parish, LA. 1989.

Variety	Main crop grain yield at 12% moisture					Second crop grain yield at 12% moisture					Total grain yield at 12% moisture				
	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	Mean
	(lb/A)														
Lemont	5678	5375	5067	4962	5270	2377	2386	2462	2259	2371	8055	7761	7529	7220	7641
Gulfmont	5358	5213	5228	4897	5174	2729	2594	2592	2698	2653	8088	7807	7821	7595	7828
Mars	5838	5997	4985	4264	5271	1955	2391	2556	2143	2261	7793	8389	7541	6408	7532
Mercury	6201	6390	6023	5731	6087	2080	2028	2241	2002	2088	8282	8419	8264	7733	8174
Katy	4728	4903	4447	3791	4467	1988	2172	2151	2490	2200	6715	7075	6598	6280	6667
2201	6024	5763	5390	5035	5553	2628	2395	2545	2155	2431	8652	8158	7935	7190	7984
Rico 1	6804	6620	5243	4407	5769	1580	1300	1439	1434	1438	8384	7919	6683	5841	7207
V4716	4534	4758	4802	4516	4653	2006	2277	2310	2257	2212	6540	7035	7112	6773	6865
V7817	5614	5304	4992	4898	5202	1493	1427	1690	1399	1502	7106	6730	6683	6298	6704
CB801	5086	5004	5478	4927	5124	1857	1726	1421	1663	1667	6942	6730	6899	6590	6790
V4916	3824	4547	4229	4401	4250	2153	1978	2361	2246	2185	5977	6525	6590	6647	6435
2207	5592	5601	5316	5104	5403	2354	2403	2537	2601	2474	7945	8004	7853	7706	7877
N															
Mean	5440	5456	5100	4745		2100	2090	2192	2112		7540	7546	7292	6857	
C.V., %			8.99					11.28					7.20		
LSD (0.01):															
Nitrogen			439					ns					ns		
Variety			431					221					487		
V within N			863					443					975		
V across N			934					561					1203		

Experiment: Early variety x nitrogen trial

Location: Rapides Parish, Will Bollich Farm

Soil Type/Analysis: Moreland silty clay; pH: 7.3; O.M.: 2.54%; extractable nutrients (mg/kg): P-., Na-42, K-264, Ca-3694, Mg-921, Zn-4.07, S-8.67, As-9.24, Fe-57.72

Variety/Seeding Rate: LMNT, GFMT, MARS, MERC, KATY, 2201, RICO, V4716, V7817, CB801, V4916, 2207, 150 lb/A

Planting Method/Date: Water-seeded, May 5

Fertilization: Nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, MERC, May 7; 2207, KATY, 2201, V4716, V4916, RICO, May 8; LMNT, GFMT, V7817, May 9; CB801, May 10

Water Management: Flooded, May 4; drained, May 8; flooded, May 12; drained, May 27; flushed, May 31; flooded, June 7; harvest drainage, Aug 22

Herbicides: 4.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran, (bentazon), June 6

Insecticides: 0.25 lb ai/A Methyl (methyl parathion), July 19

Fungicides: 0.25 lb ai/A Monceren (pencycuron), July 7, July 19

Harvest: Sep 5

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: The medium-grain entries and experimental long-grain 2207 emerged through the water before the other long-grain entries. No lodging was observed for any entry at even the highest rate of fertilizer N (Table 11). Difficulties in water management probably reduced the efficiency of the applied N and decreased the risk of lodging. All entries responded to 150 lb/A, which also indicates that some loss of N occurred during the study. RICO, 2207, and 2201 were the highest yielding entries in the test. Grain yields of MERC, V4716, V7817, and V4916 were the lowest.

Table 11. Effect of N rate on agronomic performance of water-seeded early rice varieties and advanced experimental lines. Will Bollich Farm, Rapides Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Lemont	80	81	82	82	81	72	71	79	77	75	0/0	0/0	0/0	0/0	5694	6680	7152	7060	6646
Gulfmont	77	78	80	81	79	73	72	79	78	76	0/0	0/0	0/0	0/0	5647	6407	6626	7210	6473
Mars	82	81	82	82	82	97	96	103	98	99	0/0	0/0	0/0	0/0	6342	6187	6624	6594	6437
Mercury	78	78	78	80	79	79	77	85	84	81	0/0	0/0	0/0	0/0	5146	5634	6432	6744	5989
Katy	79	80	84	84	82	86	85	102	100	93	0/0	0/0	0/0	0/0	5696	5854	6683	6930	6291
2201	80	80	82	82	81	74	73	80	78	76	0/0	0/0	0/0	0/0	6194	6755	6780	7529	6814
Rico 1	83	81	81	83	82	86	90	94	96	92	0/0	0/0	0/0	0/0	6858	7677	7601	7856	7498
V4716	80	79	79	79	79	73	72	80	78	76	0/0	0/0	0/0	0/0	5220	5850	5539	5959	5642
V7817	88	88	88	88	88	72	71	71	72	72	0/0	0/0	0/0	0/0	5632	5848	5556	5971	5752
CB801	87	87	87	88	87	71	68	77	71	72	0/0	0/0	0/0	0/0	5701	5937	6787	6343	6192
V4916	75	76	76	76	76	80	84	90	90	86	0/0	0/0	0/0	0/0	5369	5290	5482	6835	5744
2207	80	80	80	81	80	73	72	78	78	75	0/0	0/0	0/0	0/0	6346	6639	7148	7740	6968
N																			
Mean	81	81	82	82		78	78	85	84						5820	6230	6534	6897	
C.V., %			2.20					4.62									8.58		
LSD (0.01):																			
Nitrogen			1					ns									763		
Variety			2					3									505		
V within N			ns					7									ns		
V across N			ns					11									ns		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Experiment: Early variety x nitrogen trial

Location: Morehouse Parish, Zaunbrecher Farm

Soil Type/Analysis: Hebert silty clay; pH: 6.4; O.M.: 2.36%; extractable nutrients (mg/kg): P-., Na-103, K-300, Ca-2791, Mg-851, Zn-2.04, S-6.30, As-6.52, Fe-127.95

Variety/Seeding Rate: LMNT, GFMT, MARS, MERC, KATY, 2201, RICO, V4716, V7817, CB801, V4916, 2207, 150 lb/A

Planting Method/Date: Water-seeded, June 2

Fertilization: Nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, MERC, 2207, KATY, V7817, June 6; V4916, RICO, LMNT, GFMT, V7817, CB801, June 7

Water Management: Flooded, June 1; drained, June 4; reflooded, June 11; drained, June 17; reflooded, June 20; harvest drainage, Sep 12

Herbicides: 4.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran, (bentazon), June 19; 1.2 oz ai/A Londax (bensulfuron-methyl), July 6

Insecticides: 0.6 lb ai/A Furadan (carbofuran), July 6

Fungicides: 0.28 lb ai/A Tilt (propiconazol), Aug 14

Harvest: Sep 26

Experimental Design: Split plot in a randomized complete block with four replications, N assigned to main plots and varieties to subplots

Comments: No differences were observed in emergence through the water. Growing conditions were excellent after seeding. MARS and RICO lodged severely at high rates of N, and this was reflected in the grain yields (Table 12). LMNT, GFMT, 2201, and RICO required 60 lb N/A for optimum grain yields. Grain yield of MERC increased as N increased, although it was the lowest yielding entry in the test. MARS, KATY, V4716, CB801, V4916, 2207, and V7817 responded to higher rates of N. Grain yields were highest for LMNT, GFMT, 2201, RICO, and 2207.

Table 12. Effect of N rate on agronomic performance of water-seeded early rice varieties and advanced experimental lines. Zaunbrecher Farm, Morehouse Parish, LA. 1989.

	N rate (lb/A)																		
	Days to 50% heading					Plant height					% Lodging/type*				Grain yield at 12% moisture				
Variety	60	90	120	150	Mean	60	90	120	150	Mean	60	90	120	150	60	90	120	150	Mean
						------------(cm)-----------									-------------(lb/A)-------------				
Lemont	75	74	77	78	76	69	74	78	82	76	0/0	0/0	0/0	0/0	8803	8730	8489	8192	8554
Gulfmont	71	73	75	76	74	72	75	79	83	77	0/0	0/0	0/0	0/0	8426	8258	8284	8293	8315
Mars	73	73	74	75	74	96	98	102	109	101	0/0	0/0	30/3	37/3	8409	8696	7875	7379	8090
Mercury	70	72	73	75	72	71	76	80	85	78	0/0	0/0	0/0	2/1	6614	6709	6807	7411	6885
Katy	71	71	76	78	74	91	90	102	109	98	0/0	0/0	10/1	37/2	8143	8080	8333	7391	7987
2201	73	73	75	75	74	70	72	77	78	74	0/0	0/0	0/0	0/0	8665	8564	8537	8479	8561
Rico 1	73	74	76	77	75	92	94	98	103	97	7/1	20/1	52/4	77/4	9882	9604	7879	7318	8671
V4716	72	71	72	73	72	71	72	74	84	75	0/0	0/0	0/0	0/0	6182	7184	7644	7479	7122
V7817	80	79	80	80	80	67	68	72	76	71	0/0	0/0	0/0	0/0	6518	7030	7082	7429	7015
CB801	80	80	80	81	80	68	70	71	76	71	0/0	0/0	0/0	0/0	6755	7432	7683	7225	7274
V4916	67	68	71	72	70	81	85	91	97	89	0/0	0/0	0/0	0/0	6346	7896	8307	8270	7705
2207	73	74	76	77	75	74	75	80	84	78	0/0	0/0	0/0	0/0	8979	9220	8847	8834	8970
N																			
Mean	73	74	75	76		77	79	84	89						7810	8117	7981	7808	
C.V., %			1.77					2.92									6.28		
LSD (0.01):																			
Nitrogen			2					6									ns		
Variety			1					2									460		
V within N			2					4									922		
V across N			3					8									1100		

* Lodging rate in percent/lodging type on a scale of 1 to 5, where 1 = leaning and 5 = complete.

Table 13. Milling yields for very early and early rice varieties and advanced experimental lines. 1989.

	Location*				
Entry	Rice Research Station	East Carroll Parish	Vermilion Parish	Rapides Parish	Morehouse Parish
Very early	(% head - % total)				
Tebonnet	54 - 67	61 - 70	40 - 60	-	-
Skybonnet	57 - 67	63 - 70	52 - 64	-	-
Maybelle	56 - 67	63 - 70	57 - 69	-	-
3083	49 - 66	60 - 70	-	-	-
1084	56 - 69	62 - 70	-	-	-
3006	55 - 68	60 - 68	-	-	-
1105	-	57 - 71	-	-	-
Early					
Lemont	60 - 70	68 - 72	51 - 64	58 - 69	63 - 71
Gulfmont	60 - 69	66 - 70	49 - 64	59 - 69	63 - 71
Mars	63 - 68	68 - 70	61 - 66	60 - 67	67 - 71
Mercury	63 - 69	66 - 70	60 - 67	61 - 70	61 - 71
Katy	57 - 67	63 - 67	45 - 61	55 - 67	60 - 68
2201	59 - 69	68 - 71	48 - 64	55 - 69	61 - 71
Rico 1	54 - 67	55 - 73	56 - 65	63 - 70	63 - 70
V4716	67 - 70	71 - 72	58 - 64	66 - 71	71 - 72
V7817	50 - 66	60 - 69	47 - 62	51 - 66	59 - 66
CB801	47 - 65	60 - 68	47 - 61	50 - 66	61 - 68
V4916	68 - 71	71 - 73	56 - 63	65 - 72	69 - 72
2207	59 - 68	68 - 71	46 - 62	59 - 69	65 - 71
Jasmine 85	41 - 64	-	-	-	-

* (-) indicates a variety or experimental line was not grown at that location.

Table 14. Growth stage information for the DD-50 Rice Management Program. Water-seeded rice varieties and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

Variety	Emergence date	First tiller	Green ring	Panicle 2mm	Date of 50% heading
<u>Very Early</u>					
Tebonnet	4-20	5-09	5-27	6-03	7-01
Skybonnet	4-20	5-06	5-25	6-02	7-01
Maybelle	4-19	5-04	5-24	5-31	6-20
3083	4-20	5-09	5-27	6-03	6-24
1084	4-18	5-08	5-24	5-31	6-21
3006	4-19	5-08	5-27	6-02	6-27
<u>Early</u>					
Lemont	4-20	5-08	6-01	6-10	7-07
Gulfmont	4-20	5-09	6-02	6-11	7-06
Mars	4-18	5-08	6-01	6-11	7-06
Mercury	4-18	5-06	6-02	6-10	6-29
Katy	4-19	5-08	6-02	6-09	7-05
2201	4-20	5-09	5-31	6-10	7-06
Rico 1	4-18	5-05	6-07	6-16	7-10
V4716	4-20	5-06	5-29	6-10	7-03
V7817	4-20	5-08	6-02	6-17	7-12
CB801	4-21	5-09	6-04	6-16	7-15
V4916	4-19	5-04	6-01	6-09	7-01
2207	4-18	5-04	5-30	6-10	7-06
Jasmine 85	4-20	5-09	6-07	6-17	7-15

Table 15. Growth stage information for the DD-50 Rice Management Program. Drill-seeded rice varieties and advanced experimental lines. Buford Perry Farm, East Carroll Parish, LA. 1989.

Variety	Emergence date	First tiller	Green ring	Panicle 2mm	Date of 50% heading
<u>Very Early</u>					
Tebonnet	6-10	6-27	7-20	8-06	8-23
Skybonnet	6-11	6-27	7-20	8-08	8-27
Maybelle	6-10	6-26	7-18	7-28	8-17
3083	6-10	6-26	7-20	8-01	8-22
1084	6-10	6-26	7-22	7-31	8-20
3006	6-10	6-27	7-22	8-03	8-24
1105	6-10	6 27	7-19	8-04	8-24
<u>Early</u>					
Lemont	6-12	6-26	7-26	8-08	8-31
Gulfmont	6-11	6-27	7-25	8-08	8-27
Mars	6-10	6-27	7-25	8-06	8-28
Mercury	6-10	6-26	7-26	8-05	8-26
Katy	6-11	6-28	7-26	8-08	8-30
2201	6-11	6-27	7-23	8-06	8-29
Rico 1	6-12	6-26	7-29	8-06	8-30
V4716	6-10	6-28	7-25	8-07	8-28
V7817	6-11	6-28	7-28	8-10	8-30
CB801	6-12	6-27	7-28	8-11	8-31
V4916	6-10	6-27	7-25	8-04	8-26
2207	6-10	6-26	7-23	8-09	8-29

Table 16. Growth stage information for the DD-50 Rice Management Program. Water-seeded rice varieties and advanced experimental lines. Errol Lounsberry Farm, Vermilion Parish, LA. 1989.

Variety	Emergence date	First tiller	Green ring	Panicle 2mm	Date of 50% heading
<u>Very Early</u>					
Tebonnet	3-30	4-22	5-16	5-24	6-16
Skybonnet	3-31	4-21	5-15	5-23	6-17
Maybelle	3-28	4-21	5-13	5-19	6-05
<u>Early</u>					
Lemont	3-31	4-18	5-19	5-26	6-21
Gulfmont	3-31	4-21	5-19	5-26	6-19
Mars	3-28	4-18	5-20	5-26	6-23
Mercury	3-28	4-19	5-21	5-26	6-22
Katy	3-30	4-21	5-22	5-28	6-20
2201	3-30	4-19	5-19	5-26	6-18
Rico 1	3-31	4-21	5-22	5-29	6-24
V4716	3-30	4-23	5-19	5-27	6-20
V7817	3-30	4-26	5-22	5-31	6-28
CB801	3-31	4-26	5-22	5-31	6-30
V4916	3-30	4-19	5-19	5-27	6-18
2207	3-29	4-19	5-19	5-27	6-20

Table 17. Growth stage information for the DD-50 Rice Management Program. Water-seeded rice varieties and advanced experimental lines. Will Bollich Farm, Rapides Parish, LA. 1989.

Variety	Emergence date	First* tiller	Green ring	Panicle 2mm	Date of 50% heading
Early					
Lemont	5-09	----	6-21	6-30	7-29
Gulfmont	5-09	----	6-22	7-01	7-26
Mars	5-07	----	6-23	7-02	7-27
Mercury	5-07	----	6-23	7-01	7-24
Katy	5-08	----	6-22	7-03	7-27
2201	5-08	----	6-21	7-02	7-27
Rico 1	5-08	----	6-28	7-05	7-28
V4716	5-08	----	6-22	7-01	7-26
V7817	5-09	----	6-26	7-11	8-05
CB801	5-10	----	6-29	7-11	8-05
V4916	5-08	----	6-21	6-30	7-23
2207	5-08	----	6-21	7-01	7-27

* Data not taken.

Table 18. Growth stage information for the DD-50 Rice Management Program. Water-seeded rice varieties and advanced experimental lines. Zaunbrecher Farm, Morehouse Parish, LA. 1989.

Variety	Emergence date	First tiller	Green ring	Panicle 2mm	Date of 50% heading
<u>Early</u>					
Lemont	6-07	6-20	7-12	7-25	8-20
Gulfmont	6-07	6-21	7-11	7-26	8-19
Mars	6-06	6-18	7-10	7-26	8-18
Mercury	6-06	6-19	7-11	7-23	8-17
Katy	6-06	6-18	7-12	7-26	8-16
2201	6-07	6-20	7-10	7-26	8-19
Rico 1	6-07	6-20	7-15	7-28	8-20
V4716	6-07	6-20	7-12	7-24	8-17
V7817	6-06	6-20	7-14	7-30	8-24
CB801	6-07	6-21	7-14	7-30	8-26
V4916	6-07	6-19	7-12	7-21	8-14
2207	6-06	6-19	7-09	7-25	8-19

EVALUATION OF COMMERCIAL VARIETIES, HYBRIDS, AND ADVANCED EXPERIMENTAL LINES FOR STRAIGHTHEAD

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

A straighthead evaluation nursery was established at the Rice Research Station, Crowley, LA, in 1988. Sixty-seven entries were screened in 1989 for reaction to arsenic (As)-induced straighthead. Included in the nursery were 29 commercial varieties, both public and private, 4 private hybrid lines, 2 private advanced experimental lines, and 27, 2, 2, and 1 advanced experimental lines from the rice varietal development programs of Louisiana, Texas, Arkansas, and Mississippi, respectively.

MATERIALS AND METHODS

The nursery was established on a Crowley silt loam soil. Approximately 120 lb N/A and 60 lb/A P_2O_5 and K_2O were banded 2 inches deep prior to planting. Arsenic as MSMA (monosodium salt of methylarsonic acid) was surface applied at the rate of 2 lb As/A, and the test area was flooded 3 days later. Presoaked seed of each entry was seeded at the rate of 150 lb/A. The test area was drained for 3 days to encourage seedling anchorage. A shallow, permanent flood was then established. Pest control (weeds, insects, disease) was practiced as necessary. Evaluations for straighthead reaction were made at maturity, with each entry being rated on a scale of 0 to 9, based on the estimated percentage of normal grain yield. A rating of 0 indicated that there was no damage or apparent symptoms present, and was considered to be highly resistant. A rating of 9 indicated that no grain was produced due to severe damage, and was considered to be highly susceptible. Results of the evaluation are shown in Table 1.

Experiment: Straighthead evaluation

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 7.0; O.M.: 0.93%; extractable nutrients (mg/kg): P-., Na-120, K-89, Ca-1562, Mg-345, Zn-0.97, S-7.47, As-4.58, Fe-53.78

Variety/Seeding Rate: 67 entries, 150 lb/A

Planting Method/Date: Water-seeded, May 15

Fertilization: 60 lb/A P_2O_5 and K_2O + 120 lb N/A ppi

Plot Size: 4 x 6 ft (24 ft^2)

Emergence Date: May 18

Water Management: Flooded, May 15; drained, May 16; reflooded, May 18; harvest drainage, Aug 31

Herbicides: 1.2 oz ai/A Londax (bensulfuron-methyl), May 31; 0.9 oz ai/A Londax, June 7

Insecticides: 0.6 lb ai/A Furadan (carbofuran), June 6, June 15

Fungicides: None

Harvest: Straighthead evaluation, Aug 31

Experimental Design: Completely randomized with 67 entries and 2 replications

Comments: Straighthead reaction ranged from resistant to very susceptible, with most entries exhibiting some degree of susceptibility to straighthead.

Table 1. Straighthead evaluation for commercial rice varieties, hybrids, and advanced experimental lines. Rice Research Station, Crowley, LA. 1989.

Entry	Grain type*	Rating**
CB801	L	7.5
Jasmine	L	7.0
V7817	L	7.0
8703083	L	7.0
A301	L	6.5
V4916	M	6.5
Toro 2	L	6.5
8902218	M	6.0
V4716	M	6.0
8902213	M	5.5
AS 3058	M	5.5
8902212	L	5.5
8902226	L	5.0
Leah	L	4.5
8902225	L	4.5
8702005	L	4.5
V7035	L	4.5
8902214	M	4.5
8701105	L	4.0
8902227	L	4.0
Rexmont	L	4.0
8802204	L	4.0
8902203	L	4.0
8902216	L	4.0
Mercury	M	4.0
8804014	L	4.0
8802210	L	4.0
Skybonnet	L	3.5
8902217	L	3.5
8702106	L	3.5
RAX 2003	L	3.5
IRGA 409	L	3.5
8502186	L	3.5
8902215	L	3.0
Della	L	3.0
Starbonnet	L	3.0
8502201	L	3.0
8603006	L	3.0
8902224	L	3.0
8802205	L	3.0
Katy	L	3.0
Tebonnet	L	3.0
Mars	M	2.5
RAX 2233	L	2.5
8902209	L	2.5

Continued.

Table 1. Continued.

Entry	Grain type*	Rating**
8902228	L	2.5
L202	L	2.5
Saturn	M	2.5
8902202	L	2.0
8902223	L	2.0
AS 3510	L	2.0
Newbonnet	L	2.0
8802211	L	2.0
RAX 2041	L	2.0
Maybelle	L	2.0
Lemont	L	2.0
Pecos	M	2.0
Lebonnet	L	2.0
8701084	L	2.0
RAX 2235	L	2.0
Labelle	L	1.5
Nato	M	1.5
Gulfmont	L	1.5
8902206	L	1.0
Rico 1	L	1.0
8802207	L	1.0
8902208	L	1.0

* L = long grain, M = medium grain.

** Rating based on a scale from 0 to 9, where 0 = resistant and 9 = highly susceptible.

EFFECT OF N RATE AND TIMING ON PERFORMANCE, GRAIN YIELD, AND YIELD COMPONENTS OF LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Nitrogen (N) fertilization greatly influences the yield potential of rice. The N requirement varies among rice varieties and may be affected by environmental influences and management practices. Placement and timing of fertilizer N application and water management both impact N efficiency.

Numerous approaches to fertilizer N management are available to the producer, depending on the cultural system used. The total N requirement can be applied preplant incorporated prior to flooding in the water-seeded, continuous or pinpoint flood cultural system, or preflood in the dry-seeded cultural system. In some situations it is desirable to apply a split application of N in either system. Split applications may be necessary when there is a lack of precision in placement of large amounts of fertilizer product. Difficulties or delays in flooding large areas in a short period of time could also necessitate the use of split applications. Research, however, has shown that there is generally no advantage to using split applications when proper management practices are followed. Inadequate amounts of basal N or improperly timed topdress applications could actually lead to decreased grain yield. When applying split applications, enough basal N should be applied to maintain the rice plant through the tillering stage and into early reproductive growth. Topdress applications of N need to be applied before severe N deficiency occurs. This approach usually results in grain yields comparable to those of the single preplant or preflood N application. Multiple topdress applications should be avoided in order to reduce N inefficiency and input cost.

Single preplant or preflood N applications and two-way or multiple split applications have been practiced commercially in rice producing areas of the southern United States. The objectives of this study are to 1) determine the effect of N rate and time of application on performance, grain yield, and grain yield components of Lemont rice in different environments and in both cultural systems, and 2) compare the various approaches to fertilizer management.

MATERIALS AND METHODS

The long-grain semidwarf variety Lemont was used in all experiments. Nitrogen rates of 0, 30, 60, 90, 120, 150, and 180 lb/A were banded approximately 2 inches deep 1 to 2 days prior to flooding in the water-seeded experiments. In soils requiring P and K, approximately 60 lb/A P_2O_5 and K_2O were also banded with N as ammonium sulfate. The 90 and 120 lb N/A rates were also split to provide two-thirds to three-fourths preplant with the remaining N being applied at panicle initiation (green ring). The 180 lb N/A rate was also applied as a three-way split, providing two-thirds preplant, with the remaining one-third being applied in two applications of 30 lb each at panicle differentiation (panicle 2 mm) and 10 days after panicle differentiation. In drill-seeded experiments, basal N treatments were applied as a broadcast application prior to establishment of the permanent flood, and the split applications were applied as in the water-seeded experiments.

Water-seeded experiments were seeded at the rate of 150 lb/A with presoaked seed. After 3 to 4 days, the experiments were drained briefly to promote seedling anchorage. A permanent flood was established 2 to 3 days after drainage, never allowing the soil to dry.

In drill-seeded experiments, Lemont was seeded at 100 lb/A and flushed periodically until the permanent flood was established (4 to 5 weeks after planting). Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, lodging, grain moisture, and grain yield were measured. Yield components were determined.

SUMMARY AND CONCLUSIONS

Field experiments were conducted at the Rice Research Station and in East Carroll, Morehouse, and Rapides parishes to determine the influence of N rate and timing on performance, grain yield, and yield components of Lemont rice.

Nitrogen requirements for optimum grain yield in water- and drill-seeded experiments varied according to location. Optimum range of N was between 60 and 180 lb/A, and in most instances a single application of N was sufficient. A single application of the optimum rate of N compared favorably with the 2-way splits of the same amount when enough N was applied as a basal application. In the water-seeded experiments at the Rice Research Station and in Rapides Parish, yields were slightly reduced when a 90 lb/A N rate was split and was probably due to the occurrence of N deficiency prior to topdress application (Tables 1 and 4). A slight yield advantage was observed in the drill-seeded experiment in Rapides Parish when 120 lb N/A was split when compared to a single application of an equivalent amount (Table 3). The 3-way split of 180 lb N/A was more efficient when compared to a single 180 lb/A application in the drill-seeded experiment in Rapides Parish and in the water-seeded experiments at the Rice Research Station and in Morehouse Parish (Tables 1, 3, and 5). The drill-seeded experiment in Rapides Parish was the only one that required 180 lb N/A to obtain maximum grain yield and was due to poor efficiency of the preflood N applications.

All other locations required 120 lb N/A or less. The highest grain yields occurred in Morehouse Parish and exceeded 8000 lb/A. Only 60 lb N/A was required at the Morehouse location.

Whole plant weight, number of panicles, and sterile florets tended to increase as N increased. Panicle and grain weight also increased except in Morehouse Parish, where little difference was observed in any of the yield components. Rate of N rather than method of application appeared to have the most influence on yield components.

Experiment: Nitrogen rate x timing study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.5; O.M.: 1.12%; extractable nutrients (mg/kg): P-., Na-66, K-60, Ca-1091, Mg-220, Zn-0.24, S-6.34, As-3.70, Fe-93.59

Variety/Seeding Rate: LMNT, 150 lb/A

Planting Method/Date: Water-seeded, Apr 21

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate; 0.54 lb ai/A zinc chelate, June 7

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: Apr 28

Water Management: Flooded, Apr 20; drained, Apr 24; reflooded, Apr 27; harvest drainage, Aug 8

Herbicides: 1.2 oz ai/A Londax (bensulfuron-methyl), May 9; 0.9 oz ai/A Londax, May 23

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 17, May 24, May 30, June 6

Fungicides: 0.28 lb ai/A Tilt (propiconazol), June 30

Harvest: Aug 17

Experimental Design: Randomized complete block with four replications of 10 N rate x timing treatment combinations

Comments: Moderate N deficiency was evident 5 weeks after emergence at 30 lb/A. Root pruning by the rice water weevil caused severe bronzing, requiring an application of zinc chelate. Days to 50% heading and plant height increased with increasing N (Table 1). Optimum grain yield occurred at a N rate of 90 lb/A.

Table 1. Effect of N rate and timing on performance, grain yield, and yield components of water-seeded Lemont rice. Rice Research Station, Crowley, LA. 1989.

Total N	Time of N*: PP	PI	PD	PD + 10 days	Days to 50% heading	Plant height	Grain yield at 12% moisture	Whole plant	Panicles	Panicle weight	Grain weight	Panicle weight	Grain weight	Sterile florets	Filled grains
----------(lb/A)----------						(cm)	(lb/A)	(g/3 ft^2)	(no/3 ft^2)	----(g/3 ft^2)----		(g/20 panicles)		(no/20 panicles)	
0	--	--	--	--	75	68	5905	321	102	199	187	44	41	221	1577
30	30	--	--	--	74	71	6455	393	127	235	223	42	40	160	1543
60	60	--	--	--	75	75	7068	472	146	274	259	41	39	196	1465
90	90	--	--	--	75	81	7667	499	157	280	263	35	33	169	1308
90	60	30	--	--	74	76	7302	490	139	276	260	41	39	181	1507
120	120	--	--	--	77	83	7653	581	180	309	291	40	38	207	1473
120	90	30	--	--	75	79	7537	547	172	297	280	38	36	214	1409
150	150	--	--	--	78	82	6965	568	188	293	274	36	34	228	1379
180	180	--	--	--	79	85	6894	517	173	252	232	34	31	270	1303
180	120	--	30	30	77	83	7265	584	183	314	294	37	34	281	1372
C.V., %					1.15	3.39	5.97	10.92	10.52	11.85	12.15	12.58	12.51	29.35	11.80
LSD (0.05):					1	4	613	79	24	47	45	ns	ns	ns	ns

* Time of N: PP = preplant; PI = panicle initiation; and PD = panicle differentiation.

<u>Experiment</u>: Nitrogen rate x timing study

<u>Location</u>: East Carroll Parish, Buford Perry Farm

<u>Soil Type/Analysis</u>: Sharkey clay; pH: 6.6; O.M.: 2.22%; extractable nutrients (mg/kg): P-., Na-58, K-478, Ca-6025, Mg-1270, Zn-5.70, S-7.30, As-9.20, Fe-77.80

<u>Variety/Seeding Rate</u>: LMNT, 100 lb/A

<u>Planting Method/Date</u>: Drill-seeded, May 30

<u>Fertilization</u>: Nitrogen source, urea

<u>Plot Size</u>: 7 x 25 ft (175 ft^2)

<u>Emergence Date</u>: June 11

<u>Water Management</u>: Flushed, June 3, June 20; permanent flood, July 12; harvest drainage, Sep 19

<u>Herbicides</u>: 5.0 lb ai/A Stam (propanil), July 6; 3.0 lb ai/A Ordram (molinate), July 18; 1.2 oz ai/A Londax (bensulfuron-methyl), July 22

<u>Insecticides</u>: 0.6 lb ai/A Furadan (carbofuran), Aug 7; 0.25 lb ai/A Methyl (methyl parathion), Aug 26

<u>Fungicides</u>: 0.5 lb ai/A Benlate (benomyl), Aug 21, Sep 7

<u>Harvest</u>: Oct 11

<u>Experimental Design</u>: Randomized complete block with four replications of 10 N rate x timing treatment combinations

<u>Comments</u>: Response to applied N was observed 4 days after applying the basal N and permanent flood. A N deficiency occurred during mid-season, even at high rates of N, indicating poor efficiency and uptake. Days to 50% heading and plant height increased with increasing N (Table 2). Optimum grain yield occurred at a N rate of 120 lb/A.

Table 2. Effect of N rate and timing on performance, grain yield, and yield components of drill-seeded Lemont rice. Buford Perry Farm, East Carroll Parish, LA. 1989.

Total N	Time of N* PF	PI	PD	PD + 10 days	Days to 50% heading	Plant height	Grain yield at 12% moisture	Whole plant	Panicles	Panicle weight	Grain weight	Panicle weight	Grain weight	Sterile florets	Filled grains
----------(lb/A)----------						(cm)	(lb/A)	(g/3 ft^2)	(no/3 ft^2)	----(g/3 ft^2)----		(g/20 panicles)		(no/20 panicles)	
0	--	--	--	--	78	63	4117	308	91	175	145	41	38	231	1488
30	30	--	--	--	78	73	5636	406	105	219	194	44	42	235	1607
60	60	--	--	--	80	76	6076	454	115	243	215	43	40	285	1534
90	90	--	--	--	81	79	6187	500	151	263	233	41	39	322	1482
90	60	30	--	--	80	77	6270	433	109	231	207	49	46	310	1769
120	120	--	--	--	82	84	6466	512	136	254	223	40	37	394	1479
120	90	30	--	--	81	80	6423	506	130	254	225	45	42	342	1632
150	150	--	--	--	84	86	6368	515	140	255	218	46	43	405	1674
180	180	--	--	--	84	90	6444	490	139	235	200	44	40	484	1585
180	120	--	30	30	82	83	6460	532	136	280	242	45	42	409	1600
C.V., %					0.79	3.00	4.44	9.78	17.01	10.42	11.51	16.80	17.57	24.97	16.76
LSD (0.05):					1	3	390	66	31	36	35	ns	ns	124	ns

* Time of N: PF = preflood; PI = panicle initiation; and PD = panicle differentiation.

Experiment: Nitrogen rate x timing study

Location: Rapides Parish, Will Bollich Farm

Soil Type/Analysis: Moreland clay; pH: 7.5; O.M.: 1.99%; extractable nutrients (mg/kg): P-., Na-39, K-274, Ca-3991, Mg-973, Zn-2.65, S-7.91, As-10.87, Fe-53.81

Variety/Seeding Rate: LMNT, 100 lb/A

Planting Method/Date: Drill-seeded, May 2

Fertilization: Nitrogen source, urea

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: May 16

Water Management: Flushed, May 7, May 27, May 31; permanent flood, June 7; harvest drainage, Aug 22

Herbicides: 3.0 lb ai/A Stam (propanil) + 2.0 lb ai/A Bolero (thiobencarb), May 26; 4.0 lb ai/A Stam + 1.0 lb ai/A Basagran (bentazon), June 7

Insecticides: 0.25 lb ai/A Methyl (methyl parathion), July 20

Fungicides: None

Harvest: Sep 6

Experimental Design: Randomized complete block with four replications of 10 N rate x timing treatment combinations

Comments: Response to applied N was observed 6 days after applying the basal N and permanent flood. Nitrogen deficiency began to appear 5 weeks after fertilizer application at the lower rates. Plant height increased with increasing N (Table 3). Optimum grain yield occurred at a N rate of 180 lb/A.

Table 3. Effect of N rate and timing on performance, grain yield, and yield components of drill-seeded Lemont rice. Will Bollich Farm, Rapides Parish, LA. 1989.

Total N	Time of N*: PF	PI	PD	PD + 10 days	Days to 50% heading	Plant height	Grain yield at 12% moisture	Whole plant	Panicles	Panicle weight	Grain weight	Panicle weight	Grain weight	Sterile florets	Filled grains
----------(lb/A)----------						(cm)	(lb/A)	(g/3 ft^2)	(no/3 ft^2)	----(g/3 ft^2)----		(g/20 panicles)		(no/20 panicles)	
0	--	--	--	--	81	62	4405	264	69	154	142	47	44	204	1711
30	30	--	--	--	79	62	5179	311	80	181	164	47	44	180	1687
60	60	--	--	--	79	63	5595	393	94	212	195	47	44	132	1678
90	90	--	--	--	80	66	5944	400	97	204	185	45	42	136	1620
90	60	30	--	--	80	66	6087	391	100	216	196	43	40	167	1576
120	120	--	--	--	82	69	6419	484	112	255	233	44	41	147	1570
120	90	30	--	--	81	67	6804	472	118	260	235	45	42	152	1625
150	150	--	--	--	82	70	6524	478	115	256	281	48	44	172	1706
180	180	--	--	--	83	74	6476	617	141	306	277	43	40	179	1566
180	120	--	30	30	83	71	7286	516	123	288	258	41	38	161	1462
C.V., %					1.51	2.76	6.59	7.07	9.64	7.07	16.17	10.80	10.79	23.32	10.50
LSD (0.05):					2	3	580	113	19	65	63	ns	ns	ns	ns

* Time of N: PF = preflood; PI = panicle initiation; and PD = panicle differentiation.

Experiment: Nitrogen rate x timing study

Location: Rapides Parish, Will Bollich Farm

Soil Type/Analysis: Moreland silty clay; pH: 7.6; O.M.: 1.91%; extractable nutrients (mg/kg): P-., Na-35, K-229, Ca-4514, Mg-832, Zn-2.04, S-25.86, As-11.68, Fe-48.56

Variety/Seeding Rate: LMNT, 150 lb/A

Planting Method/Date: Water-seeded, May 5

Fertilization: Nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: May 9

Water Management: Flooded, May 4; drained, May 8; reflooded, May 12; drained, May 27; flushed, May 31; flooded, June 7; harvest drainage, Aug 22

Herbicides: 4.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran (bentazon), June 6

Insecticides: 0.25 lb ai/A Methyl (methyl parathion), July 19

Fungicides: 0.25 lb ai/A Monceren (pencycuron), July 7, July 19

Harvest: Sep 6

Experimental Design: Randomized complete block with four replications of 10 N rate x timing treatment combinations

Comments: Nitrogen deficiency was observed 4 weeks after emergence at low rates of applied N. Plant height increased with increasing N (Table 4). Optimum grain yield occurred at a N rate of 120 lb/A.

Table 4. Effect of N rate and timing on performance, grain yield, and yield components of water-seeded Lemont rice. Will Bollich Farm, Rapides Parish, LA. 1989.

Total N	Time of N* PP	PI	PD	PD + 10 days	Days to 50% heading	Plant height	Grain yield at 12% moisture	Whole plant	Panicles	Panicle weight	Grain weight	Panicle weight	Grain weight	Sterile florets	Filled grains
----------(lb/A)----------						(cm)	(lb/A)	($g/3\ ft^2$)	($no/3\ ft^2$)	----($g/3\ ft^2$)----		(g/20 panicles)		(no/20 panicles)	
0	--	--	--	--	81	59	4895	277	104	161	146	39	36	132	1411
30	30	--	--	--	79	60	5297	334	122	186	170	33	31	114	1190
60	60	--	--	--	80	62	5729	379	117	208	188	40	37	149	1449
90	90	--	--	--	79	68	6957	459	138	263	237	38	36	106	1400
90	60	30	--	--	80	65	6595	422	143	237	212	30	27	139	1083
120	120	--	--	--	81	69	6980	496	149	264	238	39	37	159	1408
120	90	30	--	--	81	69	7111	456	140	251	229	40	37	143	1475
150	150	--	--	--	82	70	7161	461	144	239	216	38	35	143	1402
180	180	--	--	--	83	73	7130	509	146	271	243	39	36	148	1441
180	120	--	30	30	81	70	7132	493	143	272	246	42	39	199	1528
C.V., %					0.94	4.08	8.31	10.07	11.90	11.95	12.14	13.27	13.82	26.97	13.20
LSD (0.05):					1	4	784	63	23	41	37	ns	ns	ns	ns

* Time of N: PP = preplant; PI = panicle initiation; and PD = panicle differentiation.

Experiment: Nitrogen rate x timing study

Location: Morehouse Parish, Zaunbrecher Farm

Soil Type/Analysis: Hebert silty clay: pH: 6.0; O.M.: 2.26%; extractable nutrients (mg/kg): P-., Na-102, K-288, Ca-2761, Mg-811, Zn-2.04, S-5.31, As-5.71, Fe-145.35

Variety/Seeding Rate: LMNT, 150 lb/A

Planting Method/Date: Water-seeded, June 2

Fertilization: Nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: June 7

Water Management: Flooded, June 1; drained, June 4; reflooded, June 11; drained, June 17; reflooded, June 20; harvest drainage, Sep 12

Herbicides: 4.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran (bentazon), June 19; 1.2 oz ai/A Londax (bensulfuron-methyl), July 6

Insecticides: 0.6 lb ai/A Furadan (carbofuran), July 6

Fungicides: 0.28 lb ai/A Tilt (propiconazol), Aug 14

Harvest: Sep 26

Experimental Design: Randomized complete block with four replications of 10 N rate x timing treatment combinations

Comments: Nitrogen deficiency was observed 3 weeks after emergence at low N. Days to 50% heading and plant height increased with increasing N (Table 5). Optimum grain yield occurred at a N rate of 90 lb/A.

Table 5. Effect of N rate and timing on performance, grain yield, and yield components of water-seeded Lemont rice. Zaunbrecher Farm, Morehouse Parish, LA. 1989.

Total N	Time of N*: PP	PI	PD	PD + 10 days	Days to 50% heading	Plant height	Grain yield at 12% moisture	Whole plant	Panicles	Panicle weight	Grain weight	Panicle weight	Grain weight	Sterile florets	Filled grains
----------(lb/A)----------						(cm)	(lb/A)	(g/3 ft^2)	(no/3 ft^2)	----(g/3 ft^2)----		(g/20 panicles)		(no/20 panicles)	
0	--	--	--	--	76	69	7872	472	145	260	228	43	40	216	1585
30	30	--	--	--	75	70	8273	499	155	266	233	39	36	177	1441
60	60	--	--	--	76	74	8351	550	159	284	250	40	36	268	1435
90	90	--	--	--	77	76	8127	538	174	272	231	33	29	329	1195
90	60	30	--	--	77	77	8464	518	171	266	224	40	37	290	1490
120	120	--	--	--	79	80	8020	536	171	253	215	33	30	323	1274
120	90	30	--	--	79	79	8007	557	183	263	221	30	27	302	1149
150	150	--	--	--	80	82	7545	536	187	247	203	31	28	336	1212
180	180	--	--	--	81	82	7299	537	175	238	197	36	32	419	1436
180	120	--	30	30	80	82	8040	502	178	242	196	32	28	462	1221
C.V., %					1.40	2.94	3.87	7.07	11.42	7.86	8.32	15.66	16.57	20.52	15.61
LSD (0.05):					2	3	449	ns	ns	ns	26	8	8	93	ns

* Time of N: PP = preplant; PI = panicle initiation; and PD = panicle differentiation.

INFLUENCE OF NITROGEN FERTILIZATION ON PERFORMANCE AND RATOON CROP GRAIN YIELDS OF MARS, MERCURY, AND LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Rice farmers in southwest Louisiana have the opportunity to produce a ratoon or second crop for many of the rice varieties currently being grown. Previous research has shown that second crop grain yields can be increased if additional fertilizer nitrogen (N) is applied to the second crop upon completion of main crop harvest.

This study was initiated to determine the response of second crop grain yields of three early-season rice varieties to variable rates of N applied to the second crop.

MATERIALS AND METHODS

A N rate of 120 lb/A as ammonium sulfate was banded approximately 2 inches deep with 60 lb/A P_2O_5 and K_2O 1 day prior to flooding the water-seeded experiment. Presoaked seed of each variety was seeded at the rate of 150 lb/A into a shallow flood. The rice was grown in a pinpoint flood culture. The main crop was harvested, and grain yields were estimated for each variety. After completion of harvest, fertilizer N was surface-broadcast at rates of 0, 25, 50, 75, 100, and 125 lb/A. A shallow flood was immediately established.

Pest control (weeds, insects, disease) was practiced when necessary. Plant height, days to 50% heading, and grain yield were estimated from four plots for each variety in the main crop. In the second crop, individual whole plots were combine-harvested at field maturity. Number of ratoon tillers, days to 50% heading, grain moisture, and grain yield were measured.

SUMMARY AND CONCLUSIONS

A study was conducted to determine the influence of variable rates of N on performance and grain yield of three rice varieties at the Rice Research Station, Crowley, LA.

Tiller production was significantly higher for the varieties Mercury and Lemont (Table 1). Number of tillers generally increased as rate of N increased. Days to 50% heading of the second crop (calculated from emergence of the main crop to heading of the second crop) was different for all varieties. The medium-grain variety Mercury headed about 1 week earlier than Mars. Lemont was very slow to reach heading in the second crop. The medium-grain varieties initiated reproductive growth faster than Lemont, as evidenced by the significantly longer period of time required to reach 50% heading. Rate of applied N had little influence on maturity of the second crop. Mars and Mercury responded positively to increasing rate of N while Lemont showed little response. A gradual increase in grain yield occurred as N increased to 125 lb/A, although the increases may not be economical to justify.

Higher second crop grain yields can be realized if N is applied after harvest of the main crop. Mercury responded to much higher rates of fertilizer N than did Mars, while grain yields of Lemont increased only slightly. Additional research is needed to determine the optimum N requirement for maximizing second crop production of varieties currently being grown in Louisiana.

Experiment: Second crop variety x nitrogen study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.3; O.M.: 1.02%; extractable nutrients (mg/kg): P-., Na-53, K-58, Ca-977, Mg-191, Zn-0.97, S-6.99, As-3.27, Fe-83.27

Variety/Seeding Rate: MARS, MERC, LMNT, 150 lb/A

Planting Method/Date: Water-seeded, Apr 6

Fertilization: First planting, 60 lb/A P_2O_5 and K_2O + 120 lb N/A (ammonium sulfate) ppi; 0.54 lb ai/A zinc chelate; second planting, variable rates (ammonium sulfate)

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, MERC, Apr 14; LMNT, Apr 18

Water Management: Flooded, Apr 5; drained, Apr 12; reflooded, Apr 14; drained, Apr 17; flooded, Apr 19; harvest drainage, July 21; second planting flooded, Aug 7; drained, Oct 12

Herbicides: 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 28; 1.2 oz ai/A Londax, June 8

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 11, June 6; 1.0 lb ai/A Sevin (carbaryl), July 12

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20; 0.28 lb ai/A Tilt (propiconazol), June 30

Harvest: Main crop, Aug 4; second crop, Oct 25

Experimental Design: Split plot in a randomized complete block with four replications, nitrogen assigned to main plots and variety to subplots.

Comments: Emergence of LMNT was slow due to very cool temperatures. MARS, MERC, and LMNT yielded 7631, 6618, and 7118 lb/A, respectively, in the main crop. Regrowth in the second crop for LMNT and MERC was similar, with MARS producing a lower number of tillers (Table 1). LMNT required a much longer period of time to reach 50% heading in the second crop. MARS and MERC responded to increasing rates of N in the second crop, and produced excellent grain yields. Yield of LMNT was much lower.

Table 1. Effect of N rate on performance and second crop grain yields of water-seeded rice varieties. Rice Research Station, Crowley, LA. 1989.

Total N	Tillers				Second crop days to 50% heading*				Second crop grain yields at 12% moisture			
	MARS	MERC	LMNT	N Mean	MARS	MERC	LMNT	N Mean	MARS	MERC	LMNT	N Mean
(lb/A)	------(no/3 ft^2)------				---------(cm)---------				--------(lb/A)--------			
0	196	295	308	266	153	145	170	156	1509	1502	1337	1450
25	209	373	340	307	154	144	171	157	1586	1881	1205	1557
50	274	443	349	355	152	145	170	156	1813	2216	1281	1770
75	335	385	371	364	152	146	172	157	1973	2331	1280	1861
100	274	371	407	351	152	146	173	157	2101	2359	1492	1984
125	250	448	414	370	154	147	170	157	2043	2898	1442	2127
Variety mean	256	386	365		153	146	171		1837	2198	1339	
C.V., %		21.60				0.90				13.99		
LSD (0.01):												
Nitrogen		75				ns				274		
Variety		57				1				197		
Varieties within N		ns				3				482		
Varieties across N		ns				3				479		

* Days to 50% heading is calculated from emergence of the main crop to 50% heading of the second crop.

EFFECT OF STUBBLE MANAGEMENT AND N FERTILIZATION ON RATOON PERFORMANCE, GRAIN YIELD, AND YIELD COMPONENTS OF MERCURY RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Ratoon cropping, or second cropping, has been practiced in Louisiana for many years. Second cropping gives the farmer an excellent opportunity to increase total production on a given area with a limited amount of additional input. At the present time, second crop production is rather inconsistent, and has not been fully exploited. Typically, a second crop gets little attention from the farmer, resulting in very low grain yields. Research has not adequately addressed second cropping systems. More emphasis is currently being placed on yield maximization of the second crop, by farmers as well as researchers.

Previous research has shown that cultural practices, varieties, and fertilization may influence second crop grain production. Varieties differ in their ratoon potential, and a variety with good ratooning ability may be influenced by management in both the main crop and the ratoon. Earlier research has shown some varieties to respond to higher rates of nitrogen (N). Stubble height also appears to influence second crop response, since clipping of the stubble and straw removal increased tiller production and grain yield of some varieties. At the present time, a general recommendation for second crop production in southwest Louisiana is to apply 45 to 60 lb N/A after main crop harvest and immediately flood the field.

This study was initiated to determine whether second crop grain yields could be improved by using better straw management techniques and a more defined N fertilization program. The objectives of this study are to 1) determine the influence of three straw management techniques on tiller formation, grain yield, and yield components of the ratoon, 2) determine the influence of post-heading main crop N fertilization on tiller production and grain yield of the ratoon, and 3) determine optimum N rate for ratoon production.

MATERIALS AND METHODS

The medium-grain, semidwarf variety Mercury was used in the study. A N rate of 120 lb/A as ammonium sulfate was banded approximately 2 inches deep with 60 lb/A P_2O_5 and K_2O 1 day prior to flooding the water-seeded experiment. Presoaked Mercury was seeded at the rate of 150 lb/A into a shallow flood. Pinpoint flood water management (a brief drainage period after seeding to encourage seedling anchorage) was practiced in this study. Pest control (weeds, insects, disease) was practiced when necessary. The experiment was combine-harvested at field maturity, and main crop grain yield and plant height were estimated from four individual whole plots.

The straw management systems were imposed onto the experiment after completion of harvest. Conventional straw management consisted of harvesting the main crop plots at a height of 14 to 16 inches (for optimum harvest efficiency) and leaving the straw spread on the remaining stubble. A rolling treatment consisted of knocking down the stubble that had been handled in the conventional manner with a heavy roller. A clipping treatment consisted of recutting the stubble to a height of 6 to 8 inches after harvest and removing all straw.

Ten N treatments were imposed onto each of the three straw management systems. Two treatments consisted of applying either 30 or 60 lb N/A into the main crop floodwater (MCF) 2 days prior to harvest drainage, with no additional N applied in the second crop. Two treatments consisted of applying either 30 or 60 lb N/A into the MCF, followed by 45 lb N/A in the second crop. The remaining treatments included N rates of 0, 30, 45, 60, 75, and 90 lb/A applied only to the second crop. All second crop N treatments were applied to the stubble prior to establishing a shallow, permanent flood.

Number of tillers in the ratoon was determined 3 weeks after flooding. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, grain moisture, and grain yield were measured. Yield components and total biomass were measured.

SUMMARY AND CONCLUSIONS

A study was conducted to determine the influence of stubble management and N fertilization on performance, second crop grain yield, and yield components of Mercury rice. Main crop grain yield was estimated to be 6000 lb/A.

Clipping the rice stubble and removing the straw had no influence on tiller production, days to 50% heading, or grain yield (Table 1). Rolling the stubble significantly decreased tillering and grain yield in 1988, however, this straw management system also had no effect in 1989. Grain yields and tiller production increased as rate of N increased. Main crop post-heading applications generally showed no advantage in grain yield over comparable rates of N applied to the second crop after harvest, unless additional N was applied to the second crop.

Stubble management also influenced yield components of the second crop. Clipping or rolling the stubble decreased whole plant weight (Table 2). Weight of panicles and grain and the number of filled grains were increased by rolling (Table 3). No differences were observed between conventional straw management and clipping with respect to influence on yield components except whole plant weight. Increasing N tended to increase all yield components. Nitrogen applied to the MCF significantly increased panicle number and weight and whole plant weight when an additional application was made to the second crop. There was little difference in influence on yield components of a single application of N in the MCF when compared to a similar amount applied only to the second crop.

Experiment: Second crop improvement study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.4; O.M.: 0.97%; extractable nutrients (mg/kg): P-., Na-38, K-65, Ca-985, Mg-185, Zn-0.65, S-6.82, As-2.40, Fe-64.81

Variety/Seeding Rate: MERC, 150 lb/A

Planting Method/Date: Water-seeded, Apr 6

Fertilization: First planting, 60 lb/A P_2O_5 and K_2O + 120 lb N/A (ammonium sulfate) ppi; 0.54 lb ai/A zinc chelate, Apr 18; second planting, variable rates (ammonium sulfate)

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: Apr 14

Water Management: Flooded, Apr 5; drained, Apr 12; reflooded, Apr 14; drained, Apr 17; reflooded, Apr 19; harvest drainage, July 21; second planting flooded, Aug 7; drained, Oct 12

Herbicides: 0.6 oz ai/A Londax (bensulfuron-methyl), Apr 28; 1.2 oz ai/A Londax, May 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 11, June 6; 1.0 lb ai/A Sevin (carbaryl), July 12

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20; 0.28 lb ai/A Tilt (propiconazol), June 30

Harvest: Main crop, Aug 4; second crop, Oct 25

Experimental Design: Split plot in a randomized complete block with four replications, stubble management assigned to main plots and N to subplots.

Comments: Cool temperatures and slow seedling growth delayed stand establishment somewhat. A foliar application of zinc chelate was made to overcome any deficiency that might have occurred due to slow root growth. Bronzing was minor, and eventually an adequate stand was established. Stubble management had little influence on most agronomic variables measured (Tables 1, 2, and 3). Grain yield increased as rate of N increased.

Table 1. Effect of N rate and stubble management on tiller production, days to 50% heading, and grain yield of second crop Mercury rice. Rice Research Station, Crowley, LA. 1989.

Time of N*			Tillers				Days to 50% heading**				Second crop grain yields at 12% moisture			
Total N	H	R	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean
---(lb/A)---			--------(no/3ft^2)--------								----------(lb/A)---------			
0	--	--	335	376	297	336	143	144	144	144	1662	1967	1802	1810
30	--	30	400	371	355	376	144	144	144	144	1975	2299	2389	2221
45	--	45	441	382	342	388	144	145	145	145	2420	2661	2432	2504
60	--	60	445	434	391	424	144	144	146	145	2340	2685	2290	2438
75	--	75	439	432	364	412	145	145	146	145	2694	3108	2560	2801
90	--	90	477	448	459	461	145	145	146	145	2675	3291	3043	3003
30	30	--	335	367	371	358	143	143	142	143	1787	2003	2097	1963
75	30	45	436	459	416	437	143	143	143	143	2338	2777	2676	2597
60	60	--	362	416	398	392	142	142	142	142	1981	2261	2231	2158
105	60	45	470	560	477	502	143	142	142	142	2433	2853	2584	2623
Stubble mean			414	425	387		144	144	144		2231	2590	2415	
C.V., %				16.07				0.46				8.12		
LSD (0.01):														
Stubble					ns				ns				ns	
Nitrogen					71				1				211	
Nitrogen within stubble					ns				ns				ns	
Nitrogen across stubble					ns				ns				ns	

* Time of N: H = main crop heading; R = ratoon.

** Days to 50% heading is calculated from emergence of the main crop to 50% heading of the second crop.

Table 2. Influence of stubble management and N rate on yield components of second crop Mercury rice. Rice Research Station, Crowley, LA. 1989.

Time of N*			Whole plant				Panicles				Panicle weight				Grain weight			
Total N	H	R	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean
---(lb/A)---			--------(g/ft^2)-------				------(no/3 ft^2)------				------------------(g/3 ft^2)------------------							
0	--	--	263	221	239	241	106	122	119	116	72	87	83	81	60	68	69	66
30	--	30	327	259	273	286	141	151	133	141	91	105	100	99	75	87	85	83
45	--	45	323	268	280	291	154	141	137	144	112	106	115	111	94	92	97	95
60	--	60	329	263	258	283	161	139	129	143	106	111	109	109	88	95	91	91
75	--	75	345	306	261	304	159	168	119	149	126	126	115	122	107	106	99	104
90	--	90	344	302	299	315	151	157	147	152	116	128	126	123	96	108	107	104
30	30	--	301	224	245	257	144	140	147	144	79	89	88	86	64	74	72	70
75	30	45	314	289	313	306	146	159	163	156	97	103	118	106	78	91	98	89
60	60	--	320	237	272	276	136	139	152	142	85	87	94	88	67	72	75	72
105	60	45	326	293	290	303	165	166	162	164	100	112	118	110	80	91	98	90
Stubble mean			319	266	273		146	148	141		98	105	107		81	89	89	
C.V., %				12.08				14.43				11.82				12.08		
LSD (0.05):																		
Stubble					32				ns				ns				ns	
Nitrogen					36				17				15				13	
N within stubble					ns				ns				ns				ns	
N across stubble					ns				ns				ns				ns	

* Time of N: H = main crop heading; R = ratoon.

Table 3. Influence of stubble management and N rate on yield components of second crop Mercury rice. Rice Research Station, Crowley, LA. 1989.

Time of N*			Panicle weight				Grain weight				Sterile florets				Filled grains			
Total N	H	R	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean	Conv	Clip	Roll	N Mean
---(lb/A)---			----------------(g/20 panicles)----------------								--------------(no/20 panicles)--------------							
0	--	--	16	17	20	18	15	15	18	16	171	225	211	202	648	646	749	681
30	--	30	18	19	20	19	17	17	19	18	230	207	192	210	748	744	797	763
45	--	45	18	24	20	21	16	22	18	19	229	280	260	256	720	959	808	829
60	--	60	18	23	24	22	17	22	23	20	182	205	199	196	721	938	951	870
75	--	75	22	17	31	23	21	15	30	22	220	239	227	229	899	662	1214	925
90	--	90	24	24	27	25	22	22	25	23	217	238	187	214	970	967	1072	1003
30	30	--	15	20	18	18	13	19	16	16	215	242	207	222	602	811	692	702
75	30	45	16	21	19	19	14	19	18	17	261	216	207	228	649	835	783	756
60	60	--	17	20	15	17	15	18	13	15	325	265	197	263	668	758	608	678
105	60	45	18	17	20	18	16	16	18	16	254	253	226	244	717	697	760	725
Stubble mean			18	20	22		16	18	20		231	237	211		734	802	844	
C.V., %				19.15				20.32				27.22				18.81		
LSD (0.05):																		
Stubble					2				2				ns				80	
Nitrogen					3				3				ns				121	
N within stubble					5				5				ns				210	
N across stubble					6				6				ns				224	

* Time of N: H = main crop heading; R = ratoon.

INFLUENCE OF SEEDING RATE ON PERFORMANCE AND GRAIN YIELDS OF SELECTED RICE VARIETIES GROWN IN WATER-SEEDED AND DRY-SEEDED CULTURAL SYSTEMS

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Stand establishment is a very critical initial step toward successful rice production. Poor establishment can result in greater weed competition and increased pressure from the rice water weevil. Excessively thick stands can result in increased disease pressure and plant lodging. In either of these situations, lower grain yields will probably occur.

Rice is planted in Louisiana in three ways. Rice is water-seeded with either dry or pre-sprouted seed, drill-seeded on 7- to 10-inch spacings, or broadcast dry. According to current information, regardless of the method of planting, the optimum plant stand is 15 to 20 plants per square foot, with a minimum of 6 to 8 and a maximum of 30.

The current recommendation for seeding rate for either water seeding or dry broadcasting is 100 to 150 lb/A, and 90 to 110 lb for drill seeding. The higher seeding rates are recommended when planting during cool weather conditions, especially when water seeding; in areas where bird depredation is a problem; when planting seed with a low germination percentage; where seedbed preparation is less than desirable; or in any situation where water management or water quality (such as salt water) is a problem.

Commercial rice varieties differ in seedling vigor and in their ability to tiller, and these factors can significantly influence stand establishment in either cultural system. The recommended varieties have changed considerably in recent years, especially with the development of the semidwarf plant type. The objective of this study is to determine the response of four of the more commonly grown rice varieties to seeding rate.

MATERIALS AND METHODS

Four rice varieties were compared at variable seeding rates in water- and dry-seeded culture: Tebonnet (TBNT), a very early long grain, Mars and Mercury (MERC), early medium grains, and Lemont (LMNT), an early long grain. Seeding rates in the water-seeded study were 100, 125, and 150 lb/A, and 50, 75, and 100 lb/A in the drill-seeded study.

Each study was fertilized with 60 lb/A P_2O_5 and K_2O preplant incorporated. Approximately 120 lb N/A were applied preplant incorporated in the water-seeded study and preflood in the drill-seeded study. Water management typical of a water-seeded, pinpoint flood system and a drill-seeded system was followed.

Pest control (weeds, insects, disease) was practiced when necessary. Stand counts were determined at the 4-leaf growth stage (3 weeks after emergence). Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, lodging, grain moisture, and grain yield were measured. Yield components were determined.

SUMMARY AND CONCLUSIONS

Seeding rate studies were conducted at the Rice Research Station to determine the influence of seeding rate on performance, grain yields, and yield components of Tebonnet, Mars, Mercury, and Lemont in water- and dry-seeded culture.

Stand densities increased with increasing seeding rate in the drill-seeded study as expected (Table 1). Stand densities for all varieties were similar at each seeding rate. Seeding rate had little influence on days to 50% heading or plant height. Seeding rate did have a slight effect on grain yield for the varieties Tebonnet, Mars, and Mercury, although not significant. Yields of Tebonnet increased 600 lb/A from the lowest to highest rate. There was no response to rate for Lemont. Yield components were not influenced by seeding rate (Table 2). Most of the differences in yield components were due to variety, with Mars and Tebonnet having the highest plant weight and highest percentage of filled grain. Mercury and Tebonnet produced the greatest number of sterile florets.

Response of stand density to increasing seeding rate in the water-seeded study was similar. Average density for Tebonnet was much lower than that of the other varieties (Table 3). There was no influence of seeding rate on days to 50% heading or plant height. Grain yields of Mars and Lemont increased as seeding rate increased from 100 to 150 lb/A, while grain yields of Mercury and Tebonnet were optimum at a rate of 125 lb/A. Seeding rate had no significant influence on any other yield component (Table 4), although there were some differences among varieties.

Experiment: Seeding rate x variety trial

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.4; O.M.: 0.96%; extractable nutrients (mg/kg): P-., Na-51, K-75, Ca-1032, Mg-213, Zn-1.53, S-6.44, As-3.27, Fe-73.00

Variety/Seeding Rate: MARS, MERC, TBNT, LMNT; variable rate

Planting Method/Date: Drill-seeded, Apr 7

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; 120 lb N/A, nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MARS, TBNT, Apr 18; MERC, Apr 19; LMNT, Apr 21

Water Management: Flushed, Apr 20, Apr 26; permanent flood, May 11; harvest drainage, Aug 1

Herbicides: 3.0 lb ai/A Stam (propanil), Apr 28, May 9; 0.9 oz ai/A Londax (bensulfuron-methyl), May 23

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 24, June 6

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20

Harvest: Main crop, Aug 11

Experimental Design: Split plot in a randomized complete block with four replications, seeding rate assigned to main plots and varieties to subplots

Comments: Days to 50% heading increased slightly at the lowest seeding rate (Table 1). Grain yield was not affected.

Table 1. Effect of seeding rate (SR) on performance and grain yields of drill-seeded rice varieties. Rice Research Station, Crowley, LA. 1989.

	Stand count				Days to 50% heading				Plant height				Grain yield at 12% moisture			
Variety	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean
	---(plants/ft^2)---								---------(cm)---------				--------(lb/A)--------			
MARS	19	27	31	26	83	81	81	82	115	108	113	112	7336	6994	7080	7137
MERC	17	26	30	25	78	78	77	78	86	86	86	86	5760	5972	6086	5939
TBNT	16	24	31	24	83	83	82	83	137	132	131	134	6145	6611	6779	6512
LMNT	16	27	31	25	84	83	82	83	86	85	84	85	7292	7225	7295	7271
SR Mean	17	26	31		82	81	80		106	103	104		6633	6701	6810	
C.V., %		10.76				1.58				5.37				5.05		
LSD (0.01):																
Seed rate			3				1				ns				ns	
Variety			ns				1				6				384	
V within SR			ns				ns				ns				ns	
V across SR			ns				ns				ns				ns	

Table 2. Effect of seeding rate (SR) on yield components of drill-seeded rice varieties. Rice Research Station, Crowley, LA. 1989.

	Whole plant				Panicles				Panicle weight				Grain weight				Panicle weight				Grain weight				Sterile florets				Filled grains			
Variety	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean	50	75	100	Mean
	-----(g/ft^2)----				---(no/3 ft^2)---				-------------(g/3 ft^2)------------								---------(g/20 panicles)--------								-----------(no/20 panicles)-----------							
MARS	704	553	599	619	139	107	116	121	338	274	295	302	322	260	280	288	50	54	54	53	48	52	52	51	292	377	287	319	2121	2272	2258	2217
MERC	501	533	498	511	127	130	134	130	229	233	222	228	210	218	203	210	39	36	35	37	35	33	32	34	573	477	501	517	1560	1503	1457	1507
TBNT	548	650	548	582	109	130	118	119	254	278	263	265	235	263	246	248	49	49	45	48	45	46	43	45	558	481	404	481	2156	2199	2042	2133
LMNT	571	539	517	542	136	136	139	137	298	282	267	282	289	273	258	273	48	40	41	43	46	38	40	42	196	194	175	188	1762	1472	1522	1585
SR Mean	581	569	541		128	126	127		280	267	261		264	253	247		46	45	44		44	42	42		405	383	342		1900	1862	1820	
C.V., %			8.77				8.29				9.00				9.02				15.14				15.99				33.91				14.92	
LSD (0.05):																																
SR			ns				ns				ns				ns				ns				ns				ns				ns	
V			54				12				26				23				5				5				74				197	
V within SR			72				15				35				33				ns				ns				ns				ns	
V across SR			74				17				40				38				ns				ns				ns				ns	

Experiment: Seeding rate x variety trial

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.4; O.M.: 0.98%; extractable nutrients (mg/kg): P-., Na-65, K-63, Ca-1047, Mg-212, Zn-1.61, S-7.84 As-4.58, Fe-124.17

Variety/Seeding Rate: MARS, MERC, TBNT, LMNT, 150 lb/A

Planting Method/Date: Water-seeded, Apr 27

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; 120 lb N/A ppi, nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: MERC, MARS, May 1; TBNT, LMNT, May 3

Water Management: Flooded, Apr 25; drained, Apr 30; reflooded, May 3; harvest drainage, Aug 14

Herbicides: 1.2 oz ai/A Londax (bensulfuron-methyl), May 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 24, June 6

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20

Harvest: Main crop, Aug 31

Experimental Design: Split plot in a randomized complete block with four replications, seeding rate assigned to main plots and varieties to subplots

Comments: Days to 50% heading and plant height were not influenced by seeding rate (Table 3). Grain yields were significantly lower at a 100 lb/A seeding rate.

Table 3. Effect of seeding rate (SR) on performance and grain yields of water-seeded rice varieties. Rice Research Station, Crowley, LA. 1989.

	Stand count				Days to 50% heading				Plant height				Grain yield at 12% moisture			
Variety	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean
	---(plants/ft^2)---								---------(cm)---------				--------(lb/A)--------			
MARS	18	25	31	25	79	78	78	79	110	106	109	109	6026	6087	6575	6230
MERC	21	27	30	26	77	76	76	77	89	89	89	89	6664	6717	6454	6612
TBNT	11	16	14	14	82	80	79	81	128	127	130	129	5017	5882	5553	5484
LMNT	19	20	22	20	82	81	81	82	84	82	81	82	6890	7332	7540	7254
SR Mean	17	22	24		80	79	79		103	101	102		6149	6504	6531	
C.V., %		20.32				1.92				3.10				9.81		
LSD (0.01):																
Seed rate			4			ns				ns				100		
Variety			5			2				4				709		
V within SR			ns			ns				ns				ns		
V across SR			ns			ns				ns				ns		

Table 4. Effect of seeding rate (SR) on yield components of water-seeded rice varieties. Rice Research Station, Crowley, LA. 1989.

	Whole plant				Panicles				Panicle weight				Grain weight			
Variety	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean
	-----(g/ft^2)----				---(no/3 ft^2)---				-------------(g/3 ft^2)------------							
MARS	602	609	561	591	110	125	110	115	271	267	258	265	243	236	229	236
MERC	524	551	560	545	117	135	136	129	247	261	265	258	217	230	232	226
TBNT	689	627	671	663	105	104	104	105	302	270	290	287	245	229	240	238
LMNT	592	604	589	595	133	147	143	141	294	298	297	296	265	274	273	271
SR Mean	602	598	595		116	128	123		279	274	278		242	242	243	
C.V., %			13.60				12.54				12.50				13.08	
LSD (0.05):																
SR			ns				ns				ns				ns	
V			68				13				29				27	
V within SR			ns				ns				ns				ns	
V across SR			ns				ns				ns				ns	

	Panicle weight				Grain weight				Sterile florets				Filled grains			
Variety	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean	100	125	150	Mean
	---------(g/20 panicles)--------								-----------(no/20 panicles)----------							
MARS	55	52	50	52	49	46	45	47	506	429	363	433	2092	1995	1934	2007
MERC	43	42	42	42	37	37	38	37	576	521	518	539	1606	1578	1594	1593
TBNT	56	53	62	57	45	46	52	48	1159	788	1190	1046	2127	2259	2459	2282
LMNT	46	43	43	44	42	39	40	40	294	200	209	234	1621	1488	1527	1546
SR Mean	50	47	49		44	42	44		634	484	570		1861	1830	1878	
C.V., %			16.40				17.85				39.42				19.07	
LSD (0.05):																
SR			ns				ns				ns				ns	
V			7				6				185				297	
V within SR			ns				ns				ns				ns	
V across SR			ns				ns				ns				ns	

NO-TILL AND STALE SEEDBED RICE PRODUCTION FOR LOUISIANA

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Rice farmers in Louisiana typically prepare a seedbed prior to planting in a number of ways. Rice land is usually worked in late fall or early spring to some extent. Operations may include disking, field cultivation, and water or dry leveling. Preparing a seedbed by some conventional means destroys weeds and provides moisture, nutrients, and air to allow for plant root penetration.

The advantages of conventional seedbed preparation are obvious. There has been considerable interest in recent years, however, to utilize no-tillage and stale seedbed planting practices in many crops. These techniques have been promoted to conserve moisture, reduce seedbed preparation costs, reduce soil erosion, and save time. Little attention has been given to adapting these tillage techniques to rice production.

A no-tillage system is the seeding of one crop into previous residue of another crop without disturbing the soil. A stale seedbed system requires some degree of early seedbed preparation, and then allowing a flush of weeds to develop prior to planting. In each of these systems a herbicide treatment is used to control or kill existing vegetation at or before planting. The objective of this study is to determine the feasibility of producing rice using stale seedbed and no-tillage practices in the water- and dry-seeded rice cultural systems.

MATERIALS AND METHODS

The fall-prepared stale seedbed treatment was disked once, and vibra-shanked and conditioned with a roller harrow in early November. The spring prepared seedbed was established in a similar manner 9 weeks before planting. The conventional seedbed was disked once, and vibra-shanked and conditioned with a roller harrow as needed immediately before planting. Roundup was applied at the rate of 1.0 lb/A by air 1 week prior to seeding. Approximately 60 lb/A P_2O_5 and K_2O in the drill-seeded study and 45 lb/A in the water-seeded study were banded with a no-till drill 1 to 2 inches deep. In the drill-seeded experiment, 20 lb N/A was also banded and the test area was planted 2 days after herbicide application. In the water-seeded experiment, 90 lb N/A was banded and the test area was flooded and planted within 7 days of herbicide application. Pinpoint flood water management was practiced for the water-seeded study. The drill-seeded study was frequently flushed to encourage emergence and stand establishment. The test area was fertilized with 90 lb N/A prior to establishment of the permanent flood (4th to 5th leaf growth stage). Each experiment was topdressed with 45 lb N/A at midseason (panicle initiation).

Pest control (weeds, insects, disease) was practiced when necessary. Stand density was determined at the 4- to 5-leaf growth stage (3 weeks after emergence). Individual whole plots were combine-harvested at field maturity. Days to 50% heading, grain moisture, and grain yield were determined.

SUMMARY AND CONCLUSIONS

Fertilizer placement was generally more precise in the conventional and stale seedbeds than in the no-till areas. The seedbed in the no-till treatment was very hard and compact, and placement of fertilizer was less uniform. Water management was compromised in the water-seeded study due to development of algal blooms when the rice was in the seedling stage. This was attributed to poor placement of preplant fertilizer, and the floodwater was removed numerous times to correct the problem. Seed placement in the drill-seeded study was more uniform than in previous years, and stand establishment was considerably improved.

The burndown herbicide (Roundup) did an excellent job in controlling existing vegetation in the no-till and stale seedbed treatments. Weeds in the stale seedbed treatment included annual seedling grasses, dayflower, and some alligatorweed. Weeds in the no-till treatment consisted primarily of large winter annual broadleaves and alligatorweed. A lesser number of annual grasses and dayflower was present. Two postemergence herbicide applications were required prior to establishment of the permanent flood for control of dayflower and annual grasses in the drill-seeded study, and for control of ducksalad, dayflower, and annual grasses in the water-seeded study. The water-seeded experiment also required an application of Londax for control of aquatic weeds in areas of low stand density.

Decreased stand density was observed in the water-seeded study, especially in the no-till treatment. This was probably due to difficulty in seedling root penetration and interference of the dead vegetation with seedling anchorage. There also appears to be some influence of water quality on germination and emergence. Decomposition of the dying vegetation in the no-till and stale seedbed areas is probably decreasing dissolved oxygen in the floodwater and inhibiting the germination process. The decomposition process is also providing a more favorable environment for the proliferation of fungal organisms which attack germinating rice seeds. Stand density was decreased in the water-seeded study as the length of time between seedbed preparation and planting increased, with density being the lowest in the no-till treatment. This was due to compaction of the seedbed and the amount of vegetation present at burndown. The decrease in stand density had no influence on grain yield of either stale seedbed treatment, but yields were reduced significantly in the no-till planting. Maturity was also delayed in the fall-prepared stale seedbed and in the no-till treatments. No differences were observed in stand densities, maturity, or grain yields in the drill-seeded experiment.

Results of this study indicate potential for utilizing stale and no-till seedbed techniques in Louisiana rice production. Although yields decreased in the no-till, water-seeded system, less input was required for production. Stand establishment appears to be the limiting factor in no-till production, especially in a water-seeded cultural system. The amount of vegetation present at burndown and the length of time between burndown and initial flooding both influence stand establishment. Grain yields in the drill-seeded study were similar across tillage treatments. Since permanent flooding is delayed until the rice is well established there is less chance for water quality and decomposing vegetation to affect seedling anchorage or stand establishment.

Experiment: Seedbed preparation alternatives

Location: Rice Research Station, South Unit

Soil Type/Analysis: Crowley silt loam; pH: 6.0; O.M.: 1.60%; extractable nutrients (mg/kg): P-., Na-113, K-96, Ca-1803, Mg-506, Zn-3.07, S-12.85, As-5.88, Fe-173.98

Variety/Seeding Rate: LMNT, 110 lb/A

Planting Method/Date: Drill-seeded, Apr 27

Fertilization: 21 lb N/A + 63 lb/A P_2O_5 and K_2O ppi; 90 lb N/A (urea) pf, May 30; 45 lb N/A topdress, June 23

Plot Size: 25 x 130 ft (3250 ft^2)

Emergence Date: May 13

Water Management: Flushed, May 1, May 10, May 24; permanent flood, May 30; harvest drainage, Aug 24

Herbicides: 1.0 lb ai/A Roundup (glyphosate), Apr 24; 3.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran (bentazon), May 17; 4.0 lb ai/A Stam + 1.0 lb ai/A Basagran, May 29

Insecticides: 0.6 lb ai/A Furadan (carbofuran), June 15; 0.25 lb ai/A Methyl (methyl parathion), July 31

Fungicides: 0.28 lb ai/A Tilt (propiconazol), June 30, July 18; 1.0 lb ai/A Rovral (iprodione), July 31

Harvest: Sep 7

Experimental Design: Randomized complete block with four replications, four treatments

Comments: Stand establishment was uniform across seedbed treatments. Roundup gave good control of vegetation prior to planting. Two applications of Stam + Basagran were required to control dayflower and annual grasses. Three applications of fungicide were made, and sheath blight pressure still had some influence on grain yields. Grain yields for all seedbed treatments were similar (Table 1).

__Experiment__: Seedbed preparation alternatives

__Location__: Rice Research Station, South Unit

__Soil Type/Analysis__: Crowley silt loam; pH: 6.0; O.M.: 1.60%; extractable nutrients (mg/kg): P-., Na-113, K-96, Ca-1803, Mg-506, Zn-3.07, S-12.85, As-5.88, Fe-173.98

__Variety/Seeding Rate__: LMNT, 110 lb/A

__Planting Method/Date__: Drill-seeded, Apr 27

__Fertilization__: 21 lb N/A + 63 lb/A P_2O_5 and K_2O ppi; 90 lb N/A (urea) pf, May 30; 45 lb N/A topdress, June 23

__Plot Size__: 25 x 130 ft (3250 ft^2)

__Emergence Date__: May 13

__Water Management__: Flushed, May 1, May 10, May 24; permanent flood, May 30; harvest drainage, Aug 24

__Herbicides__: 1.0 lb ai/A Roundup (glyphosate), Apr 24; 3.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran (bentazon), May 17; 4.0 lb ai/A Stam + 1.0 lb ai/A Basagran, May 29

__Insecticides__: 0.6 lb ai/A Furadan (carbofuran), June 15; 0.25 lb ai/A Methyl (methyl parathion), July 31

__Fungicides__: 0.28 lb ai/A Tilt (propiconazol), June 30, July 18; 1.0 lb ai/A Rovral (iprodione), July 31

__Harvest__: Sep 7

__Experimental Design__: Randomized complete block with four replications, four treatments

__Comments__: Stand establishment was uniform across seedbed treatments. Roundup gave good control of vegetation prior to planting. Two applications of Stam + Basagran were required to control dayflower and annual grasses. Three applications of fungicide were made, and sheath blight pressure still had some influence on grain yields. Grain yields for all seedbed treatments were similar (Table 1).

Table 1. Influence of seedbed preparation on agronomic performance of water- and drill-seeded Lemont rice. Rice Research Station, South Unit, Crowley, LA. 1989.

Cultural system	Seedbed preparation	Stand density	Days to 50% heading	Grain yield at 12% moisture
		(plants/ft^2)		(lb/A)
Water-seeded	Conventional	15	81	5549
	Stale - spring	12	81	5539
	Stale - fall	10	85	5118
	No-tillage	8	88	4539
C.V., %		16.5	2.58	6.16
LSD (0.05)		3	3	511
Drill-seeded	Conventional	16	79	5711
	Stale - spring	16	79	5743
	Stale - fall	12	79	5909
	No-tillage	15	80	5843
C.V., %		19.8	2.59	4.98
LSD (0.05)		ns	ns	ns

DOUBLE-CROPPING RICE FOLLOWING RICE AS AN ALTERNATIVE TO RATOON CROPPING

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

In Louisiana, typical double-cropping systems have included wheat and soybeans, rice and crawfish, and to a lesser extent wheat and rice. Double-cropping systems offer the opportunity to produce more than one crop on the same land area annually. Various forms of reduced tillage seeding have been incorporated into double-cropped systems to take advantage of moisture and soil conservation, reduced labor and fuel costs, and earliness in getting the double crop initiated.

Rice producers in southwest Louisiana have been growing a ratoon crop, or second crop as it is commonly called, to increase total annual production per unit area for many years. With a minimum amount of input, a farmer may realize a second crop grain yield of 20-35% of the main crop. An important consideration for successful second cropping is earliness in main crop planting. Early planting and early maturing varieties are necessary for successful second cropping, since the length of the growing season during the fall is relatively short. The time required to produce a second crop for most varieties is roughly 75% of that required for the main crop.

There has been no research to determine the feasibility in growing two planted rice crops within a season. Second cropping requires fewer days from main crop harvest to second crop harvest than would a crop planted from seed. Second cropping also offers the advantage of lower input for optimum yield. Although yields are decreased somewhat in very late planted rice, a planted rice crop will generally out-yield a second crop.

The objectives of this study are to 1) determine the feasibility of planting two successive rice crops from seed within a single growing season, 2) compare a number of planting methods for the second rice crop, and 3) compare two planted rice varieties in the second rice crop to the standard ratoon crop.

MATERIALS AND METHODS

The long-grain, semidwarf, California variety L202 and the long-grain, short-stature Texas variety Maybelle were used in the study. A nitrogen rate of 120 lb/A as ammonium sulfate was banded approximately 2 inches deep with 60 lb/A P_2O_5 and K_2O 1 day prior to flooding the water-seeded experiment. Presoaked L202 and Maybelle were seeded at the rate of 150 lb/A into a shallow flood. Pest control (weeds, insects, disease) was practiced when necessary. The experiment was harvested at field maturity and the main crop yield was estimated from eight individual whole plots.

Planting methods were then imposed onto the experiment. Two days prior to draining for main crop harvest, presoaked L202 and Maybelle were seeded at a rate of 150 lb/A. All other treatments were established after completion of harvest. Conventional seedbed preparation consisted of tillage and smoothing to produce a fine, well-prepared seedbed. Rice stubble was either burned or left standing green. Presoaked L202 and Maybelle were water-seeded into each seedbed type at a rate of 150 lb/A. A combine reseed treatment consisted of seed resulting from harvest loss in the first planted crop and was considered a replanted treatment. This treatment was tilled just enough to disturb the main crop seedbed. A ratoon was also produced from the L202 and Maybelle planted in the first crop. Rice straw was removed from the reseed, ratoon, and stubble replant treatments. The experiment was drained 2 days after planting, and then flushed three times to allow for stand establishment. Approximately 30 lb N/A was applied after the first flush. The entire experiment received 60 lb N/A and was permanently flooded 3 weeks after establishment of all planting methods.

A small plot harvester was used to remove the center of each individual plot at field maturity. Grain moisture and grain yield were measured.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the Rice Research Station to determine the feasibility of double-cropping rice following rice within a single growing season. A number of planting methods and two varieties for the second rice crop were evaluated.

Average grain yields for L202 and Maybelle from the first planting were 4445 and 3688 lb/A, respectively. Severe bronzing caused loss of stand, seriously impacted water management, and decreased the efficiency of applied fertilizer N. Highest grain yields in the second planting resulted from planting into a conventionally prepared seedbed, although the yield increase above typical ratoon production was small. Yields were similar among traditional ratoon cropping, seeding into green standing stubble, and reseeding prior to main crop harvest. An adequate stand was established when seeding was performed into the main crop, however, there appeared to be competition for nutrients and sunlight between the established ratoon and the young, developing rice plants that limited the yield potential of this treatment. Grain yields were also lower in the combine reseed treatment. There was probably not enough seed remaining after harvest to propagate another crop. Grain yields were lowest when rice was planted into burned stubble. Stand density was much less than expected in this planting system. Stand establishment in a burned seedbed was also less than optimum in 1988.

Cool temperatures in early October and November significantly decreased yield potential of L202 and Maybelle in all of the reseeded treatments. In 1987, all reseeded treatments significantly outyielded the ratoon. Poor growing conditions during the fall have limited the potential yield advantage of a double crop for the past 2 years.

This study indicates that double-cropping rice following rice has the same risks that are associated with ratoon cropping. Very early planting will be essential, and less than optimum growing conditions during the double crop cycle (such as cool temperatures during reproductive plant growth) will have a significant effect on yield potential. Rice varieties that mature much earlier than those previously tested will be necessary for rice double-cropping to be considered a viable alternative to traditional ratoon cropping.

Experiment: Rice double-cropping study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.5; O.M.: 1.18%; extractable nutrients (mg/kg): P-., Na-56, K-71, Ca-1076, Mg-214, Zn-1.61, S-7.43, As-4.36, Fe-72.42

Variety/Seeding Rate: L202, MBLE, 150 lb/A

Planting Method/Date: Water-seeded, Mar 23

Fertilization: First planting, 60 lb/A P_2O_5 and K_2O + 120 lb N/A (ammonium sulfate) ppi; 120 lb N/A surface broadcast after emergence; 0.54 lb ai/A Zinc chelate, Apr 18, Apr 28; 40 lb N/A topdress; second planting, 30 lb N/A preflush + 60 lb N/A preflood

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: L202, Mar 30; MBLE, Mar 31

Water Management: Flooded, Mar 22; drained, Mar 31; reflooded, Apr 3; drained, Apr 17; reflooded, Apr 20; drained, Apr 26; reflooded, May 3; harvest drainage, Aug 2; second planting flushed, Aug 7, Aug 18; flooded, Aug 24; harvest drainage, Nov 14

Herbicides: 1.0 lb ai/A Basagran (bentazon), Apr 28; 4.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran, May 2; 0.9 oz ai/A Londax (bensulfuron-methyl), May 23

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 24, June 6

Fungicides: 0.5 lb ai/A Benlate (benomyl), June 20

Harvest: Main crop, July 26; double crop, Nov 17

Experimental Design: Split plot in a randomized complete block with four replications, variety assigned to main plots and planting method to subplots.

Comments: Cool temperatures, poor seedling vigor, and severe bronzing negatively influenced N fertilization and water management during early vegetative growth. A less than optimum stand was established and main crop yields were decreased, with L202 and MBLE yielding 4445 and 3688 lb/A, respectively. Stand establishment in the double crop was good for all areas except where the stubble was burned. Grain yields were lowest in the burned stubble planting and the combine reseed treatment (Table 1).

Table 1. Grain yields of double-cropped L202 and Maybelle long-grain rice planted in conventional and non-conventional seedbeds. Rice Research Station, Crowley, LA. 1989.

Seedbed preparation	Grain yield at 12% moisture		
	L202	Maybelle	Mean
	---------(lb/A)---------		
Ratoon	2065	2042	2054
Preharvest reseed	2106	2211	2159
Conventional seedbed	2269	2342	2305
Standing stubble	1972	2200	2086
Burned stubble	1502	1708	1605
Combine reseed	1814	1883	1849
Variety mean	1955	2064	
C.V., %		6.62	
LSD (0.05):			
Variety		ns	
Seedbed		136	
Seedbed within variety		ns	
Seedbed across variety		ns	

NITROGEN MANAGEMENT IN FURROW-IRRIGATED LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Rice produced in the United States is grown under flooded conditions. Attempts have been made to grow rice under upland conditions, using sprinkler irrigation to supplement rainfall to supply the water requirement for proper plant growth. Problems encountered included increased disease pressure, decreased weed control, and maintenance of fertilizer nitrogen (N).

Research was initiated in Missouri to evaluate the potential for growing rice under upland conditions using furrow irrigation. Many of the rice farmers also grow row crops, and are familiar with traditional furrow irrigation for supplying supplemental water during periods of low rainfall. The objective of the research was to determine whether furrow irrigation could reduce the water requirement necessary for rice culture under flooded conditions. Preliminary results indicate a reduction in the traditional water requirement by 50%. Additional research is currently underway to address pest management and N fertilization in furrow-irrigated rice culture in Missouri. Arkansas has also initiated research to study the behavior of fertilizer N when introduced into the irrigation water.

Many rice farmers in Louisiana are also producing row crops such as cotton and soybeans, especially in the northeast section of the state, and emphasis on row crop irrigation to supplement rainfall is increasing. There appears to be some potential for farmers in these situations to use furrow irrigation to further diversify their farm operations. A study was initiated in 1988 to evaluate the potential for production of furrow-irrigated rice. The objective of the study was to investigate a number of N sources, N rates, and N timings to determine how N should be managed in upland rice culture.

MATERIALS AND METHODS

Approximately 21 lb N/A and 60 lb/A P_2O_5 and K_2O were preplant incorporated. Rows were formed with a 32-inch spacing, followed by conditioning with a roller harrow. Lemont rice was seeded at the rate of 110 lb/A with a no-till grain drill. Each flushing operation consisted of running irrigation water down the row middles until the seedbed was completely saturated. Nitrogen treatments were applied 3 weeks after rice emergence at the 3- to 4-leaf growth stage. This timing is comparable to a preflood (PF) application in a traditional dry-seeded cultural system. Three N sources were applied at different rates and timings. Urea, Super Urea (SU, a urea containing dicyandiamide manufactured by Agrico Chemical Company), and sulfur-coated urea

(SCU) were applied as a single PF application of 90, 120, or 150 lb/A, as a 2-way split with 2/3 PF and the remaining 1/3 at panicle initiation (PI), and as a 5-way split of 30 lb N/A at 7-day intervals beginning with a PF application.

Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, grain moisture, and grain yield were measured. Water use was also estimated.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the South Unit of the Rice Research Station to evaluate the potential for growing rice under furrow-irrigated, upland conditions and to develop strategy for N management in such a system.

Slow early-season growth of the rice and the absence of a flood reduced the effectiveness of weed control, and three herbicide applications were required. After the last application, closure of the rice canopy eliminated additional weed pressure, and the test area remained relatively weed-free for the remainder of the season.

Source of N had no influence on any of the agronomic characters measured. There was little influence on days to 50% heading by the N treatments, with a range of 79 to 81 days. Plant height was influenced by N, generally increasing with higher levels of N. Split applications tended to increase yields suggesting that more N was available to the plant when applied over time. Grain yields tended to increase with increasing rate of N with little difference being observed between single PF applications and 2-way splits. The highest grain yields resulted from the multiple applications of 30 lb N/A every 7 days. A total of 150 lb N/A was applied in this 5-way treatment. These multiple applications evidently supplied more N to the rice plant for a longer period of time than did a similar amount applied either as a single PF application or as a 2-way split.

A rough estimate of total water supplied in acre inches was determined. Approximately 25 inches of water were applied to the test area through furrow irrigation. An additional 41 inches of water were supplied through rainfall, resulting in 66 inches of total water supplied. Based on information generated at the Texas Research and Extension Center in 1988, a total of 42 inches of water were applied to a dry-seeded, flooded system. Runoff was determined to be 15 inches of water, resulting in a net water requirement of 27 inches. Runoff was not determined in this study, however, based on total water applied through irrigation and rainfall, the estimates for furrow-irrigated rice and flooded rice culture were similar.

Nitrogen efficiency and stability will be influenced in an upland, furrow-irrigated system to a greater extent than in traditional flood management. More research is required to determine how N should be managed for maximum efficiency. Slow-release N formulations and materials possessing inhibitor properties need to be evaluated for their potential use in furrow-irrigated rice culture.

Experiment: Nitrogen management for furrow-irrigated rice

Location: Rice Research Station, South Unit

Soil Type/Analysis: Crowley silt loam; pH: 6.0; O.M.: 1.78%; extractable nutrients (mg/kg): P-., Na-107, K-105, Ca-1915, Mg-610, Zn-0.89, S-6.68, As-4.14, Fe-153.07

Variety/Seeding Rate: LMNT, 110 lb/A

Planting Method/Date: Drill-seeded, Apr 27

Fertilization: 20 lb N/A + 60 lb/A P_2O_5 and K_2O ppi; variable rates and timings of N preflood

Plot Size: 10.67 x 25 ft (267 ft^2), 6.2-inch drill spacing

Emergence Date: Apr 13

Water Management: Furrow irrigated, May 1, May 10, May 24, May 31, July 13, Aug 15

Herbicides: 3.0 lb ai/A Stam (propanil) + 1.0 lb ai/A Basagran (bentazon), May 17; 4.0 lb ai/A Stam + 1.0 lb ai/A Basagran, May 29; 3.0 lb ai/A Stam + 0.75 lb ai/A Ronstar (oxadiazon), June 14

Insecticides: 0.25 lb ai/A Methyl (methyl parathion), July 31

Fungicides: 0.28 lb ai/A Tilt (propiconazol), June 30, July 18; 0.5 lb ai/A Rovral (iprodione), July 31

Harvest: Sep 8

Experimental Design: Split plot in a randomized complete block with three replications, N source assigned to main plots and rates to subplots

Comments: Stand establishment was slow, with good uniformity across the furrowed seedbed. Three herbicide applications were required to control weeds. Furrow irrigation was generally necessary once a week until June. Rainfall supplied most of the water requirement during July and August. Sheath blight was observed at panicle differentiation in some treatments, although there did not appear to be any significant influence on grain yield.

Table 1. Effect of N source, rate, and timing on agronomic performance of drill-seeded, furrow-irrigated Lemont rice. Rice Research Station, South Unit, Crowley, LA. 1989.

Time of N*			Days to 50% heading				Plant height				Grain yield at 12% moisture			
Total N	PF	PI	Urea	SU	SCU	N Mean	Urea	SU	SCU	N Mean	Urea	SU	SCU	N Mean
---(lb/A)---							-----------(cm)----------				----------(lb/A)---------			
90	90	--	79	80	80	80	68	64	67	67	5124	5259	5570	5317
90	60	30	79	79	79	79	65	63	67	65	5357	5302	5355	5338
120	120	--	82	80	81	81	71	68	68	69	5984	5564	5635	5728
120	80	40	80	79	80	79	70	65	68	68	6090	5796	5735	5874
150	150	--	81	81	82	81	70	70	70	70	5684	5920	6224	5943
150	100	50	80	79	81	80	71	67	71	70	6025	6308	6233	6189
150	30	--**	82	81	81	81	74	71	73	73	6532	6477	6272	6427
Source mean			80	80	80		70	67	69		5828	5804	5861	
C.V., %				0.93				3.35				4.15		
LSD (0.01):														
Source				ns				ns				ns		
Split				1				3				310		
Split within source				ns				ns				466		
Split across source				ns				ns				557		

* Time of N: PF = preflood; PI = panicle initiation.

** Approximately 30 lb N/A was applied at 7-day intervals beginning with a PF application for a total of five applications.

INFLUENCE OF ZINC SOURCE AND TIME OF APPLICATION ON DRILL-SEEDED LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Zinc (Zn) deficiencies in rice have been reported throughout Louisiana for many years. This condition has been described by the term 'bronzing'. The leaves take on a rusty appearance characterized by dark-brown lesions. Severe deficiency can cause stunting, loss of tillers, and thinning of stand. Low soil Zn levels, cool temperature and slow seedling root growth, deep floodwater on young rice, high pH, land formation and topsoil removal, and root pruning are known to cause Zn deficiency.

Zinc deficiency can be corrected in a number of ways, and there are different types of products available. The source of Zn used depends on method and time of application. On soils low in Zn, an oxide, a salt, or a chelated product can be applied preplant. Less material is required for true chelated products due to higher availability, but are generally more expensive. Zinc can also be applied as a foliar spray if bronzing develops after planting.

The objective of this investigation was to evaluate the effectiveness of different sources of Zn when used in a drill-seeded cultural system on two different soil types.

MATERIALS AND METHODS

The long-grain semidwarf variety Lemont was used in the study. Approximately 60 lb/A P_2O_5 and K_2O were banded 2 inches deep, and Lemont was drill-seeded at the rate of 100 lb/A. Four sources of Zn were used in the study. Rebel, a liquid product (7% Zn with Zn sulfate as the source and lignin sulfonate as a complexing agent) was applied at a rate of 0.72 lb Zn/A. This material was applied as a preplant surface application and also as a foliar spray prior to permanent flood establishment. Micromate (36% Zn with Zn sulfate as the source) was applied preplant incorporated at the rate of 7.2 lb Zn/A. Maxsul 0021 (21% Zn with Zn sulfate and Zn oxide as sources) was also applied at 7.2 lb Zn/A. Ruffin-Tuff (10% Zn, a water-soluble polyflavonoid Zn source, fully chelated) was applied preplant incorporated at a rate of 1.20 lb Zn/A. Nitrogen was surface-broadcast at the rate of 120 lb/A 5 weeks after planting and a shallow, permanent flood was established.

Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Zinc content (Y-leaf), plant height, grain moisture, and grain yield were determined.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the Rice Research Station and in Rapides Parish to evaluate the effectiveness of different sources of Zn in drill-seeded rice.

Bronzing was observed after the permanent flood was established at the Rice Research Station. The symptoms were not consistent with respect to treatment, however, since it occurred in both treated and untreated plots. There was no influence of Zn on plant growth or grain yield (Table 1). A Y-leaf analysis showed no differences in Zn content between treatments, even where no Zn was applied. Previous research has determined that rice leaf tissue containing >20 mg/kg is considered to be sufficient and a yield increase is not expected. According to a soil analysis prior to planting, however, Zn content was considered to be very low (0.81 mg/kg as measured by 0.1N HCL). Similar results were obtained in Rapides Parish (Table 2). There was no influence of Zn application on plant growth or grain yield, and Y-leaf Zn concentration was >20 mg/kg, although the leaf samples were highly variable in Zn content. Zinc content of the Moreland clay was considered to be very high (4.48 mg/kg). There was no indication of bronzing at any time in Rapides Parish.

Experiment: Zinc source study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.7; O.M.: 1.04%; extractable nutrients (mg/kg): P-., Na-80, K-75, Ca-1350, Mg-282, Zn-0.81, S-8.91, As-4.89, Fe-38.83

Variety/Seeding Rate: LMNT, 100 lb/A

Planting Method/Date: Drill-seeded, Apr 20

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, urea at 120 lb/A preflood, May 25

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: May 1

Water Management: Flushed, Apr 21, Apr 27, May 10; flooded, May 25; harvest drainage, Aug 11

Herbicides: 3.0 lb ai/A Stam (propanil), May 11, May 23; 0.9 oz ai/A Londax (bensulfuron-methyl), June 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), June 15

Fungicides: None

Harvest: Aug 21

Experimental Design: Randomized complete block with four replications, six treatments

Comments: Minor bronzing was observed after establishment of the permanent flood, however, deficiency symptoms were not consistent with respect to treatment.

Experiment: Zinc source study

Location: Rapides Parish, Will Bollich Farm

Soil Type/Analysis: Moreland silty clay; pH: 7.2; O.M.: 2.19%; extractable nutrients (mg/kg): P-., Na-37, K-243, Ca-3517, Mg-920, Zn-4.48, S-10.52, As-11.14, Fe-66.83

Variety/Seeding Rate: LMNT, 100 lb/A

Planting Method/Date: Drill-seeded, May 2

Fertilization: 120 lb N/A preflood; nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: May 16

Water Management: Flushed, May 7, May 27, May 31; flooded, June 7; harvest drainage, Aug 22

Herbicides: 3.0 lb ai/A Stam (propanil) + 2.0 lb ai/A Bolero (thiobencarb), May 26; 4.0 lb ai/A Stam + 1.0 lb ai/A Basagran (bentazon), June 7

Insecticides: 0.25 lb ai/A Methyl (methyl parathion), Aug 20

Fungicides: None

Harvest: Sep 6

Experimental Design: Randomized complete block with four replications, six treatments

Comments: There was no visual indication of zinc deficiency at any time during the growing season.

Table 1. Influence of zinc source and time of application on agronomic performance of drill-seeded Lemont rice. Rice Research Station, Crowley, LA. 1989.

Source	Rate and time* of application	Zinc content	Plant height	Grain yield
	(lb/A)	(mg/kg)	(cm)	(lb/A)
Check	--	25	79	6266
Zinc chelate	0.72 PP	27	81	6603
Ruffin-Tuff	1.20 PP	27	79	6539
Maxsul	7.20 PP	26	79	6357
Zinc sulfate	7.20 PP	25	80	6428
Zinc chelate	0.72 F	25	77	6441
C.V.%		5.89	2.86	2.90
LSD (0.05)		ns	ns	ns

* Time of Zinc application: PP = preplant; F = foliar at the 4 - 5 leaf growth stage.

Table 2. Influence of zinc source and time of application on agronomic performance of drill-seeded Lemont rice. Will Bollich Farm, Rapides Parish, LA. 1989.

Source	Rate and time* of application	Zinc content	Plant height	Grain yield
	(lb/A)	(mg/kg)	(cm)	(lb/A)
Check	--	43	69	6760
Zinc chelate	0.72 PP	34	70	6734
Ruffin-Tuff	1.20 PP	38	69	6481
Maxsul	7.20 PP	46	69	6724
Zinc sulfate	7.20 PP	40	69	6634
Zinc chelate	0.72 F	39	68	6591
C.V.%		21.67	1.81	2.32
LSD (0.05)		ns	ns	ns

* Time of Zinc application: PP = preplant; F = foliar at the 4 - 5 leaf growth stage.

INFLUENCE OF FEEDER ROOT NECROSIS ON MANAGEMENT PRACTICES OF WATER-SEEDED LEMONT RICE

P.K. Bollich, R.W. Schneider, M.C. Rush, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Recent studies have shown feeder root necrosis (FRN), a disorder associated with a host of pathogenic fungi, especially *Pythium* spp., to affect seedling rice. Research has indicated that this disorder can be quite severe, especially in water-seeded rice, resulting in seedling loss and poor plant stands. Previous studies have shown the fungicide Ridomil (metalaxyl) to be effective in controlling FRN and increasing plant stands of water-seeded rice.

A study was initiated in 1988 to evaluate the potential use of Ridomil in water-seeded rice when coupled with currently recommended best management practices. The objectives of this 1989 study are to 1) evaluate the effectiveness of Ridomil on FRN of water-seeded Lemont rice, and 2) compare agronomic performance of Lemont at variable rates of seeding and fertilizer nitrogen (N) application with and without Ridomil.

MATERIALS AND METHODS

The long-grain semidwarf variety Lemont was planted in this study. Nitrogen rates of 60, 90, 120, and 150 lb/A, and 60 lb/A P_2O_5 and K_2O were banded approximately 2 inches deep into a prepared seedbed. Ridomil was sprayed onto the soil surface at a rate of 1 pint/A. The test was immediately flooded to a depth of 2 to 3 inches. Presoaked Lemont was seeded at rates of 60, 90, 120, and 150 lb/A. Continuous flood water management was practiced, and the rice was allowed to emerge through the flood.

Pest management (weeds, insects, disease) was practiced when necessary. Plant stands were determined after emergence. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, grain moisture, and grain yield were determined.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the Rice Research Station to determine the influence of Ridomil on FRN of water-seeded Lemont rice grown under continuous flood culture and to compare variable rates of seeding and fertilizer N application with and without Ridomil.

Number of seedlings increased as seeding rate increased, as expected. Application of Ridomil significantly increased the number of seedlings at all seeding rates regardless of N application. Ridomil decreased days to 50% heading but had no influence on plant height or grain yield.

Days to 50% heading and plant height increased as rate of N increased. No yield response was observed above 120 lb/A. Days to 50% heading and plant height decreased slightly as seeding rate increased. Grain yields were relatively constant across seeding rates above 60 lb/A. A yield reduction was observed when only 60 lb seed/A was planted.

Ridomil did have a significant influence on stand establishment, with emergence and vigor being much more pronounced in 1989. Seedling number increased at all seeding rates with the application of Ridomil. With the exception of a 60 lb/A seeding rate at fertilizer N levels of 60, 90, and 120 lb/A, resulting stand in the other treatments not receiving a Ridomil application was well within current recommendations for an optimum plant stand.

Experiment: Feeder root necrosis study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.4; O.M.: 0.77%; extractable nutrients (mg/kg): P-., Na-149, K-61, Ca-1111, Mg-339, Zn-0.73, S-8.77, As-5.01, Fe-57.92

Variety/Seeding Rate: LMNT, 150 lb/A

Planting Method/Date: Water-seeded, Apr 13

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, ammonium sulfate

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: Apr 19

Water Management: Flooded, Apr 12; harvest drainage, Aug 1

Herbicides: 1.2 oz ai/A Londax (bensulfuron-methyl), May 5; 3.5 lb ai/A Ordram (molinate), May 11; 0.9 oz ai/A Londax May 16

Insecticides: 0.6 lb ai/A Furadan (carbofuran), May 17, May 24

Fungicides: 1.0 pt ai/A Ridomil (metalaxyl), Apr 12; 0.28 lb ai/A Tilt (propiconazol), June 30

Harvest: Aug 11

Experimental Design: Split plot in a randomized complete block with four replications, Ridomil assigned to main plots and N rate x seeding rate combinations to subplots

Comments: LMNT displayed good seedling vigor and emergence through a continuous flood. A visual response to Ridomil was observed 1 week after emergence. Moderate N deficiency was observed at 60 lb N/A after 7 weeks. Ridomil increased stand and slightly decreased days to 50% heading (Table 1). Increasing N increased days to 50% heading, plant height, and grain yield. Days to 50% heading and plant height decreased as seeding rate increased. A seeding rate of 60 lb/A decreased grain yield.

Table 1. Influence of Ridomil, N rate, and seeding rate on performance and grain yield of water-seeded Lemont rice. Rice Research Station, Crowley, LA. 1989.

Rate		Stand count		Days to 50% heading		Plant height		Grain yield at 12% moisture	
Nitrogen	Seed	Ridomil	No Ridomil	Ridomil	No Ridomil	Ridomil	No Ridomil	Ridomil	No Ridomil
----(lb/A)----		----(plants/ft^2)---				-------(cm)--------		-------(lb/A)------	
60	60	14	8	78	83	72	72	6119	5492
60	90	20	12	76	80	72	71	5848	5801
60	120	24	15	75	80	70	70	6111	5817
60	150	33	16	73	79	70	73	6349	5787
90	60	15	8	80	83	76	78	6852	6304
90	90	21	11	78	82	75	76	6899	6610
90	120	24	15	76	80	75	76	7047	6730
90	150	32	14	75	80	73	74	7252	6513
120	60	12	8	80	84	78	82	7225	6390
120	90	24	11	79	83	78	78	7439	7040
120	120	31	17	78	81	78	79	7495	7435
120	150	32	16	79	82	79	79	7322	7190
150	60	17	10	81	85	80	81	7275	6943
150	90	18	13	80	83	78	82	7315	7318
150	120	26	10	80	83	78	81	7381	7042
150	150	31	17	79	83	76	80	7255	7302
Ridomil Mean		23	13	78	82	76	77	6949	6607
C.V., %		23.00		1.36		3.20		4.57	
LSD (0.05):									
Ridomil		5		3		ns		ns	
Nitrogen mean									
60		18		78		71		5915	
90		18		79		75		6776	
120		19		81		79		7192	
150		18		82		79		7229	
LSD (0.01):		ns		1		2		204	
Seed rate mean									
60		12		82		77		6575	
90		16		80		76		6784	
120		20		79		76		6882	
150		24		79		76		6871	
LSD (0.01):		3		1		2		204	
N rate x seed rate		ns		sig		ns		ns	

EVALUATION OF NBPT AS A UREASE INHIBITOR IN DRILL-SEEDED LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Profitable rice production is greatly influenced by uptake and efficiency of fertilizer nitrogen (N). Nitrogen source, rate, time of application, placement, rice variety, water management, and environmental conditions influence efficiency of applied fertilizer N. Denitrification, volatilization, and leaching can lead to large losses of applied N and decreased grain yields with improper management of fertilizer N. In a dry-seeded cultural system, fertilizer N applied to a dry seedbed just prior to establishment of the permanent flood is efficiently utilized by the rice plant.

Proper application in relation to water management has a significant influence on retention and availability of applied N. Although efficiency is increased when an application of fertilizer N is made just prior to establishment of the permanent flood, it is often difficult for a farmer to flood a rice field within a short period of time. The longer fertilizer N is left on the soil surface without establishment of the permanent flood the greater the risk for losses due to nitrification-denitrification, urea hydrolysis, and ammonia volatilization. An inhibitor that delays urea hydrolysis by inhibiting the enzyme urease and reducing the potential for ammonia volatilization could improve efficiency of fertilizer N in dry-seeded rice.

The objectives of this preliminary investigation were to: 1) determine the influence of preflood and postflood urea-N applications on drill-seeded Lemont rice and 2) evaluate the effectiveness of N-(n-butyl)thiophosphoric triamide (NBPT) in improving efficiency of urea-N by inhibiting urease.

MATERIALS AND METHODS

The long-grain semidwarf variety Lemont was used in the study. Approximately 60 lb/A P_2O_5 and K_2O were banded 2 inches deep, and Lemont was drill-seeded at the rate of 100 lb/A. The test area was flushed periodically for emergence and stand establishment. Urea-N with and without NBPT was surface broadcast at 3-day intervals beginning 9 days prior to permanently flooding, with the final application being made 6 days after establishment of the permanent flood for a total of six times of application. Rates of 60 and 120 lb N/A were applied for each material.

Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, grain moisture, and grain yield were determined.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the Rice Research Station to evaluate the effectiveness of NBPT as a urease inhibitor in drill-seeded rice.

An application of NBPT-amended urea had little influence on the performance of Lemont when compared to urea without the inhibitor (Table 1). Days to 50% heading and plant height were only slightly influenced while there was no significant influence on grain yield. Nitrogen rate and time of application had a significant effect on plant growth and grain yield. A rate of 120 lb N/A is considered to be optimum for the variety Lemont when grown on a Crowley silt loam soil, and grain yields were significantly higher at this level of N. Grain yields were 600 lb/A lower when N was applied at a suboptimum rate of 60 lb/A. Grain yields were highest when N was applied within 3 days of permanent flood establishment regardless of rate of application. Grain yields were reduced 16% when N was applied 9 days prior to flooding, however, applying N 3 days after the permanent flood was established resulted in a 29% reduction in grain yield, and a 36% reduction if N application was delayed until 6 days after flooding.

During late vegetative and early reproductive growth there appeared to be a significant influence of the NBPT-amended urea on growth of Lemont. At both rates of application and at all preflood timings the rice was darker green in color, slightly taller, and somewhat more leafy, indicating greater uptake of applied N. These differences in plant growth did not result in significantly higher grain yields, however. Overall grain yield was approximately 20% lower than normally expected for the variety Lemont when fertilized with 120 lb N/A. There was probably some other factor that limited yield potential in this study, which could explain the lack of a grain yield response to NBPT-amended urea when the visual assessment indicated otherwise. Bronzing, an indicator of zinc deficiency, did occur during early reproductive growth, and a corrective foliar application of zinc was made. This nutrient disorder is known to adversely affect plant growth and can limit grain yields. The rice plants appeared to recover after zinc was applied, however, there is no way to determine whether potential grain yield had already been affected.

Experiment: Urease inhibitor (NBPT) study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.8; O.M.: 0.77%; extractable nutrients (mg/kg): P-., Na-133, K-78, Ca-1541, Mg-416, Zn-0.48, S-11.24, As-5.01, Fe-32.94

Variety/Seeding Rate: LMNT, 100 lb/A

Planting Method/Date: Drill-seeded, Apr 20

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, urea with and without NBPT; 0.54 lb ai/A Zinc chelate, June 19

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: May 1

Water Management: Flushed, Apr 21, Apr 27, May 10; flooded, May 25; harvest drainage, Aug 11

Herbicides: 3.0 lb ai/A Stam (propanil), May 11, May 23; 0.9 oz ai/A Londax (bensulfuron-methyl), June 9

Insecticides: 0.6 lb ai/A Furadan (carbofuran), June 15

Fungicides: None

Harvest: Aug 21

Experimental Design: Randomized complete block with four replications, factorial arrangement of treatments

Comments: Response to applications of preflood N was observed within 5 days of application. Deficiency symptoms were observed 2 weeks after flooding at a N rate of 60 lb/A when applied 9 or 6 days prior to permanent flood. Onset of N deficiency was delayed at higher N and when the N was applied within 3 days of permanent flood. Plant growth appeared to be better when Lemont was fertilized with preflood urea+NBPT at all rates and timings when compared to urea alone. Postflood applications of either source resulted in significant N loss as evidenced by severe deficiency symptoms occurring 4 weeks after permanent flood establishment.

Table 1. Influence of nitrogen rate, time of application, and NBPT on agronomic performance of drill-seeded Lemont rice. Rice Research Station, Crowley, LA. 1989.

Source	Rate	Time of application	Days to 50% heading	Plant height	Grain yield
	(lb/A)			(cm)	(lb/A)
Urea	60	9 days pre	78	62	3920
Urea	60	6 days pre	78	64	4327
Urea	60	3 days pre	79	65	4808
Urea	60	0 days pre	81	68	5077
Urea	60	3 days post	79	59	3461
Urea	60	6 days post	79	59	3211
Urea	120	9 days pre	79	66	4699
Urea	120	6 days pre	81	73	5421
Urea	120	3 days pre	84	73	5399
Urea	120	0 days pre	84	75	5634
Urea	120	3 days post	79	63	4244
Urea	120	6 days post	79	59	3438
NBPT	60	9 days pre	77	64	4352
NBPT	60	6 days pre	80	67	4934
NBPT	60	3 days pre	82	71	4954
NBPT	60	0 days pre	80	69	5072
NBPT	60	3 days post	79	62	3522
NBPT	60	6 days post	80	58	3372
NBPT	120	9 days pre	81	68	4987
NBPT	120	6 days pre	84	74	5448
NBPT	120	3 days pre	84	74	5567
NBPT	120	0 days pre	84	75	5667
NBPT	120	3 days post	79	63	3935
NBPT	120	6 days post	79	60	3711
C.V.%			1.12	5.29	8.83
LSD (0.05)			1	5	567
		Main effects			
Source:					
Urea			80	66	4470
NBPT			81	67	4627
LSD (0.05)			1	1	ns
N rate:					
60			79	64	4251
120			81	69	4846
LSD (0.05)			1	1	164
Time:					
9 days pre			79	65	4489
6 days pre			81	70	5032
3 days pre			82	71	5182
0 days pre			82	72	5363
3 days post			79	62	3790
6 days post			79	59	3433
LSD (0.05)			1	2	283

EVALUATION OF DCD AS A NITROGEN EXTENDER IN DRILL-SEEDED LEMONT RICE

P.K. Bollich, W.J. Leonards, Jr., S.M. Rawls, and D.M. Walker

INTRODUCTION

Nitrogen (N) is a major nutrient requirement for rice grown in Louisiana. Nitrogen source, rate, time of application, placement, rice variety, water management, and environmental conditions influence efficiency of applied fertilizer N. Once N has been applied to a rice soil a number of conversion processes can occur, all of which are detrimental to its stability and availability. Denitrification, volatilization, and leaching can lead to large losses of applied N and decreased grain yields with improper management of fertilizer N.

In a dry-seeded cultural system, fertilizer N applied to a dry seedbed just prior to establishment of the permanent flood is efficiently utilized by the rice plant. Large amounts of N applied preplant in a dry-seeded system cannot be maintained or kept available to the rice plant because of water management. Applied N is readily nitrified and becomes very unstable once a rice field is flushed or flooded. Denitrification can result in significant losses of fertilizer N if improperly managed. While proper timing of N in relation to water management can reduce loss and improve efficiency, an effective nitrification inhibitor could delay the conversion of NH_4^+ to NO_3^- and keep the N available to the rice plant for a longer period of time. Increasing fertilizer N efficiency in this manner also conserves N and reduces the potential for NO_3^- accumulation, a growing environmental concern.

The objectives of this investigation were to: 1) evaluate the effectiveness of urea containing an inhibitor when applied preplant in a dry-seeded cultural system and 2) compare its performance to urea when managed according to currently recommended practices.

MATERIALS AND METHODS

The long-grain semidwarf variety Lemont was used in the study. Approximately 60 lb/A P_2O_5 and K_2O were banded 2 inches deep, and Lemont was drill-seeded at the rate of 100 lb/A. Preplant applications of urea and urea-DCD (dicyandiamide) at rates of 60 and 120 lb/A were also banded. The DCD-containing urea was supplied by Agrico Chemical Company and is marketed under the tradename Super Urea. The test area was flushed periodically for emergence and stand establishment. Urea with and without DCD was surface broadcast prior to establishment of the permanent flood. Rates of 60 and 120 lb N/A were applied preflood as a single application. The 120 lb/A rate was also applied as a split application for each material, providing either 2/3 preflood with the remainder at panicle initiation, or 1/2 preflood with the remainder being applied in two applications of 30 lb/A each at panicle initiation and panicle differentiation.

Pest control (weeds, insects, disease) was practiced when necessary. Individual whole plots were combine-harvested at field maturity. Days to 50% heading, plant height, grain moisture, and grain yield were determined.

SUMMARY AND CONCLUSIONS

A field experiment was conducted at the Rice Research Station to evaluate the effectiveness of DCD as a N extender in drill-seeded rice.

An application of DCD-amended urea had little influence on the performance of Lemont when compared to urea without DCD (Table 1). Days to 50% heading and plant height were only slightly influenced while there was no significant influence on grain yield. Nitrogen rate had a significant effect on plant growth and grain yield as expected. A rate of 120 lb N/A is considered to be optimum for the variety Lemont when grown on a Crowley silt loam soil, and grain yields were significantly higher at this level of N. Grain yields were over 1200 lb/A lower when N was applied at a suboptimum rate of 60 lb/A.

During late vegetative and early reproductive growth there appeared to be some influence of the DCD-amended urea on growth of Lemont. At both rates of application and at the preplant and preflood timings the rice was darker green in color, slightly taller, and somewhat more leafy, indicating greater uptake of applied N. These differences in plant growth as measured by maturity and height were small and did not result in additional grain production, however. Overall grain yield was 10 to 15% lower than normally expected for the variety Lemont when fertilized with 120 lb N/A. Bronzing, an indicator of zinc deficiency, did occur during early reproductive growth, and a corrective foliar application of zinc was made. This nutrient disorder is known to adversely affect plant growth and can limit grain yields. The rice plants appeared to recover after zinc was applied, however, there is no way to determine whether potential grain yield had already been affected.

Experiment: Urea-DCD study

Location: Rice Research Station

Soil Type/Analysis: Crowley silt loam; pH: 6.7; O.M.: 0.84%; extractable nutrients (mg/kg): P-., Na-73, K-64, Ca-1226, Mg-251, Zn-0.16, S-13.53, As-4.14, Fe-26.31

Variety/Seeding Rate: LMNT, 100 lb/A

Planting Method/Date: Drill-seeded, Apr 20

Fertilization: 60 lb/A P_2O_5 and K_2O ppi; nitrogen source, urea with and without DCD; 0.54 lb ai/A Zinc chelate, June 15

Plot Size: 7 x 25 ft (175 ft^2)

Emergence Date: Apr 30

Water Management: Flushed, Apr 21, Apr 27, May 10; flooded, May 25; harvest drainage, Aug 11

Herbicides: 3.0 lb ai/A Stam (propanil), May 11, May 23; 0.9 oz ai/A Londax (bensulfuron-methyl), June 9; 3.0 lb ai/A Ordram (molinate), June 23

Insecticides: 0.6 lb ai/A Furadan (carbofuran), June 15

Fungicides: None

Harvest: Aug 21

Experimental Design: Randomized complete block with four replications, 12 treatment combinations

Comments: Response to applications of preplant N was observed 2 weeks after emergence. Deficiency symptoms were observed 2 weeks after flooding at a N rate of 60 lb/A when applied preplant. Moderate deficiency was observed at 120 lb N/A prior to panicle differentiation.

Table 1. Influence of nitrogen rate, nitrogen source, and time of application on agronomic performance of drill-seeded Lemont rice. Rice Research Station, Crowley, LA. 1989.

Source	Rate and time of application [1/]	Days to 50% heading	Plant height	Grain yield
	(lb/A)		(cm)	(lb/A)
Urea	60 pp	78	61	4000
Urea-DCD	60 pp	78	64	4467
Urea	60 pf	80	69	5120
Urea-DCD	60 pf	81	72	5312
Urea	120 pp	78	69	5862
Urea-DCD	120 pp	78	68	6080
Urea	120 pf	82	74	6081
Urea-DCD	120 pf	85	77	5730
Urea	90 pf + 30 pi	82	76	6122
Urea-DCD	90 pf + 30 pi	83	71	5951
Urea	60 pf + 30 pi + 30 pd	80	73	5844
Urea-DCD	60 pf + 30 pi + 30 pd	81	74	5613
C.V.%		1.45	4.26	7.90
LSD (0.05)		2	4	627
<u>Contrasts:</u>				
Urea vs Urea-DCD		*	ns	ns
Urea vs Urea-DCD (preplant)		ns	ns	ns
Urea vs Urea-DCD (preflood)		*	ns	ns
Urea vs Urea-DCD (splits)		ns	ns	ns
60 lb N/A vs 120 lb N/A		*	*	*
Single vs Split		ns	ns	ns

[1/] Time of N: PP = preplant; PF = preflood; PI = panicle initiation; PD = panicle differentiation.

FOUNDATION SEED RICE PROGRAM

Lawrence M. White, III

INTRODUCTION

Foundation seed rice has been produced by the Rice Research Station for distribution to Louisiana farmers since 1949. The station's seed rice program was instituted in response to the critical shortage of pure planting stocks which existed during and after World War II. Since its inception, the program has made available to Louisiana growers over 101,000 cwt. of pedigreed stock of 22 rice varieties.

Concurrent with the distribution of pure seed by the Rice Research Station, there developed in Louisiana an industry comprised of independent seed dealers through whom farmers could conduct trade in registered and certified classes of pedigreed rice.

Foundation seed rice, the planting stock from which registered and certified seed are produced, is the farmers link with the work of the plant breeder. It is the product of hybridization and of successive generations of selection and testing to establish its value as crop seed and eventually as a commercial commodity. For this reason, foundation seed and the basic stocks from which it is produced, must be grown and conditioned in a manner which will insure that viability is maintained and that it be genetically pure and free from mechanical mixtures or contamination by noxious weeds.

Through the Rice Research Station's seed program, Louisiana farmers may obtain seed rice of improved varieties developed through the Louisiana Agricultural Experiment Station breeding program and of established commercial varieties originating either at Crowley or at research centers in neighboring states.

In order to fulfill the objectives of the seed program, the Rice Research Station utilizes the personnel, land, machinery, and other facilities needed to plant, harvest, condition, and store its annual seed rice crop. The production of breeder seed, planting stock for the foundation fields, and the maintenance of purity in commercial rice varieties are functions of the seed program. Breeder seed is sometimes grown within fields of foundation rice, or in a special nursery, set aside for propagating the Rice Research Station's seed stocks. The nursery also serves as a site for evaluating, purifying, and increasing selections from the Louisiana Agricultural Experiment Station breeding program which show promise as new varieties.

The distribution of pedigreed seed rice produced by the Rice Research Station is done according to a formula adopted by the Louisiana Seed Rice Growers Association. For each rice producing parish, the amount of seed allotted to an individual parish is determined by the percentage of the states total rice acreage grown in that parish during the previous crop year.

Personnel of the Louisiana Cooperative Extension Service in cooperation with parish committees of the Seed Rice Growers Association assist in the allocation of foundation seed rice. It is at the parish committee level that the allocation of seed to individual growers is decided. The county agents receive applications for seed rice from growers and handle information and publicity for the pure seed program.

In this state, the official seed certifying agency for all crops is the Louisiana Department of Agriculture. The rules and regulations pertaining to the certification of agricultural seeds are part of the Louisiana Seed Law. They are formulated by the Louisiana Seed Commission and enforced by the Agronomic Programs Division of the Louisiana Department of Agriculture. Personnel of the Agronomic Programs Division, operating from district offices conduct field inspections of growing rice and sampling of bagged rice for laboratory analyses which consist of purity determinations and germination tests.

PRODUCTION PRACTICES

Each year, the Rice Research Station devotes approximately 80 acres of land to the production of foundation seed rice. In order to eliminate noxious weeds, especially red rice, which can disqualify rice from certification, the fields are fallowed for a 2-year period preceding planting. This also enables the fields to meet the crop history requirements specified in the seed rice regulations.

Following seedbed preparation, foundation fields are planted by means of a 16-runner grain drill. A basal application of fertilizer (20-60-60 lb/A of NPK) is made at the time of seeding. The breeder stock is planted at the rate of approximately 100 lb/A. The rice receives a preflood application of urea in which the rate of N may vary from 45 to 90 lb/A.

Seedling grasses and weeds are controlled by means of commercially available herbicides, applied by airplane. Similarly, aerial applications of insecticides are used to protect the fields from outbreaks of harmful insects.

Roguing of the rice fields for the removal of off-types, varietal mixtures, and noxious weeds, begins at the onset of heading and continues until the rice is harvested. During this interval, the headed rice is inspected by personnel of the Agronomic Programs Division to determine whether or not it meets minimum field standards of the certifying agency.

The rice is harvested with a conventional combine, and dried in the Rice Research Station's continuous flow drier to a moisture level of approximately 12%. During the storage period between drying and cleaning, the rice is treated with an insecticide in order to protect it from stored-grain insects.

Cleaning of foundation and breeder seed usually commences in late October and continues until late December. The rice first moves through an air-and-screen cleaner which removes chaff, straw, and other foreign material and grades the grain according to width and thickness.

It then flows through two sets of length grading machines which consist of rotating, indented metal cylinders. The first set of cylinders removes stemmy rice, grains which have very long awns or which are attached to portions of the panicle. The second set removes small grains and broken or dehulled kernels of rice.

In the final phase of cleaning, the rice moves through a machine which performs diameter grading of the grain by means of rapidly oscillating perforated screens. This machine is designed to separate medium-grain and/or red rice from long-grain rice. It is also capable of removing shrivelled and other slender kernels from medium-grain rice.

From the cleaning machines, foundation and breeder seed rice flow directly into a treater which applies a measured quantity of liquid fungicide for protection of young rice plants from seedling disease. The rice is bagged as it comes from the treater, assigned a lot number, and placed in storage in the Station's seed rice warehouse where it remains until the time that it is distributed to Louisiana farmers.

The field and laboratory purity standards for foundation seed rice are very strict with regard to varietal mixtures and noxious weeds. In all phases of production, therefore, great care must be exercised in order to prevent these impurities from contaminating the seed stocks. To that end, it is routine procedure at the Rice Research Station to partially disassemble all planting and harvesting equipment and to clean it thoroughly with water and/or compressed air before using it in the field. The drier and cleaning plant, including all elevators and other conveying equipment, are also subjected to meticulous cleaning and inspection before and after each variety of rice is handled. The machineries used in fallow plowing and in seedbed preparation are important sources of contamination after having been used in stubble fields. Therefore, tractors, plows, harrows, and land levelers are carefully washed before they enter land which is in a fallow cycle. These measures, together with the inspection and rouging which are done during the growing season, help to insure that foundation seed is genetically pure and free of mechanical mixtures and noxious weed seeds.

1989 Activities

Of the 2725 cwt. of foundation seed rice sold in March 1989, the varieties and quantities were as follows: Lemont, 845 cwt.; Mercury, 523 cwt.; Tebonnet, 517 cwt.; Mars, 456 cwt.; and Gulfmont, 384 cwt. An additional 204 cwt. of Mercury, 130 cwt. of Mars, 88 cwt. of Gulfmont, and 12 cwt. of Tebonnet were downgraded to registered class and sold at a reduced price.

The Rice Research Station's foundation seed crop in 1989 consisted of 26.44 acres of Lemont, 18.32 acres of Tebonnet, 9.50 acres of Mercury, 5.15 acres of Rico I, and 8.41 acres of LA 2201, an experimental long-grain variety.

Breeder seed was grown in 1989 as follows: Tebonnet, 1.00 acre; Lemont, .75 acre; Mercury, .50 acre; Katy, .25 acre; Toro-2, .25 acre; Saturn, .20 acre; and Jasmine 85, .10 acre.

Headrows of Mercury, Tebonnet, Lemont, Toro-2, and Della were also grown in 1989.

STAGING-AREA BAITING WITH DRC-1339 FOR REDUCING SPROUTING RICE DAMAGE BY ROOSTING BLACKBIRDS[1]

E.A. Wilson, J.F. Glahn,[2] R.B. Davidson,[3] J.M. Hobbs,[3] and G.A. Harper[3]

Damage to sprouting rice by blackbirds is often localized near roosting sites. Lethal reduction of spring roosting blackbird populations may provide an alternative to existing methods of controlling blackbird depredations on newly seeded rice. A previous study (Wilson et al. 1988) demonstrated the feasibility of controlling large numbers of roosting blackbirds using the avicide DRC-2698 (CAT). In 1989, the state of Louisiana approved the use of a closely related avicide, DRC-1339 (Starlicide), for controlling blackbirds at the Miller's Lake roost in Evangeline Parish. This local-needs (24C) registration allowed the first full-scale attempt to control a major blackbird roost in the rice growing area of southwestern Louisiana.

MATERIALS AND METHODS

We conducted the study during March and April of 1989. Medium-grain brown rice was treated with DRC-1339 (2% by weight) using lecithin (1% by weight) as a sticker. Treated bait was then mixed with untreated brown rice to achieve a dilution rate of 1:50 (treated:untreated).

We selected 4 fields for baiting based on proximity to the roost and size of morning and evening flightlines passing over each site. On each field we established 6-8 bait lanes (20-36 ft wide spaced on 50-100-ft centers) comprising 3-6 acres. Up to 50 sampling points (proportional to total bait lane length) were systematically established along the bait lanes of each field and marked with a wire flag in the center of the lane. Bait consumption was assessed by examining the area within a 1-ft^2 grid tossed nonselectively within a 5-ft radius of each flag. Based on

---

[1] This research was supported by funds provided by rice producers through the Louisiana Rice Research Board and by the U.S. Department of Agriculture.

[2] Research Biologist; USDA,APHIS,Science and Technology; Starkville, Mississippi.

[3] Wildlife Biologists; USDA,APHIS,Animal Damage Control; Crowley, Louisiana; McAllen, Texas; and Crowley, Louisiana, respectively.

"all or none" rice consumption patterns by blackbirds, percent consumption of rice was calculated as the number of plots without rice divided by the total number of plots.

Each field was prebaited with untreated brown rice applied at 50 lbs per lane acre using aerial or ground equipment. Treated bait was applied to each field (100 lbs per lane acre) only after blackbirds had comsumed at least 75% of the prebait and observations indicated no appreciable nontarget hazards. Additional bait applications were made after at least 75% of the previous bait application was removed.

We observed each field daily to determine blackbird activity. Two of the fields were intensively observed in the morning and evening as flightlines left and returned to the roost; observers recorded numbers and species of birds passing over and landing on bait sites. The other fields were scanned for blackbird activity by driving between field locations, and peak blackbird use was recorded. Roosting population estimates were made about twice a week before, during, and after baiting. Species composition of the roost was estimated weekly during the same period.

To assess mortality of birds consuming treated particles, each of 24 caged red-winged blackbirds (*Agelaius phoeniceus*) was assigned to 1 of 4 groups. The first group was force fed 1 treated rice grain taken from bait that had never been diluted with untreated rice. The second group received 1 treated rice grain that had been mixed with untreated rice and then visually separated from the untreated. The third group received 1 treated grain from bait that had been diluted and then weathered in the field for 48 hrs. The last group (control) was force fed untreated rice. Birds were banded and caged for 7 days to assess mortality. Dead birds were necropsied to determine if they had died from DRC-1339 poisoning.

We assessed blackbird mortality resulting from foraging activity by cannon netting birds in selected baited fields. To assure that birds would have adequate opportunity to forage on treated bait, nets were fired at least 5 minutes after the blackbird flight had ended. Captured birds were immediately placed in shaded holding pens and provided with a standard bird ration and water *ad libitum*. Birds dying within 5 days of capture were necropsied to determine treatment related mortality.

To determine potential sprouting rice damage reduction due to baiting, we conducted posttreatment censuses of foraging blackbirds within a 9-mile radius of the roost along a previously established 20-mile roadside route where 3 years of baseline data had been established (Labisky and Brugger 1989). Surveys were conducted twice each week from the last week of March through mid-April, a period when much of the rice damage occurs. Blackbirds were counted at each of 20 stops located 1 mile apart beginning 30 minutes after sunrise. Bird counts were compared with each previous year of census data for the same period using a Mann-Whitney U test.

To further assess reduction of damage to newly planted rice as a result of baiting, a questionnaire was mailed to 49 rice growers who planted rice within a 10-mile radius of the roost. The questionnaire was designed to compare damage in 1989 to that occurring during the 3 previous years (before baiting).

RESULTS AND DISCUSSION

Prior to prebaiting, blackbirds were naturally staging on 3 (Fields 1-3) of the 4 bait sites. These fields provided the most consistent patterns of blackbird use throughout the baiting period (Tables 1-3). Initial attempts to prebait birds on Field 4 were unsuccesssful. Disking areas between bait lanes was necessary to attract birds, and baiting success was generally less than that on other fields (Table 4).

At Fields 1 and 2, which were observed intensively, numbers of birds in flightlines and landing on bait sites declined throughout the baiting period (Tables 1 and 2). Spot-check observations of Fields 3 and 4 suggested a similar decline of bird use over time (Tables 3 and 4). Flocks of birds landing on baited fields were comprised largely of red-winged blackbirds (Tables 1-4). Brown-headed cowbirds (Molothrus ater), common grackles (Quiscalus quiscula), and great-tailed grackles (Quiscalus mexicanus) used fields infrequently. Many of the birds landing on baited fields were observed feeding outside the baited lanes and probably failed to consume bait during a single feeding period.

Bait application ranged from 1250 to 2032 lbs per field. A total of 6562 lbs of bait was applied to the 4 bait sites. Additionally, 1125 lbs of bait were applied to a 3-acre extension of Field 2 (Field 2B). Blackbirds consumed 5383 lbs (70%) of the bait applied (Table 5). Most of the bait was consumed by 15 March; later applications of bait had poor acceptance due to competition from other food sources (i.e. invertebrates and weed seeds) produced by field preparation for rice planting.

During bioassays on caged birds (Table 6), consumption of 1 treated rice grain (unmixed, mixed, or weathered) resulted in 100% mortality of female redwings; all 12 females dosed died within 48 hours. Male redwings were more resistant to the treatment, probably because of their greater body weight. Mortality was 50% (3 of 6), and males took up to 120 hrs to die.

Table 1. Estimated blackbird flightline population over site and bird use of Field 1 during baiting with DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Date (AM or PM)	Flightline over field: Total number birds	Flightline over field: Percent red-winged blackbirds	Flightline use of field: Total number birds	Flightline use of field: Percent flightline
3/7 (PM)	546,000	99	51,000	9
3/8 (AM)	552,000	95	48,700	9
3/9 (AM)	175,000	99	35,000	20
3/9 (PM)	231,000	99	5,100	2
3/10 (AM)	355,000	99	23,500	10
3/10 (PM)	61,200	70	20,200	33
3/11 (AM)	145,000	80	35,000	24
3/12 (AM)	-------	--	30,000	--
3/13 (PM)	<100,000	<50	0	--
3/14 (AM)	75,000	--	7,500	10
3/15 (AM)	20,000	--	5,000	25
3/16 (AM)	<10,000	--	500	--

Table 2. Estimated blackbird flightline population over site and bird use of Field 2 during baiting with DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Date (AM or PM)	Flightline over field: Total number birds	Flightline over field: Percent red-winged blackbirds	Flightline use of field: Total number birds	Flightline use of field: Percent flightline
3/7 (PM)	101,000	99	19,475	19
3/8 (AM)	116,300	95	14.700	13
3/8 (PM)	-------	--	15,000	--
3/9 (AM)	122,000	99	21,000	17
3/9 (PM)	90,000	95	17,000	19
3/11 (AM)	225,000	99	13,500	6
3/11 (PM)	105,000	98	5,000	5
3/12 (AM)	120,000	99	18,000	15
3/13 (PM)	55,000	99	18,000	33
3/14 (PM)	18,400	99	10,400	56
3/15 (AM)	10,000	99	3,000	30
3/15 (PM)	28,500	96	7,300	26
3/16 (AM)	60,000	99	1,500	25

Table 3. Peak blackbird use (from spot-check observations) of Field 3 during baiting with DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Date (AM or PM)	Number blackbirds	Percent redwings
3/9 (AM)	>10,000	95
3/9 (AM)	<10,000	95
3/9 (PM)	<1,000	95
3/10 (PM)	>10,000	95
3/11 (AM)	<10,000	99
3/11 (PM)	<1,000	95
3/12 (AM)	>10,000	95
3/13 (AM)	>10,000	99
3/13 (PM)	5,000 - 10,000	75
3/14 (AM)	1,000 - 5,000	99
3/15 (AM)	1,000 - 5,000	99
3/16 (AM)	1,000 - 5,000	99
3/17 (PM)	1,000 - 5,000	99
3/18 (AM)	1,000 - 5,000	99
3/21 (AM)	<1,000	99

Table 4. Peak blackbird use (from spot-check observations) of Field 4 during baiting with DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Date (AM or PM)	Number blackbirds	Percent redwings
3/11 (PM)	>10,000	99
3/12 (AM)	1,000 - 5,000	95
3/13 (AM)	1,000 - 5,000	99
3/13 (PM)	1,000 - 5,000	99
3/14 (AM)	1,000 - 5,000	99
3/14 (PM)	>10,000	99
3/15 (AM)	1,000 - 5,000	99
3/15 (PM)	<1,000	99
3/16 (AM)	<1,000	99
3/16 (PM)	<500	99
3/17 (PM)	<1,000	99

Table 5. Application and blackbird consumption of DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Field	Bait exposure period	Bait applied	Bait consumed
		---------------(lb)---------------	
1	3/7-3/8	250	245
	3/9-3/10	500	384
	3/10-3/12	500	621
	3/13-3/15	500	110
	3/15-3/17	66	66
	3/17-3/19	66	0
	Total	1882	1426
2	3/7-3/8	200	140
	3/8-3/11	400	350
	3/11-3/12	133	108
	3/12-3/13	133	158
	3/13-3/14	133	125
	3/14-3/16	133	132
	3/16-3/18	133	106
	3/18-3/21	133	0
	Total	1398	1119
2B	3/11-3/13	300	300
	3-13-3/15	300	225
	3/15-3/17	225	84
	3/19-3/21	300	25
	Total	1125	634
3	3/9-3/11	500	490
	3/11-3/13	500	398
	3/13-3/15	500	220
	3/15-3/17	133	104
	3/17-3/19	133	125
	3/19-3/20	133	136
	3/20-3/21	133	0
	Total	2032	1473
4	3/11-3/13	500	440
	3/13-3/15	500	291
	3/15-3/17	250	0
	Total	1250	731

Based on 4 cannon net samples, percent mortality of female redwings foraging on bait sites ranged from 6-66%, with a mean of 19% (Table 7). Percent mortality for all species combined averaged 9% (range 6-22%). These data suggest that many birds either failed to consume rice bait or failed to encounter treated particles. Some of the cannon netted birds appeared to have received sublethal doses of DRC-1339. This may have been due in part to the fact that redwings often crack grains of rice during feeding and fail to consume all parts of the grain.

It is not possible to determine total blackbird mortality from DRC-1339 baiting operations, since birds die over a large area and few dead birds are found. Counts of birds in baited fields are of little value in determining mortality, since many birds do not consume bait. Natural changes in roosting populations during the baiting period due to migration and resident dispersal make it impossible to quantify population reduction due to baiting. Bait consumption can be used as an index to blackbird mortality from baiting. Using formulas derived from flightpen studies (Glahn et al. 1988), we can project mortality in excess of 1 million birds from bait consumption. However, the extent to which foraging activity by captive birds resembles that in the field has not been established.

Although blackbird roosting populations (Table 8) before and during baiting paralleled those in the 3 previous years (Labisky and Brugger 1989), bird numbers 1 week after baiting (March 30) were the lowest recorded for the end of March during the period 1986-89. The largest reduction in bird numbers occured after most of the bait had been consumed, and it is unknown whether this reduction in bird population was treatment related. We speculate that resident bird populations were reduced by baiting and migrants departed late or that treatment related mortality in the roost helped disperse and/or hasten migration in birds that normally lingered in the roost during rice planting season.

Numbers of blackbirds observed during posttreatment roadside censuses were lower ($P<0.01$) than those in 1986 but similar ($P>0.05$) to those in 1988. Insufficient baseline data were collected in 1987 for statistical comparison. Visual inspection of data (Table 9) suggests that 1989 bird numbers were lower than those in the previous 3 years.

About 67% of the rice grower questionnaires were returned. Severe bird damage during 1986-88 (prior to baiting) was reported by 61% of respondents; 36% reported moderate damage; only one respondent (3%) thought his damage was light. Roughly 91% of respondents reported that sprouting-rice damage was lower in 1989 (following baiting) than in the previous three years. About 23% of those realizing a reduction of damage in 1989 may have benefited from delayed planting (Wilson et al. 1989). The reduction of damage experienced by the remaining 77% of

Table 6. Red-winged blackbird mortality resulting from ingestion of 2% DRC-1339-treated brown rice during field bioassay. Evangeline Parish, LA. 1989.

Bait group	Redwings dosed		Mortality		Time till death
	Female	Male	Female	Male	
Unmixed	4	2	4	1	24 - 72
Mixed	4	2	4	2	24 - 120
Weathered	4	2	4	0	24 - 72
Control	6	0	0	-	- -

Table 7. Mortality of blackbirds cannon netted from selected sites baited with DRC-1339-treated brown rice. Evangeline Parish, LA. 1989.

Date	Collection site	Mortality/Sample size				% Mortality	
		Female red-winged blackbird	Male red-winged blackbird	Brown-headed cowbird	Common grackle	Female red-winged blackbird	All species
3/15	Field 2	1/15	0/8	1/6	0/2	6	6
3/10	Field 1	2/3	-	0/18	-	66	10
3/12	Field 2	2/5	0/3	0/1	-	40	22
3/10	Field 1	3/20	0/8	0/12	0/1	15	7

Table 8. Blackbird roosting population and species composition of the Miller's Lake roost before, during, and after baiting with DRC-1339-treated brown rice bait. Evangeline Parish, LA. 1989.

Date	Period	Number of blackbirds	Species composition RW[1]	CB[2]	ST[3]	GR[4]	GTGR[5]
2/22	Pretreatment	5,032,500					
2/26	"		72	23	2	3	0
2/27	"	2,967,500					
3/2	"	3,075,000					
3/5	"		89	3.7	0.8	5.7	0.8
3/6	"	2,160,000					
3/10	Treatment	1,600,000					
3/11	"		74	11	0	14	1
3/14	"	442,500					
3/18	"	382,500					
3/20	"		83.3	2.8	1.4	11.1	1.4
3/22	"	257,000					
3/30	Post-treatment	9,500					

1/ Red-winged blackbird.
2/ Brown-headed cowbird.
3/ European starling.
4/ Common grackle.
5/ Great-tailed grackle.

Table 9. Number of blackbirds observed along a road survey route 0 - 9 miles south of the Miller's Lake blackbird roost (Evangeline Parish, LA) during the sprouting rice damage periods of 1986-88 (before baiting) and following DRC-1339 baiting in 1989.

Year	Survey date	Number birds observed
1986 1/	3/27	2584
	4/2	1395
	4/7	1968
	4/10	1071
	4/14	1338
1987 1/	3/29	5824
	4/9	1053
	4/13	723
1988 1/	3/23	790
	3/31	1229
	4/5	1135
	4/9	1392
	4/12	703
1989	3/28	801
	3/31	245
	4/4	937
	4/7	817
	4/11	178
	4/13	462

1/ Data from Labisky and Brugger 1989.

respondents who did not delay planting in 1989 may be attributed to baiting operations, environmental (weather) factors, or a combination of both. For growers who did not delay planting, estimates of dollar losses to blackbirds (including the cost of bird control) averaged 5 times higher for 1986-88 ($4319) than for 1989 ($873). The highest losses were reported by growers who plant within 5 miles of the Miller's Lake roost.

CONCLUSIONS AND RECOMMENDATIONS

Strategic placement of baits was successful in attracting large numbers of blackbirds to staging areas near the Miller's Lake roost. Bait consumption by blackbirds was sustained over a 2-week period and was sufficient to achieve roost population control given an effective bait mixture. However, percent mortality of birds foraging on bait sites (based on cannon net samples) was unacceptably low. Blackbird mortality can be increased by increasing the ratio of treated to untreated particles in the bait mixture; research is needed to determine a dilution rate that is more effective, but provides a reasonable measure of safety for nontarget birds.

Based on roost counts, road surveys, and grower questionnaires, postbaiting blackbird numbers and sprouting rice damage appear to have been reduced (relative to the 3 previous years) in the Miller's Lake area. However, we lack a direct systematic method to determine baiting efficacy, and it is difficult to separate treatment effects from those of other factors such as weather. Attention should be given to development of more sophisticated techniques for determining blackbird mortality and damage reduction.

LITERATURE CITED

Glahn, J.F., M.L. Avery, P.W. Lefebvre, R.E. Matteson, and C.O. Nelms. 1988. Evaluation of DRC-2698 (CAT)-treated rice bait consumption as an index to red-winged blackbird mortality. Denver Wildlife Research Center, Bird Damage Research Report No. 417. 14pp.

Labisky, R.F., and K.E. Brugger. 1989. Population analysis and roosting- and feeding-flock behavior of blackbirds damaging sprouting rice in southwestern Louisiana. Florida Coop. Fish & Wildl. Res. Unit, Tech. Rep. 36. 77 pp.

Wilson, E.A., J.F. Glahn, P.W. Lefebvre, G.A. Harper, and E.A. LeBoeuf. 1988. Staging-area baiting with DRC-2698 (CAT) for controlling roosting blackbirds associated with damage to sprouting rice. 80'th Ann. Res. Rpt., Rice Res. Stn., La. Agri. Exp. Stn., L.S.U. Agricultural Center 80:151-158.

Wilson, E.A., E.A. LeBoeuf, K.M. Weaver, and D.J. LeBlanc. 1989. Delayed seeding for reducing blackbird damage to sprouting rice in southwestern Louisiana. Wildl. Soc. Bull. 17(2):165-171.

PLANT PHYSIOLOGY

INTRODUCTION

Plant growth regulators (PGRs) can have a tremendous effect on crop production because of their ability to alter plant growth and development. Therefore, studies of PGR modifications to plant growth and development which would improve rice production were conducted.

In preliminary greenhouse and small plot trials, emergence has been improved with PGR seed treatments which cause mesocotyl and coleoptile elongation. These structures are short in some semidwarf cultivars, and seeding more than 1 inch below the soil surface can result in poor stands. Small plot studies were continued in 1989. In addition, seedling height of semidwarf rice increases slowly resulting in poor seedling vigor. Seedling height was increased markedly in 1988, and studies to increase seedling height with PGRs were continued in 1989.

At present, PGRs have been identified which can modify internode elongation and research has shown modification of internode elongation can be beneficial. To date, research has shown PGRs can reduce plant stature by limiting internode elongation. In varieties susceptible to loding because of tall stature, reductions in plant height by PGRs have been accomplished and have resulted in a greater tolerance of tall varieties to lodging. In addition, studies to modify internode elongation in rice have shown that PGRs can limit exsertion of the panicle. Studies of this particular response to properly timed applications of PGRs have shown that seed production in red rice can be prevented. In that respect PGRs offer the first control measures for established red rice in commercial rice production. Studies on preventing red rice seed production and studies on increasing lodging resistance were continued.

Some PGRs are reported to increase grain yield directly. Several of those materials were evaluated.

To address the objectives of emergence and seedling vigor improvement of semidwarf cultivars, stature reduction, red rice seed elimination, and yield enhancement, PGRs were tested for their effects on rice growth and development.

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid-enhanced emergence in rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (3 inch planting depth, drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A, 25 Apr; urea (46% N) at 200 lb/A, 29 May

Plot Size: 166.25 ft^2 - 4.75 (8 rows) x 35 ft

Treated Area: 166.25 ft^2 - 4.75 (8 rows) x 35 ft

Treatment(s):

Formulations (conc.):
- ABG-3028A (10, 100 ppm gibberellic acid)
- ABG-3109 (13, 26, 52 ppm gibberellic acid)
- ABG-3110 (13, 26, 52 ppm gibberellic acid)
- ABG-3111 (13, 26, 52 ppm gibberellic acid)
- ABG-3112A (26 ppm gibberellic acid)
- ABG-3112B (26 ppm gibberellic acid)
- ABG-3112C (26 ppm gibberellic acid)

Timing: Seed treatment

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 30 Apr, 0.20 in.; 3 May, 0.37 in.; 4 May, 1.35 in.; 9 May, 0.03 in.; 13 May, 0.60 in.; 17 May, 0.60 in.; 18 May, 4.60 in.

Herbicide(s):
Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s):
Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 2 May

Permanent Flood: 30 May

Harvest Date: 7 Sep

Harvested Area: 74 ft^2 - 2.33 (4 rows) x 31.75 ft

Experimental Design: Randomized complete block (four replications)

Comments:

Stand and Emergence. Gibberellic acid (GA) increased seedling stand and emergence rate significantly (Table 1). The range in seedling stand for the GA seed treatments was 12 to 25 plants/ft^2. Seedling stand for the untreated checks did not exceed seven plants/ft^2. Emergence rate, expressed as days to 50% emergence, ranged from 10 to 12.6 days for all GA treatments. Emergence rates for the two untreated checks (foundation seed and seed with GA carrier only) exceeded 16 days.

A comparison of formulations showed ABG-3028A was the most active relative to its effects on seedling stand. ABG-3028A at 10 ppm was significantly more active than ABG-3028A at 100 ppm or any of the other GA formulations. Seedling stands with the ABG-3028A seed treatment were 25 and 19 plants/ft^2 for the 10 and 100 ppm rates, respectively. Seedling stands ranged between 12 and 18 plants/ft^2 with the other GA formulations. Of these formulations, ABG-3110 at 13 and 26 ppm and ABG-3112B at 26 ppm yielded stands significantly lower than ABG-3028A at 100 ppm. Stands were 12, 13, and 15 plants/ft^2, respectively. ABG-3109 had the only significant rate of response. There was a 4 plant/ft^2 difference in seedling stand between the 13 and 52 ppm rates of ABG-3110. Of the six formulations tested at the 26 ppm rate, seedling stand was highest with ABG-3111 (18 plants/ft^2) and lowest (13 plants/ft^2) with ABG-3110. This difference was significant. Seedling stands were 16, 15, 14, and 17 plants/ft^2 with ABG-3112A, ABG-3112B, ABG-3112C, and ABG-3109, respectively. Of these formulations, ABG-3109 was significantly more active than ABG-3110.

A comparison of formulations showed ABG-3028A was the most active relative to its effects on emergence rate. The activity of ABG-3028A at 10 and 100 ppm was statistically equal. Emergence rates with the ABG-3028A seed treatment were 10.3 and 10 days for the 10 and 100 ppm rates, respectively. Emergence rate with ABG-3028A was significantly lower than emergence rate with 13 ppm ABG-3110 (12.6 days), and emergence rate with 100 ppm ABG-3028A was significantly lower than emergence rate with 26 ppm ABG-3112C (11.6 days). Other rates and formulations of GA had emergence rates ranging between 10.5 and 11.5 days, and although their emergence rates were lower than the emergence rate for ABG-3028A, they were not significantly different in activity from ABG-3028A. ABG-3109, ABG-3110, and ABG-3111 tended to exhibit rate responses. Of these formulations, ABG-3110 had the only significant rate response. There was a 2-day difference in emergence rate between the 13 and 52 ppm rates of ABG-3110. There was no difference in any of the six formulations tested at 26 ppm.

Plant height and grain production. For the most part, GA seed treatment had little effect on mature plant height, panicle density, and grain yield (Table 1). The most significant effects were associated with those seed treatments which had an effect on seedling stand and emergence.

Plant height was reduced significantly by seed treatment with ABG-3028A at 10 ppm and ABG-3109 at 26 ppm. Mature plant height was 31 and 32 inches for those seed treatments, respectively. Untreated seed produced plants which were 33 inches in height. Plant height for the other GA formulations were 32 to 33 inches.

Panicle density was 34 to 35 panicles/ft^2 for both rates of ABG-3028A and ABG-3109 at 26 ppm and ABG-3110 and ABG-3111 at 52 ppm. This was significantly higher than the carrier check (26 panicles/ft^2) and higher but not significantly different from the foundation check (30 panicles/ft^2). The lowest panicle density resulted from seed treatment with ABG-3111 at 13 ppm. There tended to be a rate response with ABG-3110 and ABG-3111. There was a 6 panicle/ft^2 difference between ABG-3110 at 13 and 52 ppm, and an 11 panicle/ft^2 difference between ABG-3111 at 13 and 52 ppm.

Grain yield was decreased significantly by seed treatments with ABG-3028A at 10 ppm and ABG-3111 at 52 ppm. Yields were 5893 and 5816 lb/A, respectively. Grain yields for the untreated checks were 6612 and 6542 lb/A (foundation and carrier, respectively). The other rates and formulations of GA had no significant effect on grain yields. Their grain yields ranged from 6087 to 6478 lb/A. Heavy sheath blight infestations were associated with the GA seed treatments and may explain the lower grain yields.

Grain moisture was generally lower with GA seed treatment. Grain moisture for the GA seed treatments ranged between 16 and 16.8%. Grain moisture for the carrier check was 18.3% and grain moisture for the foundation check was 17.1%. The carrier check was significantly higher in grain moisture than all the GA seed treatments. The foundation check was significantly higher in grain moisture than the ABG-3112 formulations, ABG-3109 at 26 and 52 ppm, ABG-3110 at 52 ppm, ABG-3111 at 26 ppm, and ABG-3028A at 10 ppm. Lower grain moistures associated with GA seed treatment indicates earlier maturity. This is probably a reflection of early emergence attributed to GA seed treatment.

Table 1. The effect of gibberellic acid formulation and rate on seedling vigor and crop production in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic Acid Formulation	Gibberellic Acid Conc. (ppm)	Seedling stand (plants/ sq ft)	Time to 50% emergence (days)	Mature plant height (in)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Panicle density (panicles/ sq ft)
ABG-3112A	26	16b-g	11.1bcd[1/]	33ab	59.96e	6306abc	33ab
ABG-3112B	26	15c-f	11.4bcd	33ab	16.02de	6087abc	33ab
ABG-3112C	26	14def	11.6bc	33a	16.17cde	6484ab	32ab
ABG-3109	13	16b-f	11.1cd	33ab	16.48b-e	6130abc	32ab
ABG-3109	26	17bcd	10.5cd	32bc	16.18cde	6186abc	35a
ABG-3109	52	16b-e	10.5cd	33a	16.12de	6289abc	32ab
ABG-3110	13	12f	12.6b	32abc	16.70bcd	6473ab	28abc
ABG-3110	26	13ef	11.1bcd	33a	16.60b-e	6478ab	31ab
ABG-3110	52	16b-e	10.5cd	32abc	16.11de	6173abc	34a
ABG-3111	13	16b-e	11.5bcd	32abc	16.85bc	6188abc	24c
ABG-3111	26	18bc	11.2bcd	33a	16.33cde	6199abc	33ab
ABG-3111	52	16b-f	11.1cd	33ab	16.65b-e	5816c	35a
ABG-3028A	10	25a	10.3cd	31c	16.23cde	5893bc	34a
ABG-3028A	100	19b	10.0d	33ab	16.49b-e	6289abc	35a
Check	0	5g	16.2a	33a	18.28a	6542a	26bc

[1/] Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P<.05).

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

__Experiment__: Gibberellic acid-induced seedling elongation in rice (__Oryza__ __sativa__ 'LEMONT')

__Location__: Rice Research Station, Crowley, LA

__Variety__: Lemont

__Seeding Rate__: 100 lb/A

__Planting Date__: 25 Apr 89

__Row Spacing__: 7 inch (drill seeded)

__Fertilizer__: 7-21-21 with 1.2% zinc at 300 lb/A, 25 Apr; urea (46% N) at 200 lb/A, 30 May

__Plot Size__: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

__Treated Area__: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

__Treatment(s)__:

Formulation(s):
ABG-3067
ABG-3110
ABG-3110A
ABG-3110B
ABG-3110C

Rate: 0.014 lb gibberellic acid/A (6.4 g ai/A)

Timing: 2-3 leaf stage (17 May)
3-4 leaf stage (22 May)
5-6 leaf stage (2 June)
7-8 leaf stage (9 June)

Surfactant: Tween 20 (0.5%)

__Sprayer__: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

__Pertinent Rainfall__: 17 May, 0.60 in.; 2 June, 0.90 in.

__Herbicide(s)__: Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 7 May

Permanent Flood: 31 May

Harvest Date: 7 Sep

Harvested Area: 46.6 ft^2 - 2.33 (4 rows) x 20 ft

Experimental Design: Randomized complete block (four replications)

Comments: The ABG-3067 formulation of gibberellic acid (GA) applied during the 2- to 8-leaf stages of growth increased Lemont plant height (vertically extended leaf height) significantly (Table 1). Response to GA was noted within 5 to 7 days after application. Response to GA increased with plant age at application. The maximum increase in plant height compared to the untreated check was 5, 9, 16, and 20 inches, respectively, for applications at the 2- to 3-leaf, 3- to 4-leaf, 4- to 5-leaf, and 7- to 8-leaf stages of growth. Duration of response to GA was approximately 3 weeks for the 2- to 3-leaf and 3- to 4-leaf applications, 4 weeks for the 4- to 5-leaf application, and greater than 7 weeks for the 7- to 8-leaf application. The 7- to 8-leaf application was the only treatment with a duration affecting mature plant height (vertically extended panicle height).

Of the four formulations of GA tested, ABG-3110B and ABG-3110C were consistently and equally more active than ABG-3067 (Table 1). The maximum increase in plant height due to ABG-3110B and ABG-3110C was 2 inches greater than the maximum response to ABG-3067. Also, duration of response to ABG-3110B and ABG-3110C was longer than duration of response to ABG-3067 by a week.

Maturity was delayed by foliar GA application (Table 2). All treatments except the 7- to 8-leaf application headed 91 days after planting. Heading was noted in the 7- to 8-leaf treatment at 95 days after planting.

Harvest was delayed, and in general, grain moisture was low (Table 2). Grain moisture was relatively constant, and GA treatments were not significantly different from the check. Grain moisture at harvest ranged between 14.4 and 15.2%. Normal rice harvest occurs when grain moisture is 18 to 21%.

Grain yield was significantly decreased by foliar applications of GA during the 5- to 8-leaf stages (Table 2). Grain yields for the untreated check and GA applications at the 2- to 4-leaf stages of growth ranged between 6055 and 6666 lb/A. Grain yields resulting from GA applications at the 5- to 6-leaf and 7- to 8-leaf stages were 5041 and 4968 lb/A, respectively. Reductions in grain yield are attributed primarily to reduced panicle production. Although not significant, low panicle densities were associated with GA applications at the 5- to 8-leaf stages.

Table 1. The effect of postemergence gibberellic acid on seedling height in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid		Plant height (in)									
Formulation	Time of application (leaf stage)	27 DAP[1]	34 DAP	38 DAP	43 DAP	51 DAP	56 DAP	64 DAP	77 DAP	93 DAP	135 DAP
Check		9b[2]	12c	13c	18e	27cd	28cd	29c	29b	36c	36bc
ABG-3067	2-3 LF	14a	17b	18b	19d	27d	27d	27d	29b	35c	36bc
ABG-3067	3-4 LF		20a	22a	25c	27d	28d	28d	29b	36c	36c
ABG-3067	5-6 LF		12c	14c	30a	43a	43b	41b	43a	38b	37b
ABG-3067	7-8 LF		12c	14c	19de	43a	47a	49a	45a	47a	40a
ABG-3110	3-4 LF		20a	22a	26c	28bcd	28cd	27d	29b	36c	36c
ABG-3110A	3-4 LF		19a	22a	28b	29b	28cd	27d	29b	36c	36c
ABG-3110B	3-4 LF		20a	23a	28b	29bc	28cd	28cd	29b	35c	36bc
ABG-3110C	3-4 LF		20a	23a	26c	29bc	29c	28d	29b	36c	36c

1/ Days after planting.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of postemergence gibberellic acid on mature rice (*Oryza sativa* 'LEMONT') development. Rice Research Station, Crowley, LA. 1989.

Gibberellic acid		Maturity (Days to 50% heading)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Panicle density (panicles/ sq ft)
Formulation	Time of application (leaf stage)				
Check		90b[1/]	15.07ab	6332ab	33ab
ABG-3067	2-3	90b	14.45b	6666a	34ab
ABG-3067	3-4	90b	15.25a	6246ab	36a
ABG-3067	5-6	90b	14.69ab	5041c	32ab
ABG-3067	7-8	93a	14.63ab	4968c	30b
ABG-3110	3-4	90b	14.69ab	6168ab	36a
ABG-3110A	3-4	90b	14.58ab	6055b	34ab
ABG-3110B	3-4	90b	14.40b	6184ab	33ab
ABG-3110C	3-4	90b	14.61ab	6333ab	35ab

[1/] Means followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid-induced seedling elongation in rice (*Oryza sativa* 'MARS')

Location: Rice Research Station, Crowley, LA

Variety: Mars

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr; urea (46% N) at 200 lb/A on 30 May

Plot Size: 87.5 ft^2 - 3.5 (6 rows) x 35 ft

Treated Area: 87.5 ft^2 - 3.5 (6 rows) x 35 ft

Treatment(s):

Formulation(s): ABG-3067
ABG-3110
ABG-3110A
ABG-3110B
ABG-3110C

Rate: 0.014 lb gibberellic acid/A (6.4 g ai/A)

Timing: 3-4 leaf stage (19 May)

Surfactant: Tween 20 (0.5%)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: No rainfall within 24 hours following application

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July

Emergence: 7 May

Permanent Flood: 31 May

Harvest Date: 18 Sep

Harvested Area: 23.3 ft^2 (10 ft of center 2 rows - hand harvested)

Experimental Design: Randomized complete block (four replications)

Comments: Gibberellic acid (GA) had a significant effect on plant height (Table 1). Within 3 days after treatment, seedling height (vertically extended leaf height) increased significantly above the untreated control. Response was essentially the same for all GA formulations. This trend was the same at 10 and 14 days after treatment. By 19 days after treatment, only plants treated with the ABG-3110, ABG-3110A, and ABG-3110B formulations of GA were significantly taller than the untreated check. At maturity, plant height (vertically extended panicle height) of the GA treatments averaged 2 to 3 inches shorter than the untreated check.

Maturity, panicle density, grain moisture, and grain yield were unaffected by GA (Table 2). Days from planting to 50% heading were used to estimate maturity. For all treatments, maturity ranged from 85 to 87 days after planting. Panicle density ranged from 29 to 32 panicles/ft^2. Grain moisture ranged between 14 and 15%. Grain yield ranged from a low of 4021 lb/A for the ABG-3110B formulation to a high of 4642 lb/A for the ABG-3067 formulation. The untreated check yielded 4521 lb/A.

Table 1. The effect of postemergence gibberellic acid on plant height in rice (*Oryza* sativa 'MARS'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid formulation	Plant height (in) 3 DAT[1/]	10 DAT	14 DAT	19 DAT	Maturity plant height (in)
Check	12b[2/]	14c	15b	23b	48a
ABG-3067	16a	20b	22a	24ab	46b
ABG-3110	16a	21ab	23a	26a	45b
ABG-3110A	16a	22a	23a	25a	45b
ABG-3110B	16a	22a	22a	25a	46b
ABG-3110C	16a	23a	24a	24ab	46b

1/ Days after treatment.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of postemergence gibberellic acid on mature rice (*Oryza sativa* 'MARS') development. Rice Research Station, Crowley, LA. 1989.

Gibberellic acid formulation	Maturity (Days to 50% heading)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Panicle density (panicles/ sq ft)
Check	85a	12.9a[1/]	4521a	31a
ABG-3067	85a	12.6a	4642a	30a
ABG-3110	86a	12.8a	4481a	29a
ABG-3110A	86a	12.9a	4021a	29a
ABG-3110B	86a	12.8a	4455a	29a
ABG-3110C	86a	12.9a	4547a	32a

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid-induced seedling elongation in rice (*Oryza sativa* 'TEBONNET')

Location: Rice Research Station, Crowley, LA

Variety: Tebonnet

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr; urea (46% N) at 200 lb/A on 29 May

Plot Size: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treated Area: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treatment(s):

Formulation(s): ABG-3067
ABG-3110
ABG-3110A
ABG-3110B

Rate: 0.014 lb gibberellic acid/A (6.4 g ai/A)

Timing: 2-3 leaf stage (17 May)
3-4 leaf stage (22 May)
5-6 leaf stage (2 June)
7-8 leaf stage (9 June)

Surfactant: Tween 20 (0.5%)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 17 May, 0.60 in.; 2 June, 0.90 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July

Emergence: 7 May

Permanent Flood: 30 May

Harvest Date: 30 Aug

Harvested Area: 69.9 ft^2 - 2.33 (4 rows) x 30 ft

Experimental Design: Randomized complete block (four replications)

Comments: The ABG-3067 formulation of gibberellic acid (GA) applied during the 2- to 8-leaf stages of growth increased plant height (vertically extended leaf height) significantly (Table 1). Response to GA was noted within 5 to 7 days after application. Response to GA increased with plant age at application through the 2- to 5-leaf stages of growth. The maximum increase in plant height compared to the untreated check was 6, 7, 11, and 11 inches, respectively, for application at the 2- to 3-leaf, 3- to 4-leaf, 5- to 6-leaf and 7- to 8-leaf stages of growth. Duration of response to GA was approximately 2 weeks for the 2- to 3-leaf, 3- to 4-leaf, and 5- to 6-leaf applications and 3 weeks for the 7- to 8-leaf application. The 5- to 6-leaf and 7- to 8-leaf applications reduced mature plant height (vertically extended panicle height) by 2 inches.

Of the five formulations of GA tested, ABG-3110B was the most active (Table 1). The effect of ABG-3110B on plant height at 38 days after planting, although not significantly different from the other ABG-3110 formulations, was significantly greater than the effect of ABG-3067. Duration of response of the ABG-3110 formulations was longer than duration of response to ABG-3067 by a week.

Maturity was delayed by foliar GA application (Table 2). All treatments with ABG-3067 except the 5- to 6-leaf and 7- to 8-leaf application headed between 83 and 84 days after planting. Heading was noted in the 5- to 6-leaf and 7- to 8-leaf treatments at 87 and 86 days after planting, respectively.

Grain moisture was relatively constant, and GA treatments were not significantly different from the check or each other (Table 2). Grain moisture at harvest ranged between 16.5 and 18.3%.

Grain yield was decreased significantly by foliar applications of GA during the 5- to 8-leaf stages (Table 2). Grain yields resulting from GA applications at the 5- to 6-leaf and 7- to 8-leaf stages were 6170 and 5148 lb/A. Grain yields for the untreated check and GA applications at the 2- to 4-leaf stages of growth ranged between 6692 and 6957 lb/A. Reductions in grain yield are attributed primarily to incomplete panicle exsertion. Although normal panicle densities were not significantly different from the check, ranging from 24 to 35 panicles/ft^2, suppressed panicle densities were significantly higher for the 5- to 6-leaf and 7- to 8-leaf applications. Suppressed panicle densities were 2 and 7 panicles/ft^2 for the 5- to 6-leaf and 7- to 8-leaf applications, respectively. There was no panicle suppression by GA application prior to the 5- to 6-leaf application. Panicle suppression or incomplete exsertion yields fewer seeds per panicle.

Table 1. The effect of postemergence gibberellic acid on seedling height in rice (<u>Oryza</u> <u>sativa</u> 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid		Plant height (in)									
Formulation	Time of application (leaf stage)	27 DAP[1/]	34 DAP	38 DAP	43 DAP	51 DAP	56 DAP	64 DAP	77 DAP	93 DAP	125 DAP
Check		9b[2/]	12b	14d	21c	29c	34c	39bc	45a	53a	56a
ABG-3067	2-3	13a	17a	16c	21c	28cd	32c	37c	44a	53a	55ab
ABG-3067	3-4		17a	21b	22c	28cd	32c	38bc	43a	52a	55ab
ABG-3067	5-6		12b	14d	29a	40b	41b	39b	46a	52a	54b
ABG-3067	7-8		12b	15cd	21c	44a	48a	50a	46a	52a	54b
ABG-3110	3-4		18a	22ab	25b	28cd	33c	38bc	46a	53a	55ab
ABG-3110A	3-4		18a	23ab	25b	27d	32c	38bc	45a	53a	55ab
ABG-3110B	3-4		18a	24a	25b	27cd	32c	38bc	44a	53a	55ab
ABG-3110C	3-4		18a	22b	24b	28cd	32c	39bc	43a	53a	56a

1/ Days after planting.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of postemergence gibberellic acid on mature rice (*Oryza sativa* 'TEBONNET') development. Rice Research Station, Crowley, LA. 1989.

Gibberellic acid: Formulation	Gibberellic acid: Time of application (leaf stage)	Maturity (Days to 50% moisture)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Panicle density (panicles/ sq ft)	Suppressed panicles (panicles/ sq ft)
Check	0	83b[1/]	18.3a	6692ab	28bcd	0c
ABG-3067	2-3	84b	17.9a	6927a	32abc	0c
ABG-3067	3-4	84b	17.7a	6957a	35a	0c
ABG-3067	5-6	87a	16.5a	6170b	28cd	2b
ABG-3067	7-8	86a	18.0a	5148c	24d	7a
ABG-3110	3-4	84b	18.3a	6919a	35a	0c
ABG-3110A	3-4	84b	17.5a	6714ab	32abc	0c
ABG-3110B	3-4	84b	17.9a	6872a	34a	0c
ABG-3110C	3-4	83b	17.7a	6744ab	33ab	0c

[1/] Means followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid-enhanced emergence and induced seedling elongation in rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 26 Apr 89

Row Spacing: 7 inch (3 inch seeding depth, drill-seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A, 26 Apr; urea (46% N) at 200 lb/A, 29 May

Plot Size: 166.25 - 4.75 (8 rows) x 35 ft

Treated Area: 166.25 - 4.75 (8 rows) x 35 ft

Treatment(s):

Seed Treatment

Formulation(s) (conc.): ABG-3109 (25 ppm gibberellic acid)
ABG-3111 (25 ppm gibberellic acid)

Timing: Seed treatment

Foliar Treatment

Formulation (rate): ABG-3067 (0.014 lb gibberellic acid/A or 6.4 g ai/A)

Timing: 3- to 4-leaf stage (19 May)

Surfactant: Tween 20 (0.5%)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 3 May, 0.37 in.; 4 May, 1.35 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by airplane, 24 July

Emergence: 2 May

Permanent Flood: 30 May

Harvest Date: 7 Sep

Harvested Area: 74 ft^2 - 2.33 (4 rows) x 31.75 ft

Experimental Design: Randomized complete block (four replications)

Comments: Emergence and stand were affected by gibberellic acid (GA) seed treatment (Table 1). Days to 50% emergence were decreased 4 to 6 days by ABG-3109 and ABG-3111 seed treatments. Stand was significantly increased by ABG-3109 and not by ABG-3111. There was a difference in seed quality between foundation seed and carrier treated seed.

Comparing carrier treated seed and carrier treated seed plus postemergence GA, seedling height was significantly higher at 3 and 10 days after postemergence GA application (DAT). At 3 DAT, residual activity from ABG-3109 seed treatment alone resulted in a 2-inch increase in seedling height. There was no residual activity from ABG-3111 seed treatment. All postemergence GA applications increased seedling height. At 3 DAT, the foliar application of ABG-3067 had the same effect as ABG-3109 seed treatment. Seed treatment plus postemergence GA caused a 4- to 5-inch increase in seedling height. At 10 DAT there was no residual activity from the seed treatments alone. Seedling height was increased 5 to 8 inches by foliar GA alone and in combination with GA seed treatment. There were no significant differences between the foliar GA treatments, although seedling height was highest for the ABG-3109 seed treatment plus postemergence GA.

At maturity, panicle density was significantly lower in the untreated check compared to the GA treatments (Table 2). This did not impact grain yield as there were no significant differences in grain yield between treatments. Plant height and grain moisture were similarly unaffected.

Table 1. Seed treatment effects of gibberellic acid formulation and rate on seedling vigor in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid			Seedling stand (plants/ sq ft)	Time to 50% emergence (days)	Plant height (in)	
Formulation	Conc. (ppm)	Rate (lb/A)			3 DAT[1]	10 DAT
Check			12cd	16.47a[2]	9c	13b
ABG-3109	25		17ab	9.79d	11b	13b
ABG-3111	25		14bc	11.78c	8c	11b
ABG-3067		.014	9d	16.67a	11b	18a
ABG-3109 fb[3] ABG-3067	25	.014	16ab	11.15c	14a	21a
ABG-3111 fb ABG-3067	25	.014	14bc	12.26c	13a	19a

1/ Days after treatment.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

3/ fb = followed by.

Table 2. Seed treatment effects of gibberellic acid formulation and rate on crop production in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid Formulation	Conc. (ppm)	Rate (lb/A)	Mature plant height (in)	Panicle density (panicles/ sq ft)	Grain yield at 12% moisture (lb/A)	Grain moisture (%)
Check			33a[1/]	26b	6727a	15.65a
ABG-3109	25		32a	35a	6279a	14.57b
ABG-3111	25		33a	33ab	6499a	16.13a
ABG-3067		.014	33a	33a	7043a	15.91a
ABG-3109	25		32a	33ab	6265a	15.08ab
fb[2/] ABG-3067		.014				
ABG-3111	25		32a	36a	6150a	15.14ab
fb ABG-3067		.014				

1/ Means followed by the same letter do not significantly differ (Duncan's multiple range test, P=.05)

2/ fb = followed by.

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid-induced seedling elongation and early flooding in rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A, 25 Apr; urea (46% N) at 200 lb/A, 26 May (early flood) and 2 June (standard flood)

Plot Size: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treated Area: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treatment(s):

Formulation(s): ABG-3073

Rates: 0.077 lb gibberellic acid/A (3.2 g ai/A)
0.014 lb ai/A (6.4 g ai/A)

Timing: 2- to 3- leaf stage (17 May)

Flood Dates: Early flood (26 May) based on plant height (12 in.) of GA treatments
Standard flood (1 June) based on plant height (12 in.) of untreated checks

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 17 May, 0.60 in.; 18 May, 4.60 in; 1 June, 0.69 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 26 May (early flood only)
Stam M4 (3 lb ai/A) by hand sprayer, 1 June (standard flood only)
Londax (0.6 lb ai/A) by airplane, 7 and 20 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 7 May

Harvest Date: 1 Sep

Harvested Area: 46.6 ft^2 - 2.33 (4 rows) x 29.5

Experimental Design: Split plot (main plots - flood date, subplots - gibberellic acid rate); randomized complete block (four replications)

Comments: Flooding date affected heading date, panicle density, and grain moisture (Tables 1 and 2). Gibberellic acid (GA) affected seedling height, heading, and panicle density. Mature plant height and grain yield were unaffected by flooding date and GA.

Early flooding resulted in early maturity and a slight reduction in panicle density. Days to heading were reduced 4 days and grain moisture at harvest was reduced 1.3% by early flooding. Early flooding reduced panicle density by 1 panicle/ft^2 from 37 to 36 panicles/ft^2. Panicle density for maximum grain yield is 30 to 40 panicles/ft^2.

Gibberellic acid increased seedling height allowing flooding 5 days earlier than normal (based on flooding at 12-inch seedling height). There was no difference between the effects of GA (0.014 lb ai/A) and GA (0.007 lb ai/A) plus surfactant on seedling height. Heading was delayed 1 day by GA (0.014 lb ai/A), and panicle density was increased three panicles/ft^2 by GA (0.007 lb ai/A) plus surfactant.

Table 1. The effect of flood date and gibberellic acid on seedling vigor and mature crop development in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

	Plant height (in) 5 DAT[1/]	9 DAT	Maturity (Days to 50% heading)	Mature plant height (in)
Flood date				
26 May	9	10	90a[2/]	36
1 June	9	10	86b	35
Gibberellic acid rate (lb/A)				
0	8c	9b	88	36
.007	10b	11a	88	35
.014	11a	11a	89	35

1/ Days after treatment.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of flood date and gibberellic acid on crop production in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Flood date	Gibberellic acid rate (lb/A)	Grain yield at 12% moisture (lb/A)	Grain moisture (%)	Panicle density (panicles/ sq ft)
1 June	0	6889ab[1/]	14.2b	35a
	.007	6822ab	14.6ab	38a
	.014	7009a	14.9a	38a
26 May	0	6371b	13.3c	35a
	.007	6401b	13.4c	37a
	.014	6467b	13.3c	35a

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, J.B. Baker, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid and propanil compatibility and efficacy in rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Soil Preparation: 1 May 89

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 2 May

Row Spacing: 7 inch

Fertilizer: 20-10-10 at 500 lb/A on 30 May

Plot Size: 205 ft^2 - 6.4 (11 rows) x 32 ft

Treated Area: 205 ft^2 - 6.4 (11 rows) x 32 ft

Treatment(s):

Formulation(s) (rate): ABG-3067 (.007 lb gibberellic acid/A (3.2 g ai/A)
Stam M4 (3 and 4 lb propanil/A)

Surfactant: Tween 20 (0.5%)

Timing: 2- to 3-leaf stage (23 May)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: No significant rainfall within 24 hr following treatment application

Herbicide(s): Stam M4 (3 lb ai/A) on 26 May applied to all plots not receiving Stam M4 as treatment except the check

Insecticide(s): None

Fungicide(s): None

Emergence: 9 May

Permanent Flood: 1 June

Harvest Date: 5 and 6 Sep

Harvested Area: 66.5 ft^2 - 2.33 (4 rows) x 28.5 ft

Experimental Design: Randomized complete block (four replications)

Water Management: Flushed plot area on 11 and 12 May

Comments:

Weed Control and Rice Injury: Rating taken 6 days after treatment (DAT) showed weed control was excellent compared to the untreated check (Table 1). Rice injury was minimal with a slight phytotoxicity from propanil in all treatments.

Plant Height: Plant height at 6 and 10 DAT (Table 1) was increased by application of gibberellic acid (GA). Plant height was increased 4 to 5 inches by GA alone and 6 to 9 inches by GA plus propanil. At maturity, plant height was reduced in the check due to weed competition and there was no significant difference in plant height between weed free treatments.

Grain Production: Grain moisture ranged between 15.9 and 18.2% (Table 2). Grain moisture was highest in the untreated check. There was no significant difference in grain moisture between weed free treatments. Grain yield was 1325 lb/A in the untreated check due to weed competition. There was no significant difference between the GA treatments and the propanil checks with grain yields ranging between 5915 and 6414 lb/A.

Table 1. The effect of gibberellic acid and propanil on weed control and seedling vigor in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Treatment	Rate (lb/A)	Rice tolerance[1/]	Weed control[2/]	Plant height (in) 6 DAT[3/]	10 DAT	118 DAT
Check		1d[4/]	5a	7f	8c	28b
ABG-3067	.007	5b	4c	11d	13b	35a
ABG-3067 + Tween 20, 0.1%	.007	4c	4bc	12c	13b	34a
Propanil	3	5ab	4bc	8e	10c	35a
Propanil	4	5ab	4c	8ef	9c	35a
Propanil + ABG-3067	3 .007	5ab	4bc	13a	16a	35a
Propanil + ABG-3067	4 .007	5a	4bc	13b	16a	35a
Propanil + ABG-3067 + Tween 20, 0.1%	3 .007	5ab	5b	13ab	16a	36a
Propanil + ABG-3067 + Tween 20, 0.1%	4 .007	5a	4c	13ab	17a	34a

1/ Lemont tolerance = 1 - very severe injury with >90% stand reduction; 2 - severe injury with 70-90% stand reduction; 3 - moderate injury, 30-70% stand reduction; 4 - slight injury, primarily leaf burning and stunting; 5 - no injury.

2/ Weed control = 1 - poor, <10% control; 2 - slight, 10-30% control; 3 - moderate, 30-70% control; 4 - good, 70-90% control; 5 - excellent, >90% control.

3/ Days after treatment.

4/ Means in the same column followed by same letter do not significantly differ differ (Duncan's multiple range test, P=.05).

Table 2. The effect of gibberellic acid and propanil on crop production in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Treatment	Rate (lb/A)	Time of application (leaf stage)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)
Check			18.17a[1/]	1325c
Pro-Gibb	.007	2-3	17.38ab	6269ab
Pro-Gibb + Tween 20, 0.1%	.007	2-3	17.12ab	6188ab
Propanil	3	2-3	16.15b	6038ab
Propanil	4	2-3	15.96b	6414a
Propanil + Pro-Gibb	3 .007	2-3	16.31ab	5915b
Propanil + Pro-Gibb	4 .007	2-3	17.07ab	6050ab
Propanil + Pro-Gibb + Tween 20, 0.1%	3 .007	2-3	15.91b	6229ab
Propanil + Pro-Gibb + Tween 20, 0.1%	4 .007	2-3	17.58ab	6107ab

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Phthalimide-enhanced emergence in rice (*Oryza sativa*)

Location: Rice Research Station, Crowley, LA

Variety: See treatments

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (3-inch planting depth, drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr; urea (46% N) at 200 lb/A on 29 May

Plot Size: 166.25 ft^2 - 4.75 (8 rows) x 35 ft

Treated Area: 166.25 ft^2 - 4.75 (8 rows) x 35 ft

Treatment(s):

Formulation(s) (conc.): AC94377 (1000 ppm phthalimide)

Timing: Seed treatment

Varieties: Gulfmont, Lemont, Mercury

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 30 Apr, 0.20 in.; 3 May, 0.37 in.; 4 May, 1.35 in.; 9 May, 0.03 in.; 13 May, 0.60 in.; 17 May, 0.60 in.; 18 May, 4.60 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 2 May

Permanent Flood: 30 May

Harvest Date: 7 Sep

Harvested Area: 74 ft^2 - 2.33 (4 rows) x 31.75 ft

Experimental Design: Randomized complete block (four replications)

Comments: Emergence of the semidwarf long-grain varieties Gulfmont and Lemont was significantly increased by treating seed with phthalimide. Emergence of the semidwarf medium-grain variety Mercury was not affected by treating seed with phthalimide.

Days to 50% emergence and final stand were significantly increased by treating Gulfmont and Lemont seed with phthalimide (Table 1). Time to 50% emergence was greater than 16 days without phthalimide and 13 days or less with phthalimide. Without phthalimide seedling stands were 7 and 12 plants/ft^2 for Lemont and Gulfmont, respectively. With phthalimide seedling stands were 22 plants/ft^2. An ideal stand is 15 to 20 plants/ft^2.

There were inconsistent effects on mature plant traits from seed treatment with phthalimide (Table 1). Plant height of Mercury was decreased 1 inch by seed treatment with phthalimide, while Gulfmont and Lemont were unaffected in this regard. Panicle density of Gulfmont was increased significantly by seed treatment with phthalimide. Panicle densities of Lemont and Mercury were not affected by seed treatment with phthalimide. Grain yield of Lemont was decreased significantly by seed treatment with phthalimide. This is attributed to high sheath blight infestation due to thick canopy development associated with high stands as the result of seed treatment with phthalimide. Grain yields of Gulfmont and Mercury were unaffected by seed treatment with phthalimide. Grain moisture of the three rice cultivars was unaffected by seed treatment with phthalimide.

Table 1. The effect of phthalimide on seedling vigor and crop production in rice (<u>Oryza sativa</u>). Rice Research Station, Crowley, LA. 1989.

Phthalimide conc. (ppm)	Variety	Seedling stand (plants/ sq ft)	Time to 50% emergence (DAP[1/])	Panicle density (panicles/ sq ft)	Grain yield at 12% moisture (lb/A)	Mature plant height (in)	Grain moisture (%)
0	Lemont	7c	16.65a[2/]	30bc	6613a	33ab	17.06ab
0	Gulfmont	12b	16.72a	27c	6301ab	33ab	16.27b
0	Mercury	11b	14.46bc	34ab	5162c	34a	17.22a
1000	Lemont	19a	13.03c	34ab	5977b	32b	16.49ab
1000	Gulfmont	19a	13.93bc	37a	5879b	33ab	16.60ab
1000	Mercury	11b	15.59ab	36a	4895c	33b	17.01ab

[1/] Days after planting.

[2/] Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Phthalimide-enhanced seedling elongation and flood date in rice (*Oryza sativa*)

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr; urea (46% N) at 200 lb/A on 26 May for early flood treatments and on 1 June for standard flood treatments

Plot Size: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treated Area: 122.5 ft^2 - 3.5 (6 rows) x 35 ft

Treatment(s):

Formulation(s) (conc.): AC94377 (1000 ppm phthalimide)

Timing: Seed treatment

Flood timing: Early flood (26 May) based on plant height (12 in.) of AC94377 treatments
Standard flood (2 June) based on plant height (12 in.) of untreated checks

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 30 Apr, 0.20 in.; 3 May, 0.37 in.; 4 May, 1.35 in.; 9 May, 0.03 in.; 13 May, 0.60 in.; 17 May, 0.60 in.; 18 May, 4.60 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3.0 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 7 May

Harvest Date: 1 Sep

Harvested Area: 46.6 ft^2 - 2.33 (4 rows) x 29.5 ft

Experimental Design: Split plot (main plots - flood date, subplots - phthalimide); randomized complete block (four replications)

Comments: Flood date affected plant height, maturity, and grain yield. Phthalimide affected plant height and maturity. Panicle density and grain moisture were unaffected by flood date and phthalimide seed treatment.

Early flooding resulted in shortened stature, early maturity, and reduced grain yield. Mature plant height was shortened 1 inch. Days to heading were reduced 3 days, and grain yield was reduced 459 lb/A. Grain yield reduction was attributed to sheath blight. Early flood resulted in more sheath blight than standard flood.

Phthalimide seed treatment increased seedling height by 1 inch at 31 days after planting and delayed days to heading by 1 day. Although statistically significant, neither of these effects are biologically significant.

Table 1. The effect of flood date and phthalimide on seedling vigor and crop development in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

	Plant height (in) 27 DAP[1]	Plant height (in) 31 DAP	Maturity (Days to 50% heading)	Mature plant height (in)
Flood Date				
June 1	9	9	90a	36a
May 26	8	9	87b	35b
Phthalimide Conc. (ppm)				
0	8	9	88b	36
1000	9	10	89a	36

1/ Days after planting.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, p=.05).

Table 2. The effect of flood date and phthalimide on seedling vigor and crop development in rice (Oryza sativa 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

	Grain yield at 12% moisture (lb/A)	Grain moisture (%)	Panicle density (panicles sq ft)
Flood Date			
June 1	6927a[1]	14.3	34
May 26	6468b	13.4	35
Phthalimide Conc. (ppm)			
0	6630	13.8	35
1000	6765	14.0	35

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, p=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic acid and water-seeded rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 150 lb/A

Planting Date: 28 Apr 89

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 26 Apr; seed were kept moist for 24 hr following draining and before sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A; urea (46% N) preplant incorporated on 24 Apr

Plot Size: 175 ft^2 - 5 x 35 ft

Treated Area: 175 ft^2 - 5 x 35 ft

Treatment(s): Seed Treatment

Formulation(s) (rates): ABG-3109 (13 and 52 ppm gibberellic acid)
ABG-3110 (13, 26, and 52 ppm gibberellic acid)
ABG-3111 (13 and 52 ppm gibberellic acid)
ABG-3112A (25 ppm gibberellic acid)
ABG-3112B (25 ppm gibberellic acid)
ABG-3112C (25 ppm gibberellic acid)

Pertinent Rainfall: 4 May, 1.35 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Londax (0.6 lb ai/A) by airplane, 23 and 31 May and 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July

Emergence: 28 Apr (seeded germinated seed)

Permanent Flood: 8 May

Harvest Date: 20 and 21 Sep

Harvested Area: 160 ft^2 - 5 x 32 ft

Experimental Design: Randomized complete block (four replications)

Comments: Gibberellic acid (GA) seed treatment in water-seeded rice in general lowered grain yields (Table 1). Two GA formulations, ABG-3109 and ABG-3112C, had significantly lower grain yields than the untreated checks. Grain moisture was low due to weather delayed harvest.

Table 1. The effect of gibberellic acid seed treatment and water seeding on crop production in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid		Grain moisture (%)	Grain yield at 12% moisture (lb/A)
Formulation	Conc. (ppm)		
ABG-3109	13	12.1ab[1/]	5515abc
ABG-3109	52	12.3ab	5355c
ABG-3110	13	11.7b	5790abc
ABG-3110	26	12.4ab	5951abc
ABG-3110	52	12.4ab	5980abc
ABG-3111	13	12.1ab	5770abc
ABG-3111	52	12.2ab	5813abc
ABG-3112A	25	12.3ab	5843abc
ABG-3112B	25	11.9ab	5902abc
ABG-3112C	25	12.6a	5387bc
Check	0	11.6b	6154a

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Phthalimide and water-seeded rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 150 lb/A

Planting Date: 28 Apr 89

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 26 Apr; seed were kept moist for 24 hr following draining and before sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A; urea (46% N) preplant incorporated on 24 Apr

Plot Size: 175 ft^2 - 5 x 35 ft

Treated Area: 175 ft^2 - 5 x 35 ft

Treatment(s):

Seed Treatment:

Formulation (conc.): AC94377 (1000 ppm phthalimide)

Timing: Seed treatment

Pertinent Rainfall: 4 May, 1.35 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Londax (0.6 lb ai/A) by airplane, 23 and 31 May and 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July

Emergence: 28 Apr (seeded germinated seed)

Permanent Flood: 8 May

Harvest Date: 20 and 21 Sep

Harvested Area: 160 ft^2 - 5 x 32 ft

Experimental Design: Randomized complete block (four replications)

Comments: Phthalimide seed treatment had no effect of grain yield in water-seeded rice (Table 1). Grain moisture was low due to weather delayed harvest.

Table 1. The effect of seed treatment with phthalimide on water seeded rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Gibberellic acid		Grain moisture	Grain yield at 12% moisture
Formulation	Conc. (ppm)	(%)	(lb/A)
Phthalimide	1000	11.7a[1/]	6103a
Check	0	11.7a	6123a

[1/] Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Fenoxaprop and Rice (*Oryza sativa* 'TEBONNET') Seeding Rate for Red Rice (*Oryza sativa*) Suppression

Location: Rice Research Station, Crowley, LA

Variety: Tebonnet

Seeding Rate: See Treatments

Planting Date: 17 Apr 89

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 15 Apr; seed were kept moist for 24 hr following draining before sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A and urea (46% N) at 200 lb/A on 12 Apr (preplant incorporated)

Plot Size: 150 ft^2 - 5 x 30 ft

Treated Area: 150 ft^2 - 5 x 30 ft

Treatment(s):

Seeding Rate

Tebonnet: 50, 100, 150, & 200 lb/A

Red rice: natural infestation

Foliar Treatment

Formulation (rate): Whip (0.15 fenoxaprop/A)

Timing: 4- to 5-leaf stage (16 May)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 17 May, 0.6 inches; 18 May, 4.6 inches

Herbicide(s): Stam M4 (4 lb ai/A) by airplane on 4 and 11 May

Insecticide(s): Furadan (0.5 lb ai/A) by airplane on 30 May
Sevin (1 lb ai/A) by airplane on 7 July

Fungicide(s): None

Emergence: 17 Apr (seeded germinated seed)

Permanent Flood: 21 Apr

Harvest Date: 10 Aug

Harvested Area: 100 ft^2 - 4 x 25 ft (2 to 3 ft x 6 ft areas were hand harvested in all plots except I-3; only plot not lodged)

Experimental Design: Factorial/randomized complete block (four replications)

Water Management: Flooded (1 to 2 inches) on 14 Apr for seeding; drained on 17 Apr; permanent flood (3 to 4 inches) on 21 Apr; and drained for harvest on 24 July

Comments: Fenoxaprop and rice seeding rate had independent effects on rice and red rice growth and productivity (Table 1). Fenoxaprop increased rice stand and decreased red rice stand and panicle density. Rice stands average 15 plants/ft^2 in the test area and were significantly increased to 18 plants/ft^2 by fenoxaprop application. Red rice stands were decreased from 195 plants/100 ft^2 to 41 plants/100 ft^2 and red rice panicle density was decreased from 819 panicles/100 ft^2 to 110 panicles/100 ft^2 by fenoxaprop application.

Resultant effects due to fenoxaprop were increased grain yield, decreased grain red rice content, and improved grade and value (Tables 1 and 2). The inherent grain yield of the test area was 4191 lb/A. This was significantly increased to 5067 lb/A by fenoxaprop application. Grain red rice content was lowered from 15.9% to 3% by Fenoxaprop application which in turn increased grade from USDA No. 6 mixed grain to USDA No. 4 long grain and increased unit price from \$3.94/cwt to \$6.34/cwt. Fenoxaprop application had no significant effect on milling yield.

Seeding rates above 100 lb/A increased rice stand and panicle density (Table 1). At seeding rates of 50 and 100 lb/A rice stands were 11 and 12 plants/ft^2, respectively, compared to 21 and 22 plants/ft^2 at seeding rates of 150 and 200 lb/A, respectively. Rice panicle density was similarly affected. At seeding rates of 50 and 100 lb/A rice panicle densities were 26 and 31 panicles/ft^2, respectively, compared to 40 and 38 panicles/ft^2 at seeding rates of 150 and 200 lb/A, respectively. Seeding rate had no significant effect on grain yield, quality, or milling yield (Table 2).

Table 1. The effect of fenoxaprop and seeding rate on red rice (*Oryza sativa*) suppression and crop production in rice (*Oryza sativa* 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

	Tebonnet		Red rice			
	Stand (plants/ sq ft)	Panicle density (panicles/ sq ft)	Stand (plants sq ft)	Panicle density (panicles/ sq ft)	Grain yield at 12% moisture (lb/A)	Grain moisture (%)
Fenoxaprop rate (lb ai/A)						
0	15b[1/]	33	195a	819a	4191b	13.0
0.15	18a	35	41b	110b	5067a	15.2
Seeding rate (lb/A)						
50	11b	26b	105	558	4366	13.9
100	12b	31b	134	516	4507	14.2
150	21a	40a	135	474	4710	14.1
200	22a	38a	99	310	4934	14.2

[1/] Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of fenoxaprop and seeding rate for red rice (*Oryza sativa*) suppression on the quality and milling yield of rice (*Oryza sativa* 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

	Milling yield		Grain red rice content	
	Total (%)	Whole (%)	(%)	Grade
Fenoxaprop rate (lb/A)				
0	69	59	15.9	6
0.15	68	60	3.0	4
Seeding rate (lb/A)				
50	68	58	13.4	5
100	69	60	8.4	5
150	69	59	9.5	5
200	69	62	6.5	4

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Gibberellic Acid, Phthalimide, and Fenoxaprop for Red Rice (*Oryza sativa*) Suppression in Rice (*Oryza sativa* 'TEBONNET')

Location: Rice Research Station, Crowley, LA

Variety: Tebonnet

Seeding Rate: 200 lb/A

Planting Date: 17 Apr 89

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 15 Apr; seed were kept moist for 24 hr following draining before sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A and urea (46% N) at 200 lb/A on 12 Apr (preplant incorporated)

Plot Size: 150 ft^2 - 5 x 30 ft

Treated Area: 150 ft^2 - 5 x 30 ft

Treatment(s):

Seed Treatment
Formulations (conc.): AC94377 (1000 ppm phthalimide)
ABG-3067 (50 ppm gibberellic acid)

Timing: Seed Treatment

Foliar Treatment
Formulation (rate): Whip (0.15 and 0.30 lb fenoxaprop/A)
Timing: 4- to 5-leaf stage (16 May)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 17 May, 0.6 inches; 18 May, 4.6 inches

Herbicide(s): Stam M4 (4 lb ai/A) by airplane on 4 and 11 May

Insecticide(s): Furadan (0.5 lb ai/A) by airplane on 30 May
Sevin (1 lb ai/A) by airplane on 7 July 89

Fungicide(s): None

Emergence: 17 Apr (seeded germinated seed)

Permanent Flood: 21 Apr

Harvest Date: 10 Aug

Harvested Area: 100 ft^2 - 4 x 25 ft (2 to 3 ft x 6 ft areas were hand harvested in three lodged plots

Experimental Design: Factorial (3 x 3), randomized complete block (four replications)

Water Management: Flooded (1 to 2 inches) on 14 Apr for seeding; drained on 17 Apr; permanent flood (3 to 4 inches) on 21 Apr; drained for harvest on 24 July

Comments: Fenoxaprop and plant growth regulators had independent effects (Tables 1 and 2). Fenoxaprop had significant effects on rice and red rice growth, and the plant growth regulators had little effect.

Fenoxaprop at 0.17 and 0.34 kg/ha equally reduced red rice stand and panicle density by 90% and red rice percentage in harvested grain by greater than 10%. Fenoxaprop at 0.17 and 0.34 kg/ha also delayed maturity and increased grain moisture percentages at harvest by 2 and 6%, respectively. By decreasing red rice competition, fenoxaprop at 0.17 kg/ha increased rice panicle density by 30%, grain yield by 2500 kg/ha, and total and whole milling yield percentages by 1 and 2%, respectively. Fenoxaprop at 0.34 kg/ha decreased rice stand and panicle density by 20% and total and whole milling yield percentages by 1 and 3%, respectively, yet had no effect on grain yield.

Gibberellic acid reduced red rice stands slightly and reduced total and whole milling yields by 2 and 4%, respectively. Phthalimide had no effect on rice or red rice.

Gibberellic acid and phthalimide had no antidotal effect and fenoxaprop was phytotoxic to rice. Phytotoxic effects of fenoxaprop at 0.17 kg/ha on rice were more than offset by benefits in red rice suppression in this experiment where red rice population was 24 plants/m^2. The associated increase in U.S.D.A. price support due to improvements in milling yield and grade was $4.00/hundred weight.

Table 1. The effect of plant growth regulator seed treatments and fenoxaprop on plant populations on rice (Oryza sativa 'TEBONNET') and red rice (Oryza sativa) in water seeded rice. Rice Research Station, Crowley, LA. 1989.

	Tebonnet		Red rice	
	Stand (plants/ sq ft)	Panicle density (panicles/ sq ft)	Stand (plants/ sq ft)	Panicle density (panicles sq ft)
Plant Growth Regulator				
None	19	34	102ab	280
Gibberellic acid	16	30	66b	210
Phthalimide	18	33	115a	345
Fenoxaprop Rate (lb/A)				
0	19a[1/]	31b	243a	754a
0.15	19a	40a	33b	63b
0.30	15b	25c	8b	18b

1/ Means for each factor in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of plant growth regulator seed treatment and fenoxaprop on crop production and grain quality and milling yields in water-seeded rice (*Oryza sativa* 'TEBONNET') infested with red rice (*Oryza sativa*). Rice Research Station, Crowley, LA. 1989.

	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Milling yield Total (%)	Milling yield Whole (%)	Grain red rice content (%)	Grade (USDA grade requirements)
Plant Growth Regulator						
None	15.8	4509	69a	59a	4.2	5
Gibberellic acid	16.4	4433	67c	55b	4.5	5
Phthalimide	15.6	4115	68b	56b	6.8	6
Fenoxaprop rate (lb/A)						
0	13.4b[1/]	3450b	68b	57a	12.9a	6
0.15	15.3b	5648a	69a	59a	1.6b	3
0.30	19.1a	3960ab	67c	54b	1.0b	2

1/ Means for each factor in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, J.B. Baker, R.R. Dilly, Jr., and G.A. Meche

Experiment: Herbicides and Plant Growth Regulators for Red Rice (*Oryza sativa*) Control and Seedhead Suppression in Rice (*Oryza sativa* 'TEBONNET')

Location: Rice Research Station, Crowley, LA

Variety: Tebonnet

Seeding Rate: 200 lb/A

Planting Date: Apr 17

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 15 Apr; seed were kept moist for 24 hr following draining and before sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A and urea (46%) at 200 lb/A on 12 Apr (preplant incorporated)

Plot Size: 150 ft^2 - 5 x 30 ft

Treated Area: 150 ft^2 - 5 x 30 ft

Treatment(s):

Herbicides

Bolero - 4 lb thiobencarb/A, preplant surface (12 Apr)
Ordram - 4 lb molinate/A, preplant incorporated (12 Apr)

Plant Growth Regulators

Embark - 0.25 lb mefluidide/A at late boot (29 June)
Embark - 0.25 lb mefluidide/A at physiological maturity (27 July)
UBI-1444 - 1.5 lb maleic hydrazide/A at dough stage (19 July)

Sprayer: CO_2 driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 4 May, 1.35 inches; 29 June, 0.90 inches; 19 July 1.22 inches

Herbicide(s): Stam M4 (4 lb ai/A) by airplane on 4 and 11 may

Insecticide(s): Furadan (0.5 lb ai/A) by airplane on 30 May
Sevin (1 lb ai/A) by airplane on 7 July

Fungicide(s): None

Emergence: 17 Apr (seeded germinated seed)

Water Management: Flooded (1 to 2 inches) on 14 Apr for seeding; drained on 17 Apr; permanent flood (3 to 4 inches) established on 21 Apr; and drained for harvest on 24 July

Permanent Flood: 21 Apr

Harvest Date: 3 Aug

Harvested Area: 100 ft^2 - 4 x 25 ft

Experimental Design: Factorial (3 x 3), randomized complete block (four replications)

Comments: Preplant herbicides reduced red rice stand and panicle density significantly, and postemergence plant growth regulators decreased red rice panicle density (Table 1). The combination of preplant herbicide and postemergence plant growth regulators although resulting in numerically lower red rice stands and panicle densities were not significantly better than either alone. In the untreated check red rice stand was 27 plants/m^2. Stands were reduced to 5 and 4 plants/m^2 with thiobencarb and molinate, respectively. Combinations of herbicides and plant growth regulator resulted in stands ranging from 2 to 3 plants/m^2. Red rice panicle density was 89 panicles/m^2 without herbicide or plant growth regulator treatment. Panicle density was 8 panicles/m^2 with preplant herbicides, 19 panicles/m^2 with mefluidide, 97 panicles/m^2 with maleic hydrazide and ranged between 1 and 4 panicles/m^2 for the herbicide-growth regulator combinations.

Rice stands were reduced by plant growth regulators (Table 1). Mefluidide alone and in combination with thiobencarb and molinate and maleic hydrazide alone resulted in stands ranging between 14 and 16 plants/m^2. In the other treatments stand ranged primarily between 19 and 21 plants/m^2. Rice panicle density was decreased by maleic hydrazide. Mefluidide and mefluidide in combination with molinate reduced rice plant height. Lodging occurred in the untreated check and maleic hydrazide treatment. Grain yield was increased by preplant herbicide application and decreased by plant growth regulator application. Grain yield was increased more significantly by molinate than thiobencarb. Both plant growth regulators decreased grain yield equally.

Grain red rice content was significantly decreased by herbicide and growth regulators alone (Table 2). Herbicides were more effective than growth regulators and the combination of both resulted in the lowest grain red rice content. Thiobencarb in combination with maleic hydrazide was the best treatment with no red rice seed in the harvested grain.

Lowering grain red rice content increased grade and milling yield (Table 2). The untreated check produced USDA sample grade rice (>15% red rice). Herbicide and growth regulator treatments produced mostly USDA No. 2 and No. 3 rice, and herbicide-growth regulator combinations produced the highest grade rice, USDA No. 1 (<.5%). Highest milling yields were obtained with mefluidide alone and herbicide-growth regulator combinations. Herbicides alone had slightly lower milling yield than the treatment combinations and maleic hydrazide had still slightly lower milling yields although they were higher than the control.

Except for maleic hydrazide, harvest moisture was higher for the herbicide, growth regulator and herbicide-growth regulator combinations compared to the control (Table 2). Since the maleic hydrazide and control plots lodged they had to be hand harvested in stead of bulk harvest by small plot combine. Harvest moisture differences were the result of this procedural difference and not due to treatment effects.

Table 1. The effect of preplant herbicides and late season plant growth regulators for red rice (*Oryza sativa*) suppression in rice (*Oryza sativa* 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

	Rate (lb/A)	Red rice stand (plants/ sq yd)	Tebonnet Stand (plants/ sq ft)	Tebonnet Panicle density (panicles/ sq ft)	Mature plant height (in)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)
Herbicide							
No herbicide	0	24a[1/]	16	32b	53b	17.6b	3950c
Thiobencarb		3b	18	39a	55a	20.2a	5650b
Molinate	4.00	3b	18	37ab	54ab	20.1a	6223a
Plant Growth Regulator							
No PGR	0	12	20a	35	56a	19.2	5772a
Mefluidide	0.25	6	15b	36	51b	19.8	5136b
Maleic hydrazide	1.50	12	17b	36	55ab	18.9	4914b

1/ Means for each factor in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of preplant herbicides and late season plant growth regulators for red rice suppression on crop production in water-seeded rice (*Oryza sativa* 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

Herbicide		Plant growth regulator		Red rice panicle density (panicles/ sq yd)	Lodging rating (% plot)	Milling yield		Grain red rice content (%)	Grade
Type	Rate (lb ai/A)	Rate (lb/A)	Plant growth regulator			Total (%)	Whole (%)		
None	0	0	None	89a[1/]	60a	61e	45e	14.8a	7a
	0	0.25	Mefluidide	18b	0b	70abc	60bc	2.7b	3b
	0	1.50	Maleic hydrazide	97a	51a	65d	54d	2.0bc	3bc
Thiobencarb	4	0	None	8b	0b	69bc	59bc	0.9cd	2cd
	4	0.25	Mefluidide	1b	0b	70abc	62ab	0.1d	1d
	4	1.50	Maleic hydrazide	3b	0b	71ab	65a	0.0d	1d
Molinate	4	0	None	8b	0b	68c	58c	0.6cd	1cd
	4	0.25	Mefluidide	1b	0b	71a	64a	0.2d	1d
	4	1.50	Maleic hydrazide	4b	0b	71a	65a	0.0d	1d

1/ Means for each factor in the same column followed by same letter do not significantly differ (Duncan's multiple range test, p=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, and G.A. Meche

Experiment: Maleic Hydrazide and Red Rice (*Oryza sativa*) Seedhead Suppression in Rice (*Oryza sativa* 'TEBONNET')

Location: Rice Research Station, Crowley, LA

Variety: Tebonnet

Seeding Rate: 200 lb/A

Planting Date: 17 Apr 89

Row Spacing: Water-seeded: seed were soaked in water for 24 hr beginning on 15 Apr; seed were kept moist for 24 hr following draining and sowing

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 12 Apr; urea (46%) at 200 lb/A on 12 Apr (preplant incorporated)

Plot Size: 150 ft^2 - 5 x 30 ft

Treated Area: 150 ft^2 - 5 x 30 ft

Treatment(s):

Formulation (rate): UBI-1444 (1.5 lb maleic hydrazide/A)

Timing: Milk stage, 17 July; Dough stage, 21 July

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 4 May, 1.35 inches

Herbicide(s): Stam M4 (4 lb ai/A) by airplane on 4 and 11 May

Insecticide(s): Furadan (0.5 lb ai/A) by airplane on 30 May
Sevin (1 lb ai/A) by airplane on 7 July

Fungicide(s): None

Emergence: 17 Apr

Water Management: Flooded (1-2 inches) on 14 Apr for seeding; drained on 17 Apr; permanent flood (3-4 inches) established on 21 Apr; drained for harvest on 24 July

Permanent Flood: 21 Apr

Harvest Date: 9 Aug

Harvested Area: 12 ft^2 - 2.3 x 3 ft areas were hand harvested

Experimental Design: Randomized complete block (four replications)

Comments: Maleic hydrazide significantly decreased red rice content of the grain which resulted in significant improvement in grain quality and unit price (Tables 1 and 2). Maleic hydrazide had no affect on red rice stand or panicle production as well as no affect on commercial rice stand, panicle production, grain moisture, grain yield, or milling yields. There was no difference in effects between application of maleic hydrazide at the milk and dough stage of commercial rice. All treatments were completely lodged at maturity.

The activity of maleic hydrazide inhibited red rice seed production. Since panicle density was unaffected and no seedhead suppression occurred, maleic hydrazide had a direct effect on seed set. Due to the maturity difference between Tebonnet and red rice, maleic hydrazide was applied during grain filling of the commercial rice and during heading and anthesis of the red rice. It appears maleic hydrazide caused infertility, abortion, or prevented the initiation of grain filling in red rice.

Table 1. The effect of maleic hydrazide on red rice (Oryza sativa) panicle exsertion and crop production in rice (Oryza sativa 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

Time of application (growth stage)	Maleic hydrazide rate (lb/A)	Tebonnet		Red rice		Grain moisture (%)	Grain yield at 12% moisture (lb/A)
		Stand (plants/ sq ft)	Panicle density (panicles/ sq ft)	Stand (plants/ sq ft)	Panicle density (panicles/ sq ft)		
Milk stage	0	21a[1/]	36a	254a	765a	11.4a	3060a
	1.5	19a	31a	208a	682a	12.4a	3553a
Dough stage	0	18a	34a	283a	960a	11.6a	3338a
	1.5	16a	28a	294a	1062a	12.2a	2936a

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

Table 2. The effect of maleic hydrazide as a red rice (Oryza sativa) suppressant on the quality and milling yield of rice (Oryza sativa 'TEBONNET'). Rice Research Station, Crowley, LA. 1989.

Time of application (growth stage)	Maleic hydrazide rate (lb/A)	Milling yield		Grain red rice content (%)	Grade
		Total (%)	Whole (%)		
Milk stage	0	69a[1/]	58a	12.7a	6a
	1.5	69a	62a	0.3b	1c
Dough stage	0	68a	59a	15.0a	7a
	1.5	69a	61a	1.2b	2b

1/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH IN RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Ethephon Yield Enhancement Study

Location: Rice Research Station, Crowley, LA

Variety/Seeding Rate: Rico 1 / 100 lb/A

Planting Date: 25 April 89

Row Spacing: 7 inch

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 April 89. Urea (46% N) topdressing, 200 lb/A on 30 May 89.

Plot Size: 3.5 x 35 feet **Treated Area:** 3.5 x 35 feet

Treatment(s):

Formulation (rate): Cerone (0.5 lb ethephon/A).
Application timing - 32, 39, 46, 53, and 60 days after emergence (DAE).
Applied as a foliar spray using 31.5 ml of Cerone in 1 gallon of water or 0.5 lb ai/A.

DAYS AFTER EMERGENCE	DATE	GROWTH STAGE
32	6-09-89	7-8 LEAF
39	6-15-89	8-9 LEAF
46	6-22-89	9-10 LEAF
53	6-29-89	GREEN RING
60	7-06-89	PANICLE INITIATION

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 22 June 89 - 0.19 in.; 29 June 89 - 0.90 in.; 6 July 89 - 0.61 in.

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 May 89
Stam M4 (3 lb ai/A) by hand sprayer, 30 May 89
Londax (0.6 lb ai/A) by airplane, 31 May and 20 June 89
Ordram (3.0 lb/A) by airplane, 7 June 89
Bolero (3.0 lb/A) by airplane, 7 July 89

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 June
Sevin (1 lb ai/A) by airplane, 27 July 89

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July 89
Rovral (0.5 lb ai/A) with hand sprayer, 24 July 89

Emergence: 7 May 89

Permanent Flood: 31 May 89

Harvest Date: 18 Sept 89

Harvested Plot Area: 20 linear feet (10 feet of center 2 rows-hand harvested)

Experimental Design: Randomized complete block (4 replications)

Comments: Ethephon applied during the late vegetative and early reproductive phases of growth had no biologically significant effects on maturity and grain yield of rice (Table 1). In all treatments, grain moisture ranged between 13.4 and 13.9%, and days to heading ranged between 86 and 87 days. Grain yields ranged between 6752 and 7572 lb/A. Grain yield of the check was 7392 lb/A. Highest grain yield was 7572 lb/A and resulted from ethephon application at 53 days after emergence.

All plots were lodged 2 weeks after heading. At harvest straw was decayed, and grain was germinating on some panicles. These conditions precluded collecting meaningful yield component data.

Table 1. The effect of ethephon on crop production in rice (*Oryza sativa* 'RICO 1'). Rice Research Station, Crowley, LA. 1989.

Time of application (DAE)[1/]	Grain moisture (%)	Grain yield at 12% moisture (lb/A)	Maturity (Days to 50% heading)
-	13.7a[2/]	7392a	87ab
32	13.5a	7537a	86b
39	13.7a	6752a	87ab
46	13.4a	7391a	87a
53	13.4a	7572a	86ab
60	13.9a	7430a	86b

1/ Days after emergence.

2/ Means in the same column followed by same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Chitosan and Water-Seeded Rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 150 lb/A

Planting Date: 28 Apr 89

Row Spacing: Water-seeded: see treatments

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A and urea (46% N) preplant incorporated on 24 Apr

Plot Size: 175 ft^2 - 5 x 35 ft

Treated Area: 175 ft^2 - 5 x 35 ft

Treatment(s): Seed Treatment

Formulation (rate): Ceres 211 (40 lb chitosan/A)
Seed treatment: Dry treated seed, non-soaked (Trt. 1)
Dry treated seed, soaked (Trt. 2)
Soak solution treatment: Untreated seed, soaked in Ceres 211 solution (Trt. 3)
Soak procedure: Seed were soaked for 24 hr beginning on 26 Apr; seed were kept moist for 24 hr following draining and before sowing

Pertinent Rainfall: 4 May - 1.35 inches

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Londax (0.6 lb ai/A) by airplane, 23 and 31 May and 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) with hand sprayer, 24 July

Emergence: 28 Apr (seeded germinated seed)

Permanent Flood: 8 May

Harvest Date: 20 and 21 Sept

Harvested Area: 160 ft^2 - 5 x 32 ft

Experimental Design Randomized complete block (4 replications)

Comments: Chitosan significantly increased grain yield for dry seed, water-seeded rice (Table 1). Dry or unsoaked rice seed sown onto a flooded seedbed had greater than a 700 lb/A increase in grain yield when the seed was treated dry with chitosan. Yield component analyses did not explain the yield difference. Seed treated with chitosan and soaked before water-seeding and seed soaked in a solution of chitosan produced grain yields equivalent to untreated soaked seed.

Table 1. The effect of chitosan on crop production in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Treatment	Grain yield (lb/A)1/	Grain moisture (%)	Disease rating (% plot)	Panicle density (panicles/ sq ft)	Grain density (count/ 200 g)
Check-unsoaked	5615b2/	11.5	63	35	9795
1	6374a	11.5	58	37	9742
Check-soaked	6090ab	11.6	70	--	----
2	6110ab	11.7	58	--	----
3	6494a	11.7	55	--	----

1/ Adjusted to 12% moisture.

2/ Means in the same column followed by the same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Yield Enhancement with Cytokin on Rice (*Oryza sativa* 'LEMONT')

Location: Rice Research Station, Crowley, LA

Variety: Lemont

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr and urea (46% N) at 200 lb/A on 30 May

Plot Size: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

Treated Area: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

Treatment(s):

Formulation: Cyto2630 (cytokin)
Rate: 0.5 pt/A (15.8 ml/gal)
0.1 pt/A (31.5 ml/gal)
Timing: 3 - 6 leaf stage (22 May)
Surfactant: Nu-Film 17 (0.5%) - 4 oz/A
Nu-Film 17 (0.5%) - 8 oz/A

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 17 May - 0.60 inches
2 June - 0.90 inches

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 7 May

Permanent Flood: 31 May

Harvest Date: 7 Sept

Harvested Area: 46.6 ft^2 - 2.33 ft (4 rows) x 20 ft

Experimental Design: Randomized complete block (4 replications)

Comments: Grain moisture and yield was not significantly affected by the application of cytokin at the 3-6 leaf stage of rice (Table 1). Numerically grain yields were 300 to 400 lb/A higher with cytokin at the .5 and 1 pt/A rates and with cytokin at the .5 lb/A rate in combination with the high rate of Nufilm-17. Cytokin at .5 lb/A in combination with the low rate of Nufilm-17 yielded less than the untreated check.

Table 1. The effect of cytokin on crop production in rice (*Oryza sativa* 'LEMONT'). Rice Research Station, Crowley, LA. 1989.

Cytokin rate (pt/A)	Nufilm-17 rate (oz/A)	Grain moisture (%)	Grain yield at 12% moisture (lb/A)
0	0	14.0a[1/]	6783a
0.5	0	13.6a	7250a
1.0	0	14.3a	7213a
0.5	4	13.8a	6617a
0.5	8	13.9a	7114a

1/ Means in a column followed by the same letter do not significantly differ (Duncan's multiple range test, P=.05).

PLANT GROWTH REGULATOR RESEARCH ON RICE

R.T. Dunand, R.R. Dilly, Jr., and G.A. Meche

Experiment: Stature Reduction with XE-1019 on Rice (*Oryza sativa* 'RICO 1')

Location: Rice Research Station, Crowley, LA

Variety: Rico 1

Seeding Rate: 100 lb/A

Planting Date: 25 Apr 89

Row Spacing: 7 inch (drill seeded)

Fertilizer: 7-21-21 with 1.2% zinc at 300 lb/A on 25 Apr and urea (46% N) at 200 lb/A on 30 May

Plot Size: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

Treated Area: 87.5 ft^2 - 3.5 (6 rows) x 25 ft

Treatment(s):

Formulation: XE-1019 50% wettable powder
Rate: 0.25 lb ai/A
Timing: Late tiller (23 June)
Internode initiation (30 June)

Sprayer: CO_2-driven, hand-held, 32 psi, 15 GPA, 80015 nozzles

Pertinent Rainfall: 2 June, 0.90 in; 7 June, 0.28 in; 23 June, 0.01 in; 24 June, 0.02 in; 25 June, 0.02 in; 26 June, 2.50 in; 27 June, 3.24 in; 28 June, 0.48 in; 29 June, 0.90 in; 1 July, 0.30 in; 2 July, 0.80 in; 3 July, 1.90 in; 4 July, 0.10 in; 5 July, 0.64 in; 6 July, 0.61 in; 7 July, 0.04

Herbicide(s): Stam M4 (3 lb ai/A) by airplane, 11 and 23 May
Stam M4 (3 lb ai/A) by hand sprayer, 29 May
Londax (0.6 lb ai/A) by airplane, 31 May, 7 and 20 June
Ordram (3 lb ai/A) by airplane, 7 June
Bolero (4.0 lb ai/A) by airplane, 7 July

Insecticide(s): Furadan (0.5 lb ai/A) by airplane, 6 and 15 June
Sevin (1 lb ai/A) by airplane, 27 July

Fungicide(s): Benlate (0.5 lb ai/A) by airplane, 12 July
Rovral (0.5 lb ai/A) by hand sprayer, 24 July

Emergence: 7 May

Permanent Flood: 31 May

Harvest Date: 7 Sept

Harvested Area: 46.6 ft - 2.33 (4 rows) x 20 ft

Experimental Design: Randomized complete block (4 replications)

Comments: Plant stature, maturity and yield were affected by XE-1019 (Table 1). Plant height was reduced 5 inches at two weeks after late tiller application. At maturity plant height was 29 inches for both the late tiller and internode initiation times of application and the untreated check was 43 inches. Days to 50% heading were delayed 3 days by the internode initiation time of application. Grain yield was decreased 1123 lb/A and 2336 lb/A by the late tiller and internode initiation times of application, respectively.

Table 1. The effect of XE-1019 on plant stature and crop production in rice (*Oryza sativa* 'RICO 1'). Rice Research Station, Crowley, LA. 1989.

Time of application (growth stage)	Plant height (in) 72 DAP[1/]	Plant height (in) 142 DAP	Maturity (Days to 50% heading)	Grain yield (lb/A)[2/]	Grain moisture (%)
-	20a[3/]	41a	86b	9422a	12.6
Late tiller	15b	29b	88ab	7086c	12.3
Internode initiation	18a	29b	89a	8299b	12.3

1/ Days after planting.

2/ Adjusted to 12% moisture.

3/ Means in the same column followed by the same letter do not significantly differ (Duncan's multiple range test, P=.05).

SUMMARY

Gibberellic acid (GA) seed treatment increased seedling stand and decreased emergence rate of long-grain semidwarf rice seeded 3 inches below the soil surface. The increase in seedling stand was 2 to 3 fold and the decrease in emergence rate was 20 to 25%. ABG-3028A was the most active formulation applied as a dry powder. It was active at rates as low as 10 ppm. Other formulations applied in liquid form generally rank in the following order: ABG-3109 = ABG-3112A = ABG-3112B = ABG-3112C J ABG-3110. Gibberellic acid had detrimental effects in water-seeded rice.

Postemergence GA application increased seedling height in medium- and long-grain rice, as well as semidwarf and tall stature varieties. Gibberellic acid was activated at 6.4 g/A applied between the 2- to 8-leaf stages. ABG-3110B was generally the most active formulation of the ABG-3110 series tested, and ABG-3067 was the least active formulation, especially when comparing duration of activity. On semidwarf long-grain rice, ABG-3110B increased plant height more than ABG-3067. Postemergence GA following GA seed treatment produced an initial, short term (3 DAT) increase in seedling height which was greater than postemergence GA alone. Postemergence GA applications after the 5- to 6-leaf stage increased mature plant and decreased grain yield. The effect was more severe in a very early season variety. In semidwarf long-grain rice, propanil increased ABG-3067 activity on seedling height 10 to 20% without affecting propanil efficacy.

CONCLUSIONS

Gibberellic acid applied as a seed treatment and/or as a postemergence foliar application allows planting to soil moisture adequate for germination, hastens emergence and stimulates seedling growth. This can minimize early-season water use. Flushings to provide moisture for germination and to soften the soil surface during emergence can be eliminated and earlier permanent flood establishment is possible. When stand is limiting, GA seed treatment can increase panicle density and thus yield potential. If stand is increased above 20 plants/ft^2 and disease pressure is high, grain yield can be decreased. In addition, GA can hasten maturity when emergence rate is decreased and seedling elongation is increased permitting early permanent flood establishment. Earlier maturity can increase ratoon crop potential. Gibberellic acid is compatible with propanil.

RICE WEED CONTROL STUDIES

J.B. Baker, R.T. Dunand, D.J. Pantone, and T. Downey

INTRODUCTION

Although Louisiana rice farmers have some excellent herbicides that they can use to control weeds in their fields, it is essential that the search for new herbicides or new ways of using old herbicides continue. There are a few weeds which are not adequately controlled by the currently available herbicides, and with the small number of herbicides available, it is possible that minor weeds may become major weeds if they are not controlled by the herbicides being used. This makes it important to increase the arsenal of available herbicides even if their spectrum of activity is only slightly different from those now being used.

MATERIALS AND METHODS

These experiments were conducted at the main unit of the Rice Research Station in a field which has been managed to maintain heavy infestations of many of the weeds found in rice fields of South Louisiana. The soil type is a Crowley silt loam.

The test field was plowed in late summer of 1988 to incorporate the weed seeds produced during that summer and again in early spring of 1989 to destroy the winter vegetation. Final seedbed preparation consisted of discing and spring-tooth harrowing and cultimulching. Drill-seeded tests were planted with a 11-runner grain drill and flush irrigated as needed to establish a stand. The rice was fertilized with 500 lb/A of a 20-10-10 analysis fertilizer just prior to flooding. In water-seeded tests, the area to be planted was flooded, sown with presprouted seed and drained to permit stand establishment. The flood was reestablished following stand establishment and maintained until shortly before harvest. The water-seeded rice was fertilized by applying the same amount of fertilizer to the flooded rice at the same stage of development as the drill-seeded rice. Specific details of water management and other information on each test are presented as footnotes to the tables in the results and discussion section of this report.

Yield data were collected in the advanced herbicide comparison test by combine harvesting the entire 7' x 50' plot, weighing the grain, measuring the moisture and converting the data to 100-lb/A units at 12% moisture. In the rice tolerance test four center rows from the 28' plot were combine harvested, and the harvested grain was processed the same way. Yield data in other studies was obtained by hand harvesting a 1 sq. yd. area from each plot and threshing with a small-plot thresher. The grain was cleaned with a seed-blower and weighed, and then the data were converted to 100-lb/A units.

1/ This research was supported in part by funds provided by Louisiana rice farmers through the Louisiana Rice Research Board.

Most of the tests were randomized complete block design tests with four replicates. The test of premix molinate:propanil and postflooding molinate and the cultivar tolerance test were split-plot design tests. Data were subjected to analysis of variance, and where appropriate, mean comparisons were made using the Duncan's multiple range technique or calculation of a LSD.

In most cases evaluations of weed control and rice injury were made by estimating the percentage of control or injury, but in some cases the following rating scales were used:

Rice tolerance:
- 1 - very severe injury with greater than 90% stand reduction.
- 2 - severe injury with 70 - 90% stand reduction.
- 3 - moderate injury, primarily leaf burning and stunting.
- 4 - slight injury, primarily leaf burning.
- 5 - no detectable injury.

Weed control:
- 1 - poor, less than 10% control.
- 2 - slight, 10 - 30% control.
- 3 - moderate, 30 - 70% control.
- 4 - good, 70 - 90% control.
- 5 - excellent, greater than 90% control.

Information on chemicals tested is presented in Table 8. In the listing of herbicide treatments the following conventions are used: the plus sign (+) indicates a tank mixture of the materials, the slash (/) indicates sequential applications of the herbicides, and the colon (:) indicates that the herbicides are premixed in one formulation.

RESULTS AND DISCUSSION

Advanced Herbicide Comparison Test

The treatments and results are presented in Table 1 and Table 2. The major weeds in this test were junglerice and indian jointvetch, with other weeds being present in lighter infestations. The early ratings of rice injury reflect the leaf burning that is often seen with propanil or mixtures containing propanil, but the later ratings show that the rice grows out of this injury. As can be seen in both tables, the weed control was excellent in most cases. The most notable exception in the early ratings is the late postemergence application of molinate:propanil where the ratings were taken two days after treatment and do not really indicate performance of this treatment. Late season ratings show this treatment to be excellent and to yield well. The delayed preemergence application of thiobencarb was weak on broadleaves, and an application of 2,4-D was necessary in order to be able to harvest the plots with the combine.

Drill-seeded Herbicide Screening Test

The treatments and ratings are presented in Table 3 and Table 4. The early ratings presented in Table 3 reflect the effect of the delayed preemergence treatments prior to the application of the postemergence treatments. V-53482 is a very active compound and caused considerable rice

Table 1. Advanced herbicide comparison test. Drill-seeded.[1/] Ratings taken May 31, 1989. Rice Research Station, Crowley, LA 1989.

Herbicide	Rate	Time of[2/] treatment	Rice[3/] injury	Weed control[3/]					
				ECHCO	BRAPP	SEBEX	AESIN	ECLAL	CYPIR
	(lb ai/A)		(%)	(%)					
untreated check	-	-	0e	8c	10d	0d	0d	0c	0c
thiobencarb	4	DelPre	0e	94a	83ab	82bc	82bc	96b	98a
thiobencarb + quinclorac	4 + .375	DelPre	0e	98a	98a	98a	98a	98a	98a
quinclorac	.375	DelPre	0e	98a	98a	98a	98a	98a	98a
thiobencarb / propanil	4 / 3	DelPre Po	5cde	88a	88ab	92ab	83b	98a	98a
quinclorac / propanil	.375 / 3	DelPre Po	9b-e	98a	98a	98a	98a	98a	98a
thiobencarb + propanil	4 + 3	EPo	1de	93a	83ab	96a	96a	98a	98a
quinclorac + propanil	.375 + 3	EPo	5cde	98a	98a	98a	98a	98a	98a
quinclorac	.375	EPo	0e	98a	98a	98a	98a	98a	98a
propanil	3	EPo	1de	89a	76bc	97a	97a	98a	98a
propanil/ fenoxaprop	3 / .15	EPo / LPo	4de	94a	90ab	97a	97a	97a	97a
propanil / propanil	3 / 3	EPo / Po	14bc	97a	97a	98a	98a	98a	98a

Continued

Table 1. (continued)

Herbicide	Rate	Time of[2/] treatment	Rice[3/] injury	Weed control[3/] ECHCO	BRAPP	SEBEX	AESIN	ECLAL	CYPIR
	(lb ai/A)		(%)	(%)					
quinclorac / sethoxydim + COC(1.7 pt/A)	.375 / .1	EPo / LPo	5cde	98a	98a	98a	98a	98a	98a
quinclorac / propanil	.375 / 3	EPo / Po	5cde	98a	98a	98a	98a	98a	98a
propanil	3	Po	10bcd	94a	94ab	98a	98a	98a	98a
propanil + thiobencarb	3 + 3	Po	28a	98a	98a	98a	98a	98a	98a
propanil + bromoxynil	3 +	Po	27a	98a	98a	98a	98a	98a	98a
propanil + triclopyr	3 + .375	Po	10bcd	98a	98a	98a	98a	98a	98a
propanil : molinate	3 : 3	Po	15b	98a	98a	98a	98a	98a	98a
propanil : molinate	3 : 3	LPo	9b-e	67b	60c	70c	70c	83b	83b

1/Lemont drill seeded at 100 lb/A on May 2, 1989. Rain on May 2, 1989 and May 3, 1989. Flushed May 11, 1989. Emerged on May 10, 1989. Flooded June 5, 1989.

2/DelPre applied May 8, 1989. EPo applied May 15, 1989 - wet soil. Po applied May 23, 1989. LPo applied May 29, 1989.

3/See Table 9 for identification of weeds. Ratings within a column followed by the same letter are not significantly different at alpha = .01.

Table 2. Advanced herbicide comparison test. Drill seeded.1/ Ratings taken August 2, 1989. Rice Research station, Crowley, LA. 1989.

Herbicide	Rate	Time of2/ treatment	Rice injury	Weed control3/ ECHCO	BRAPP	AESIN	CNPPA	Yield5/
	(lb ai/A)		(%)	(%)				(100 lb/A)
untreated check4/	-	-	0	0c	0c	33b	33b	30.7b
thiobencarb4/	4	DelPre	0	98a	98a	92a	98a	65.0a
thiobencarb + + quinclorac	4 + .375	DelPre	0	98a	98a	98a	98a	63.8a
quinclorac	.375	DelPre	0	98a	98a	98a	98a	63.4a
thiobencarb / propanil	4 / 3	DelPre Po	0	98a	98a	64ab	65a	64.3a
quinclorac / propanil	.375 / 3	DelPre / Po	0	98a	98a	98a	98a	57.2a
thiobencarb + propanil	4 + 3	EPo	0	98a	98a	97a	98a	63.3a
quinclorac + propanil	.375 + 3	EPo	0	98a	98a	98a	98a	64.5a
quinclorac	.375	EPo	3	98a	98a	98a	98a	66.4a
propanil	3	EPo	0	98a	98a	96a	98a	62.7a
propanil / fenoxaprop	3 / .15	EPo / LPo	0	98a	98a	95a	98a	66.6a
propanil / propanil	3 / 3	EPo / Po	1	98a	98a	98a	98a	64.9a
quinclorac sethoxydim + COC (1.7 pt/A)	.375 / .1	EPo / LPo	0	98a	98a	98a	98a	70.0a

Continued

Table 2. (continued)

Herbicide	Rate	Time of[2/] Treatment	Rice injury	Weed control[3/] ECHCO	BRAPP	AESIN	CNPPA	Yield[5/]
	(lb ai/A)		(%)	------------	(%)	------------		(100 lb/A)
quinclorac / propanil	.375 3	EPo Po	0	98a	98a	98a	98a	63.8a
propanil	3	Po	0	98a	98a	98a	98a	59.0a
propanil thiobencarb	3 + 3	Po	0	98a	98a	98a	98a	62.8a
propanil + bromoxynil	3 + .375	Po	0	98a	98a	98a	98a	66.8a
propanil + triclopyr	3 + .375	Po	3	95b	95b	98a	98a	57.2a
propanil : molinate	3 : 3	Po	0	98a	98a	98a	98a	66.6a
propanil : molinate	3 : 3	LPo	5	98a	98a	98a	98a	65.4a

1/Lemont drill seeded at 100 lb/A on May 2, 1989. Rain on May 2, 1989 and May 3, 1989. Flushed May 11, 1989. Emerged on May 10, 1989. Flooded June 5, 1989.

2/DelPre applied May 8, 1989. EPo applied May 15, 1989 - wet soil. Po applied May 23, 1989. LPo applied May 29, 1989.

3/See Table 9 for identification of weeds. Ratings within a column followed by the same letter are not significantly different at alpha = .01.

4/Sprayed with 2, 4-D at 1.5 lb ai/A on July 10, 1989.

5/Yield means followed the same letter are not significantly different at alpha = .05.

Table 3. Drill-seeded herbicide screening trial.[1] Ratings taken May 23, 1989.
Rice Research Station, Crowley, LA, 1989.

Herbicide	Rate	Time of treatment[2]	Rice[3] injury	Weed control[3]	
				Grasses	Broadleaves
	(lb ai/A)		(%)	-------- (%) --------	
V-53482	.005	DelPre	34b	98a	98a
V-53482	.007	DelPre	41ab	98a	98a
V-53482	.009	DelPre	40ab	98a	98a
V-53482 / propanil	.055 / 3	DelPre / Po	43ab	98a	98a
V-53482 / propanil	.077 / 3	DelPre / Po	49a	98a	98a
V-53482 / propanil	.099 / 3	DelPre / Po	48a	98a	98a
Thiobencarb / V-53482 + COC[4]	4 / .022	DelPre / Po	8cde	98a	86a
Thiobencarb / V-53482 + COC	4 / .044	DelPre / Po	5de	94a	80a
Thiobencarb / V-53482 + COC	4 / .066	DelPre / Po	11cd	82a	81a
V-53482 + COC	.022	Po	-	-	-
V-53482 + COC	.044	Po	-	-	-
V-53482 + COC	.066	Po	-	-	-
Propanil	4	Po	-	-	-
Thiobencarb	4	DelPre	13c	94a	79a
Quinclorac	.375	Po	-	-	-

Continued

Table 3. (continued)

Herbicide	Rate	Time of treatment[2]	Rice[3] injury	Weed control[3] Grasses	Broadleaves
	(lb ai/A)		(%)	-------- (%)	--------
Quinclorac / HOE 46360	.375 / .075	Po / LPo	-	-	-
Triclopyr + HOE 46360	.375 + .075	LPo	-	-	-
Untreated check	-	-	0e	0b	0b

[1]Drill seeded May 2, 1989 with 100 lb/A Lemont. Rain May 3, 4 and 5, 1989. Emergence May 10, 1989. Flushed May 11, 1989.

[2]Times of treatment: DelPre - May 8, 1989 with grasses and broadleaves just emerging. Po - May 23, 1989 with grass in 3 - 4 leaf and broadleaves in first true leaf. LPo - May 29, 1989 with grass in early tiller and broadleaves in two leaf stage.

[3]Means within a column followed by the same letter are not significantly different at alpha = .01.

[4]COC used at rate of 1.7 pts/A.

Table 4. Drill-seeded herbicide screening trial.1/ Ratings taken May 31, 1989. Rice Research Station, Crowley, LA. 1989.

Herbicide	Rate	Time of2/ treatment	Rice3/ injury	Weed control 3/					
				ECHCO	BRAPP	SEBEX	AESIN	ECLAL	CYPIR
	(lb ai/A)		(%)	(%)					
V-53482	.055	DelPre	34b-e	98a	98a	98a	98a	98a	98a
V-53482	.077	DelPre	49a-d	98a	98a	98a	98a	98a	98a
V-53482	.099	DelPre	53abc	98a	98a	98a	98a	98a	98a
V-53482 / propanil	.055 / 3	DelPre / Po	35a-e	97a	97a	97a	97a	97a	97a
V-53482 / propanil	.077 / 3	DelPre / Po	51abc	98a	98a	98a	98a	98a	98a
V-53482 / propanil	.099 / 3	DelPre / Po	59ab	98a	98a	98a	98a	98a	98a
thiobencarb / V-53482 + COC4/	4 / .022	DelPre / Po	54abc	96a	96a	97a	97a	98a	98a
thiobencarb / V-53482 + COC	4 / .044	DelPre / Po	48a-d	97a	96a	98a	98a	98a	98a
thiobencarb / V-53482 + COC	4 / .066	DelPre / Po	38a-e	97a	97a	98a	98a	99a	97a
V-53482 + COC	.022	Po	33c-f	49b	48b	73b	73b	80b	95a
V-53482 + COC	.044	Po	55abc	52b	52b	90ab	90ab	91ab	96a

Continued

Table 4 (cont'd)

Herbicide	Rate	Time of[2] treatment	Rice[3] injury	Weed control[3]					
				ECHCO	BRAPP	SEBEX	AESIN	ECLAL	CYPIR
	(lb ai/A)		(%)	(%)					
V-53482 + COC	.066	Po	60a	53b	55b	92ab	92ab	93ab	92ab
propanil	4	Po	25def	96a	96a	98a	98a	98a	98a
thiobencarb	4	DelPre	13efg	90a	90a	84ab	84ab	99a	97a
quinclorac	.375	Po	16efg	83a	83a	88ab	88ab	93ab	83ab
quinclorac / HOE46360	.375 .075	Po / LPo	17efg	83a	80a	90ab	90ab	96ab	73b
triclopyr + HOE46360	.375 + .075	LPo	9fg	10c	10c	44c	44c	48c	38c
untreated check	--	--	0g	0c	0c	0d	0d	0d	0d

1/Drill seeded May 2, 1989 with 100 lb/A Lemont. Rain May 3, 4 and 5, 1989. Emergence May 10, 1989. Flushed May 11, 1989.

2/Time of treatment: DelPre - May 8, 1989 with grasses and broadleaves just emerging. Po - May 23, 1989 with grass in 3-4 leaf and broadleaves in first five leaf. LPo - May 29, 1989 with grass in early tiller and broadleaves in two leaf stage.

3/Means within a column followed by the same value are not significantly different at alpha = .01. See Table 9 for identification of weeds.

4/COC used at rate of 1.7 pts/A.

injury at all rates tested. As a delayed preemergence treatment it gave excellent control of all weeds at all rates tested. As a postemergence treatment it gave even greater rice injury even though the rates were lower than the delayed preemergence rates, and weed control was not as good as the delayed preemergence treatments. It was also noted that at maturity the rice was delayed and stunted in the case of the postemergence treatments, but it appeared that the rice recovered from the injury from the delayed preemergence treatments. The sequential postemergence application of propanil following the delayed preemergence application of V-53482 did not improve on weed control, but weed control was better when thiobencarb was used as a delayed preemergence treatment followed by V-53482. Further testing of V-53482 as a delayed preemergence treatment at lower rates is needed to determine the minimum rate needed for weed control. V-53482 should be included in a rice tolerance test in which there is no weed pressure in order to determine if yields are adversely affected by the injury that was observed.

HOE46360 was evaluated as a late postemergence treatment following a postemergence treatment of quinclorac and as a tank mixture with triclopyr as a late postemergence treatment. Quinclorac is weak on amazon sprangletop, and the sequential treatment with HOE46360 was applied to see if it would clean up this and any other grass that was not controlled with the quinclorac. The quinclorac did a very good job, and the infestation of amazon sprangletop was very light. The May 31st ratings were taken only 2 days after the late postemergence treatment and do not give an accurate assessment of the results of the late postemergence treatment. Later ratings indicated that the late postemergence sequential treatment cleaned up the grasses missed by the quinclorac and did not injure the rice. The tank mixture with triclopyr did not perform as well. There seemed to be an antagonistic interaction and neither grass nor broadleaf control was as good as expected.

Quinclorac Use in Water-seeded Rice

The application of quinclorac at various times and in two different water management schemes was evaluated. Information on the treatments and the results are presented in Table 5. The postdrainage treatment in the pinpoint water management scheme was applied 3 days after seeding, and the rice was just beginning to develop its root system with even less shoot development. At this time of treatment the rice was very susceptible to injury, and the stand was almost eliminated. At all other treatment times in both water management schemes rice injury was insignificant. Control of junglerice and hemp sesbania was excellent with all treatments, but the control of indian jointvetch was variable.

Sequential Postflood Molinate Combinations

Treatment and yield information are presented in Figure 1. The preflood postemergence herbicide treatments gave excellent control of junglerice, indian jointvetch and hemp sesbania, and the postflood application of the granular molinate controlled the junglerice but not the broadleaves in the plots that had not received any preflood treatments. The yield data reflect the junglerice weed control primarily, with only the plots which did not receive any herbicide treatment being significantly lower yielding.

Table 5. Quinclorac use in water-seeded rice.[1/] Rice Research Station, Crowley, LA. 1989.

Herbicide	Rate	Time of[2/] treatment	Water management	Rice[3/] tolerance	Weed control[3/] ECHCO	Weed control[3/] SEBEX	Weed control[3/] AESIN	Yield[4/]
	(lb ai/A)							(100 lb/A)
Untreated	--	--	pinpoint	5.0a	4.0ab	1.0c	1.0d	24.0c
quinclorac + molinate	.5 + 3	PoDr	pinpoint	2.0b	5.0a	5.0a	4.8a	7.5d
molinate	3	PoDr	pinpoint	5.0a	4.0ab	4.5a	2.3bcd	51.9ab
quinclorac + thiobencarb	.5 + 3	PoDr	pinpoint	1.8b	5.0a	5.0a	4.5ab	10.4d
thiobencarb	3	PoDr	pinpoint	5.0a	5.0a	5.0a	2.8a-d	55.8a
quinclorac w/BCH 864	.5	PoDr	pinpoint	2.3b	5.0a	5.0a	3.8abc	9.5d
quinclorac w/BCH 864	.5	PreFlo	pinpoint	5.0a	5.0a	5.0a	5.0a	48.6ab
quinclorac w/BCH 864	.5	PoFlo	pinpoint	5.0a	5.0a	4.3a	2.8a-d	49.7ab
quinclorac w/BCH 864	.5	LPoFlo	pinpoint	5.0a	5.0a	5.0a	3.0a-d	46.5ab
quinclorac	.5	PreFlu	delayed	5.0a	5.0a	5.0a	4.8a	47.7ab
quinclorac + thiobencarb	.5 + 3	PreFlu	delayed	4.5a	5.0a	5.0a	4.8a	49.6ab

Continued

Table 5 (continued)

Herbicide	Rate	Time of[2/] treatment	Water management	Rice[3/] tolerance	Weed control[3/]			Yield[4/]
					ECHCO	SEBEX	AESIN	
	(lb ai/A)							(100 lb/A)
thiobencarb	3	PreFlu	delayed	5.0a	5.0a	5.0a	3.3a-d	50.3ab
quinclorac	.5	EPo	delayed	5.0a	5.0a	5.0a	5.0a	49.7ab
untreated	--	--	delayed	5.0a	1.5c	1.5bc	2.0cd	39.2b

1/Presprouted Lemont seeded on May 5, 1989 and drained. Applied pinpoint flood on May 11, 1989. Flush nonflooded plots on May 11, 1989. Applied delayed flood on May 17, 1989. Applied 500 lb/A of 20-10-10 on May 23, 1989.

2/Time of treatment: Po (Postdrainage) - May 8, 1989; PreFlo (Preflood) - May 11, 1989; PreFlu (Preflush) - May 11, 1989; PoFlo (Postflood) - May 12, 1989; EPo (Early post) and LPoFlo (late postflood) - May 17, 1989.

3/Ratings taken August 2, 1989. See text for rating scales. Ratings within a column flooded by the same letter are not significantly different at alpha = .01. See Table 9 for identification of weeds.

4/Yield means followed by the same letter are not significantly different at alpha = .01.

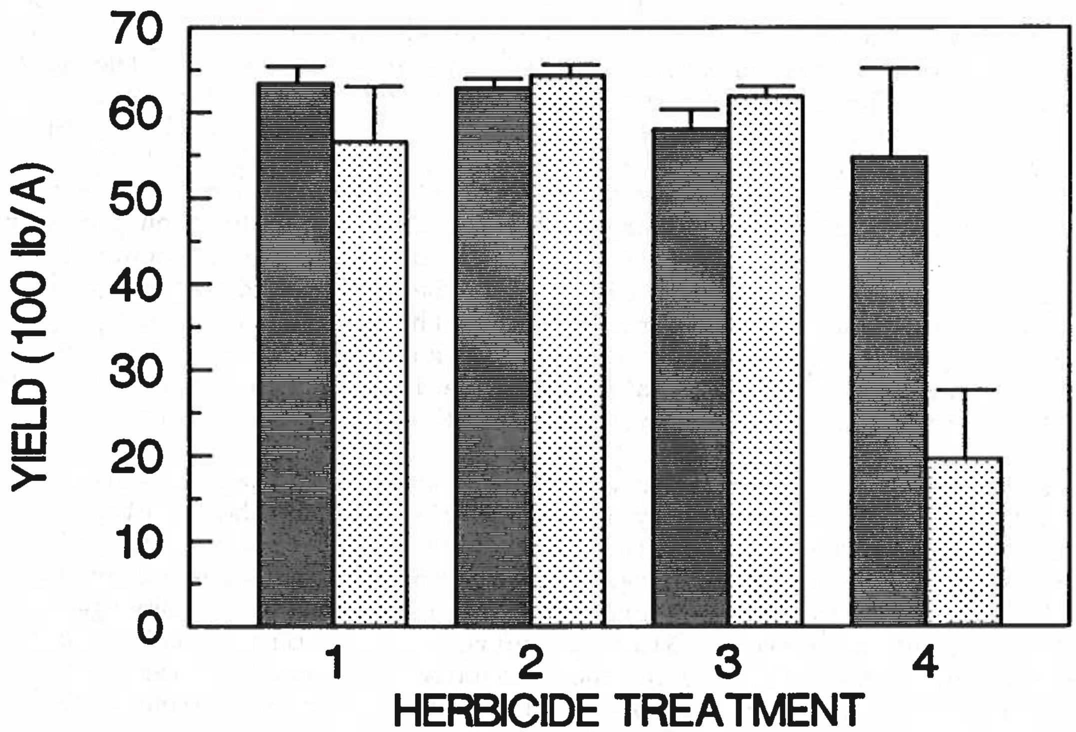


Figure 1. Effect of postflood molinate application on rice yield of plots treated with preflood herbicides.

Postflood treatments:
+ = With molinate (15G) postflood at 4 lb ai/A
− = Without postflood herbicide

Preflood treatments:
1 = Molinate:propanil premix early postemergence at 3:3 lb ai/A
2 = Propanil early postemergence at 3 lb ai/A
3 = Propanil early postemergence at 3 lb ai/A followed by propanil postemergence at 3 lb ai/A
4 = No preflood herbicide

Broadleaf Herbicide Efficacy Test

This test was established in an area which was drill seeded and treated postflood with granular molinate at 4 lb ai/A in order to control the grasses and sedges leaving the rice infested with hemp sesbania and texasweed. Treatments and ratings are presented in Table 6. The rates of the herbicides were selected to represent the probable use rate and one half of this rate. It is important that the herbicides be effective at these rates. An early set of ratings was made for the main purpose of getting information on the visual injury before the rice grew out of the injured condition. Weed control ratings at this early time did not distinguish between broadleaf species. The rice injury ratings suggest that triclopyr has the potential for causing serious rice injury if the time of application and rate are not selected carefully. A more detailed examination of rice injury from these herbicides is made in the rice tolerance study presented later in this report.

The early weed control ratings agree with the later ones in showing that both rate and time of treatment may influence efficacy of the herbicides. Triclopyr is most active when applied early, but by midseason it failed to give satisfactory control of hemp sesbania. Bromoxynil, on the other hand, appears to be most active early postemergence, least active postemergence and regains activity at midseason. Since uncontrollable environmental conditions may have influenced the efficacy of these treatments these studies must be continued for additional years before a firm statement can be made with regard to proper rate and timing for safe, efficacious use of these compounds, but the data do suggest that caution must be used in the application of triclopyr.

Varietal Herbicide Tolerance Study

In this study the tolerance of the three principal varieties currently being grown to three herbicides which are in the early stages of label development was investigated. These three herbicides were tested at the use rate (X) and two times the use rate (2X), since it is felt that rice must be tolerant to these rates if it is going to be used in rice. They were also tested at three different times since it may be possible to avoid rice injury at a specific time by treating at another time when the rice is more tolerant. In order to remove the complication that develops when weeds are present in such a study, the whole test area was oversprayed with molinate:propanil at 3:3 lb ai/A when the grasses were in the 3- to 4-leaf stage.

Information on the treatments and visual ratings of rice injury and stand reduction and yield data are presented in Table 7. Analysis of the rice injury data (Table 7A) indicates there is a significant interaction between variety and herbicide treatment and a significant herbicide treatment effect but no significant variety effect. The interaction is probably due to slight differences in the tolerance of the varieties at different times of treatment. All three varieties showed significant injury by bromoxynil and triclopyr at the early postemergence and postemergence times of treatment, but none of the varieties were injured significantly at the midseason treatment time. Quinclorac did not cause significant injury at any time or with any variety.

Table 6. Broadleaf Herbicide Efficacy Trial.1/ Rice Research Station, Crowley, LA. 1989.

Herbicide	Rate	Time of 2/ treatment	Rice3/ injury	Weed control		
				Broadleaves3/	SEBEX4/	CAPPA4/
	(lb ai/A)		(%)	-------------	(%)	------------
triclopyr5/	.19	EPo	84ab	88a	92ab	78abc
triclopyr	.38	EPo	73ab	91a	93a	93ab
triclopyr + propanil	.38 + 4	EPo	73ab	95a	95a	95a
triclopyr	.19	LPo	73ab	76ab	82ab	78abc
triclopyr	.38	LPo	58b	91ab	93a	75bc
triclopyr + propanil	.38 + 3	LPo	73ab	95a	95a	95a
triclopyr	.19	MS	--	--	58cd	90ab
triclopyr	.38	MS	--	--	73bc	93ab
triclopyr + propanil	.38 + 3	MS	--	--	95a	95a
bromoxynil	.13	EPo	91a	91a	92ab	93ab
bromoxynil	.25	EPo	95a	91a	95a	95a
bromoxynyl + propanil	.25 + 3	EPo	95a	95a	95a	93ab
bromoxynil	.13	LPo	95a	58b	52d	63c

Continued

Table 6 (continued)

Herbicide	Rate (lb ai/A)	Time of 2/ treatment	Rice3/ injury	Weed control Broadleaves3/	SEBEX4/	CAPPA4/
	(lb ai/A)		(%)	-------------	(%)	-------------
bromoxynil	.25	LPo	88a	91a	95a	92ab
bromoxynil + propanil	.25 + 3	LPo	95a	95a	95a	95a
bromoxynil	.13	MS	--	--	77ab	92ab
bromoxynil	.25	MS	--	--	90ab	85ab
bromoxynil + propanil	.25 + 3	MS	--	--	95a	95a
untreated	--	--	84a	5c	0e	0d

1/Lemont drill seeded at rate of 100 lb/A on May 2, 1989. Rain on May 2, 1989 and May 3, 1989. Flushed on May 11, 1989. Emerged on May 10, 1989. Fertilized with 500 lb/A 20-10-10 on May 31, 1989. Flooded and granular molinate applied at rate of 4 lb ai/A on May 31, 1989.

2/Time of treatment: Early postemergence (EPo) applied May 15, 1989. Late postemergence (LPo) applied May 26, 1989. Midseason (MS) applied July 15, 1989.

3/Early ratings taken June 7, 1989. Means followed by the same letter are not significantly different at alpha = .01.

4/Late ratings taken July 24, 1989. Means followed by the same letter are not significantly different at alpha = .01. See Table 9 for identification of weeds.

5/Nonionic surfactant added at 0.25% to triclopyr treatment.

Table 7. Tolerance of rice cultivars to herbicides.[1/] Rice Research Station, Crowley, LA 1989.

A. Estimate of rice injury (leaf burn, chlorosis and stunting).

Herbicide	Rate	Time of[2/] treatment	Rice injury Lemont	Mars	Tebonnet
	(lb ai/A)		- - - - - (%)	- - - - -	
quinclorac	.375	DelPre	0	0	11
quinclorac	.75	DelPre	5	10	10
quinclorac	.375	EPo	4	3	4
quinclorac	.75	EPo	8	6	9
quinclorac	.375	Po	5	4	8
quinclorac	.75	Po	6	4	6
bromoxynil	.25	EPo	8	13	12
bromoxynil	.5	EPo	16	25	24
bromoxynil	.25	Po	19	10	19
bromoxynil	.5	Po	28	28	35
bromoxynil	.25	MS	4	3	1
bromoxynil	.5	MS	3	3	9
triclopyr	.375	EPo	59	46	43
triclopyr	.75	EPo	86	93	69
triclopyr	.375	Po	15	9	15
triclopyr	.75	Po	19	19	15
triclopyr	.375	MS	4	3	0
triclopyr	.75	MS	5	1	4
untreated	-	-	8	0	9
LSD_{05}			8	8	8

1/ Lemont drill seeded at 100 lb/A on May 2, 1989. Rain on May 2 and May 3, 1989. Flushed on May 11, 1989. Emerged on May 10, 1989. Sprayed with molinate:propanil at 3:3 lb ai/A on May 22, 1989. Fertilized with 20-10-10 at the rate of 380 lb/A on May 29. Flooded on June 5, 1989.

2/ DelPre (delayed preemergence) applied May 8, 1989. EPo (early postemergence) applied May 16, 1989. Po (postemergence) applied on May 24, 1989. MS (midseason) applied on July 5, 1989.

Analysis of the stand reduction estimates (Table 7B) indicates a significant interaction between the variety and herbicide treatment effects as well as a significant response to variety and herbicide treatment. Triclopyr was the only herbicide that caused a significant stand reduction, and Lemont was the most sensitive cultivar. Only the high rate of triclopyr early postemergence caused stand reduction in all varieties. Lemont was also sensitive to the use rate of triclopyr applied early postemergence and the 2X rate applied postemergence.

Analysis of yield data (Table 7C) indicate significant variety and herbicide treatment effects but no significant interaction. Tebonnet yields were higher than Mars yields, and Mars yields were higher than Lemont yields. Triclopyr reduced yields when applied at the 2X rate at all times of treatment and at the use rate when applied early postemergence and at midseason.

It would appear that rice recovered from injury caused by bromoxynil, but the injury caused by triclopyr resulted in reduced yields even when it was not detected in visual ratings. It would also appear that extreme caution should be excercised when using triclopyr to avoid applying it to rice at a sensitive time and to flag the fields carefully in order to avoid overlapping of spray swaths that can lead to application of higher than recommended rates.

Table 7. (Continued)

B. Estimate of rice stand reduction.

Herbicide	Rate	Time of[2/] treatment	Stand reduction Lemont	Mars	Tebonnet
	(lb ai/A)		- - - - - - (%)	- - - - - -	
quinclorac	.375	DelPre	5	0	0
quinclorac	.75	DelPre	0	0	0
quinclorac	.375	EPo	0	0	0
quinclorac	.75	EPo	0	0	0
quinclorac	.375	Po	3	0	0
quinclorac	.75	Po	3	0	0
bromoxynil	.25	EPo	0	0	0
bromoxynil	.5	EPo	0	0	0
bromoxynil	.25	Po	0	0	0
bromoxynil	.5	Po	4	0	0
bromoxynil	.25	MS	0	0	0
bromoxynil	.5	MS	0	0	0
triclopyr	.375	EPo	11	4	0
triclopyr	.75	EPo	55	54	10
triclopyr	.375	Po	0	0	0
triclopyr	.75	Po	13	0	0
triclopyr	.375	MS	0	0	0
triclopyr	.75	MS	0	0	0
untreated	-	-	0	0	0
LSD_{05}			10	7	4

1/ Lemont drill seeded at 100 lb/A on May 2, 1989. Rain on May 2 and May 3, 1989. Flushed on May 11, 1989. Emerged on May 10, 1989. Sprayed with molinate:propanil at 3:3 lb ai/A on May 22, 1989. Fertilized with 20-10-10 at the rate of 380 lb/A on May 29. Flooded on June 5, 1989.

2/ DelPre (delayed preemergence) applied May 8, 1989. EPo (early postemergence) applied May 16, 1989. Po (postemergence) applied on May 24, 1989. MS (midseason) applied on July 5, 1989.

Table 7. (Continued)

C. Effect on yield.

Herbicide	Rate	Time of[2/] treatment	Yield			
			Lemont	Mars	Tebonnet	Average
	(lb ai/A)		- - - - - - - (100 lb/A) - - - - - - -			
quinclorac	.375	DelPre	56	61	61	59
quinclorac	.75	DelPre	54	59	61	58
quinclorac	.375	EPo	57	59	61	59
quinclorac	.75	EPo	57	59	61	59
quinclorac	.375	Po	56	58	57	57
quinclorac	.75	Po	57	59	59	58
bromoxynil	.25	EPo	57	56	60	57
bromoxynil	.5	EPo	55	52	60	56
bromoxynil	.25	Po	52	57	60	56
bromoxynil	.5	Po	51	60	55	56
bromoxynil	.25	MS	54	60	60	58
bromoxynil	.5	MS	56	57	53	55
triclopyr	.375	EPo	54	49	54	52
triclopyr	.75	EPo	33	39	48	39
triclopyr	.375	Po	54	60	61	59
triclopyr	.75	Po	50	49	58	52
triclopyr	.375	MS	52	53	56	54
triclopyr	.75	MS	48	50	48	48
untreated	-	-	54	64	61	60
LSD_{05}						4

1/ Lemont drill seeded at 100 lb/A on May 2, 1989. Rain on May 2 and May 3, 1989. Flushed on May 11, 1989. Emerged on May 10, 1989. Sprayed with molinate:propanil at 3:3 lb ai/A on May 22, 1989. Fertilized with 20-10-10 at the rate of 380 lb/A on May 29. Flooded on June 5, 1989.

2/ DelPre (delayed preemergence) applied May 8, 1989. EPo (early postemergence) applied May 16, 1989. Po (postemergence) applied on May 24, 1989. MS (midseason) applied on July 5, 1989.

Table 8. Herbicides tested in studies at the Rice Research Station, Crowley, LA. 1989.

Name or code no. used in report	Formulation	Chemical nature of active ingredient	Manufacturer
BAS-684		experimental surfactant	BASF
bromoxynil	2EC	3,5-dibromo-4-hydroxybenzonitrile	Rhone-Poulenc
COC		Crop oil concentrate	Various
fenoxaprop	1EC	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy] phenoxy]propanoic acid, ethyl ester	Hoechst-Roussel
HOE 46360	.625EC	chemistry not released	Hoechst-Roussel
molinate	8EC & 15G	S-ethyl hexahydro-1H-azepine-1-carbothioate	ICI
molinate:propanil	3:3EC	premix of molinate and propanil	ICI
propanil	4EC	N-(3,4-dichlorophenyl)propionamide	Rohm & Haas
quinclorac	50WP	3,7-dichloro-8-quinolinecarboxylic acid	BASF
sethoxydim	1.5EC	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio) propyl]-3-hydroxy-2-cyclohexen-1-one	BASF
thiobencarb	8EC	S-[4-chlorophenyl)methyl]diethylcarbamothioate	Valent
triclopyr	3EC	[(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid	Hoechst-Roussel
V-53482	50DG	chemistry not released at this time	Valent

Table 9. Weeds rated in herbicide test conducted at the Rice Research Station, Crowley, LA. 1989.

Abbreviation used in tables	Common name	Scientific name
AESIN	indian jointvetch	Aeschynomene indica
BRAPP	broadleaf signalgrass	Brachiaria platyphylla
CYPIR	rice flatsedge	Cyperus iria
CNPPA	texasweed	Caperonia palustris
ECHCO	junglerice	Echinochloa colona
ECLAL	eclipta	Eclipta prostrata
SEBEX	hemp sesbania	Sesbania exaltata

CHEMICAL CONTROL OF RED RICE IN RICE [1/]

J.B. Baker, R.T. Dunand, P.K. Bollich, D.J. Pantone, and T.J. Downey

INTRODUCTION

Control of red rice should be accomplished with a program of activities which contribute to the goals of freeing the soil of red rice seed and preventing the introduction of additional red rice seed into the field. There are many practices which can be followed to accomplish these goals, such as fallow plowing, crop rotation with control of the red rice in the rotation crops, planting red rice free seed, using clean equipment, etc. The use of chemicals to control red rice in the year rice is being grown is an important component of such a program and is especially important for the farmer who has a short term lease and can not execute some of the long term practices. In these studies we investigate the use of chemicals to aid in preparation of a seedbed with reduced red rice, to control red rice in drill-seeded and water-seeded rice, and to prevent the red rice from producing viable seed.

MATERIALS AND METHODS

These experiments were conducted at the South Unit of the Rice Research Station in a field that was naturally infested with a long-awned type of red rice. The test area was left idle in 1988, the red rice allowed to mature and shatter, and the soil was disc plowed in the fall to bury the newly produced red rice seed. The fields were disc plowed in the spring as soon as weather conditions permitted and later were chisel plowed and land levelled. They were retilled as needed to prevent excessive weed growth, and just before seeding the final seedbed was prepared. In the grooved seedbed test the appropriate plots were grooved with a tool which provides V-shaped grooves at 7 in. spacings in the seedbed.

In water-seeded tests, levees were built, and the field to be seeded was flooded as quickly as possible. Normally, flooding was accomplished 2-3 days after seedbed preparation. In the case of the stale seedbed test the test area was flooded for seeding about a month after the original final seedbed was prepared. In this test, selected plots were tilled with a garden front-tine tiller prior to flooding. Water-seeded tests were sown with presprouted Lemont rice at a rate equivalent to 125 lb/A of dry seed. Bags of seed to be presprouted were placed in a canal for 24 hours, removed from the canal and placed on a rack to drain for an additional 24 hours, and then sown into the flooded test plots. The plots were drained within 24 hours after seeding and reflooded 5 - 7 days later. Tests were fertilized by broadcasting 500 lb/A of 20-10-10 over the flooded test area.

In drill-seeded experiments an 11-runner drill was used to seed 100 lb/A of Lemont. The tests were flush irrigated as needed to assure a stand or as called for in the experiment. Just prior to applying the permanent flood, 500 lb/A of 20-10-10 was broadcast over the test area.

[1/] This research was supported in part by funds provided by Louisiana rice farmers through the Louisiana Rice Research Board.

Preplant incorporated treatments were applied as sprays and incorporated as quickly as possible with a front-tine garden rototiller. Preplant surface treatments were applied as sprays as soon as possible after seedbed preparation. Sprays were applied in a volume of 15 GPA with a four-nozzel boom equipped with 80015 flat fan tips, spraying at a pressure of 32 psi and a ground speed of 2.5 mph. Further information on specific tests is presented in the results and discussion.

Red rice control and Lemont tolerance were evaluated by either making stand counts of the red rice and Lemont at about 5 weeks after sowing or by making panicle count of red rice and Lemont at harvest and in some cases threshing the Lemont to obtain yield estimates.

The schedules of activities for the various tests are presented in Table 3. Information on herbicides tested is presented in Table 4.

RESULTS AND DISCUSSION

Red rice herbicide screening: Drill-seeded.

This study was a split plot design in which the main plots were either untreated or treated with molinate at 4 lb ai/A PPI. The subplot treatments were various rates of V-53482 applied either pre- or postemergence and an untreated check.

The effect of the treatments on red rice stand density are presented in Figure 1. Analysis of the data indicated that there was a highly significant effect of the main plot treatments and a significant effect of the subplot treatments but no significant interaction. Molinate PPI alone reduced the red rice stand density significantly - about 60% reduction. V-53482 appears to be more active as a preemergence treatment, but even at the highest rate it only gave about 47% control when used alone. When used sequentially with molinate it gave only slight improvement of red rice control.

The effect of the treatments on Lemont stand density are presented in Figure 2. Due to some drainage problems and puddling problems during flushing there was a large amount of variation in Lemont stand density, and there was no significant effect of mainplot or subplot treatments on stand density.

Effect of flushing on PPI molinate in drill-seeded rice.

Satisfactory red rice control with PPI molinate in water-seeded rice is dependent upon combining its use with water management - specifically a brief drainage period between seeding and the permanent flood. Since flushing is a common practice with short-statured cultivars, such as Lemont, it was considered that repeated flushing prior to flooding may improve red rice control with PPI molinate in drill-seeded rice. Since it was also possible that this flushing may increase cultivar injury, it was felt that the use of an herbicide safener or protectant may be beneficial. A split plot design was used for this experiment with two water-management practices being the mainplot treatments: repeated flushing at 3-day intervals and flushing only when needed to prevent crusting of the soil. There were four subplot treatments: molinate PPI at 4 lb ai/A, seeded with Lemont treated with 1%

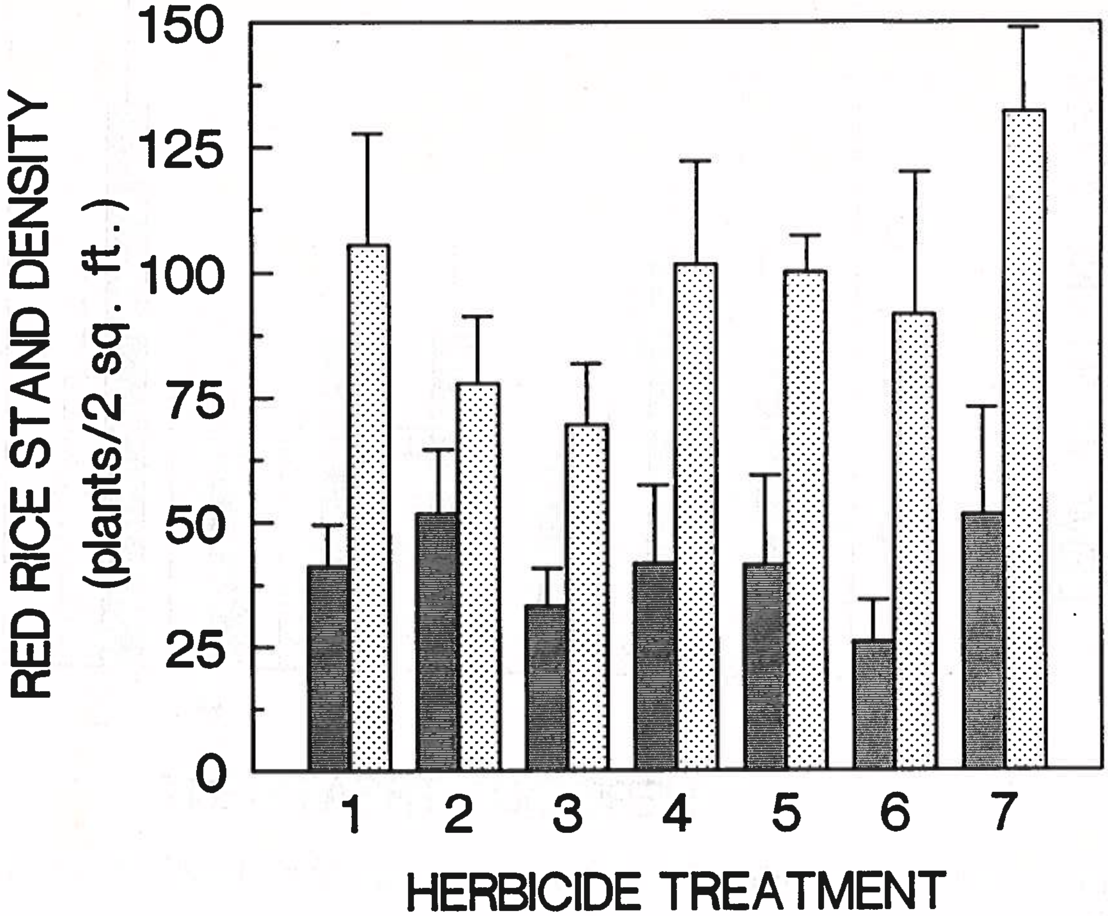


Figure 1. Red rice herbicide screening: Drill-seeded.

+ = With molinate preplant incorporated at 4 lb ai/A
− = Without PPI herbicide

Herbicide treatments:
1 = V53482 preemergence at 0.055 lb ai/A
2 = V53482 preemergence at 0.077 lb ai/A
3 = V53482 preemergence at 0.099 lb ai/A
4 = V53482 postemergence at 0.022 lb ai/A
5 = V53482 postemergence at 0.044 lb ai/A
6 = V53482 postemergence at 0.066 lb ai/A
7 = No additional herbicide

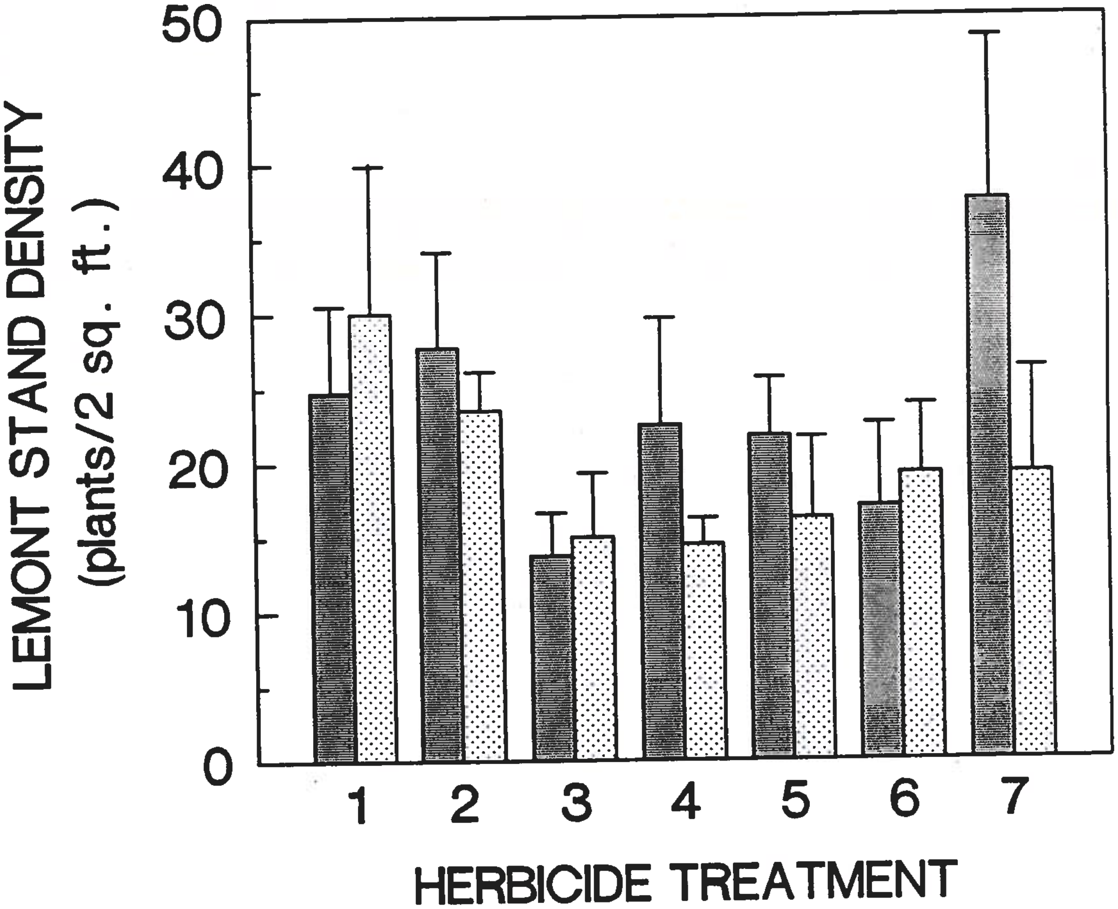


Figure 2. Red rice herbicide screening: Drill-seeded.

+ = With molinate preplant incorporated at 4 lb ai/A
– = Without PPI herbicide

Herbicide treatments:
1 = V53482 preemergence at 0.055 lb ai/A
2 = V53482 preemergence at 0.077 lb ai/A
3 = V53482 preemergence at 0.099 lb ai/A
4 = V53482 postemergence at 0.022 lb ai/A
5 = V53482 postemergence at 0.044 lb ai/A
6 = V53482 postemergence at 0.066 lb ai/A
7 = No additional herbicide

naphthalic anhydride; molinate PPI, seeded with Lemont without protectant; no PPI herbicide, seeded with Lemont treated with protectant; and no PPI herbicide and no seed protectant.

The effects of these treatments on red rice stand density are presented in Figure 3. There was no significant water-management effect, but molinate PPI reduced the red rice stand density significantly. The seed protectant has no effect on red rice stand density.

The effects of the treatments on Lemont stand density are presented in Figure 4. There were no significant treatment effects on Lemont stand density.

In summary, repeated flushing did not increase the red rice control obtained with PPI molinate, nor did it decrease the Lemont stand density. While there was a significant reduction in red rice stand density in the plots treated with PPI molinate, the level of control was inadequate.

Effect of seedbed grooving on herbicide performance.

The practice of grooving the seedbed prior to water seeding is becoming more common in Louisiana. The intent of this practice is to reduce drifting of seedlings in a water-seeded system, but it may also influence the performance of preplant red rice herbicides. This test was established to determine if seedbed grooving would alter the performance of these herbicides. The test was a factorial design with two types of seedbed, grooved and normal, and five red rice control treatments: molinate PPI at 4 lb ai/A, thiobencarb PPS at 4 lb ai/A applied before grooving, thiobencarb PPS at 4 lb ai/A applied after grooving, thiobencarb at 4 lb ai/A mixed with quinclorac at .375 lb ai/A applied PPS after grooving, and no preplant herbicide. These ten treatments were replicated four times.

The effect of these treatments on red rice panicle density at maturity is presented in Figure 5. Analysis of the data indicated that there was no significant effect of seedbed grooving, there was a significant herbicide effect, and there was no significant interaction. The mixture of thiobencarb and quinclorac performed in the same way as thiobencarb alone.

Lemont yield data are presented in Figure 6. Analysis of the data indicated a highly significant herbicide effect but no significant seedbed effect or interaction. All herbicide treated plots yielded significantly higher than the untreated check, and the molinate PPI yield was significantly higher than the thiobencarb PPS pregrooving and thiobencarb plus quinclorac PPS postgrooving. There was no significant difference between the various treatments containing thiobencarb.

In summary, grooving the seedbed does not alter the performance of the preplant herbicide treatments, and Lemont yield was increased as a result of the control of red rice.

Stale seedbed red rice control

One approach to control of red rice in rice that has been considered for many years is the stale seedbed approach. This consists of preparing a

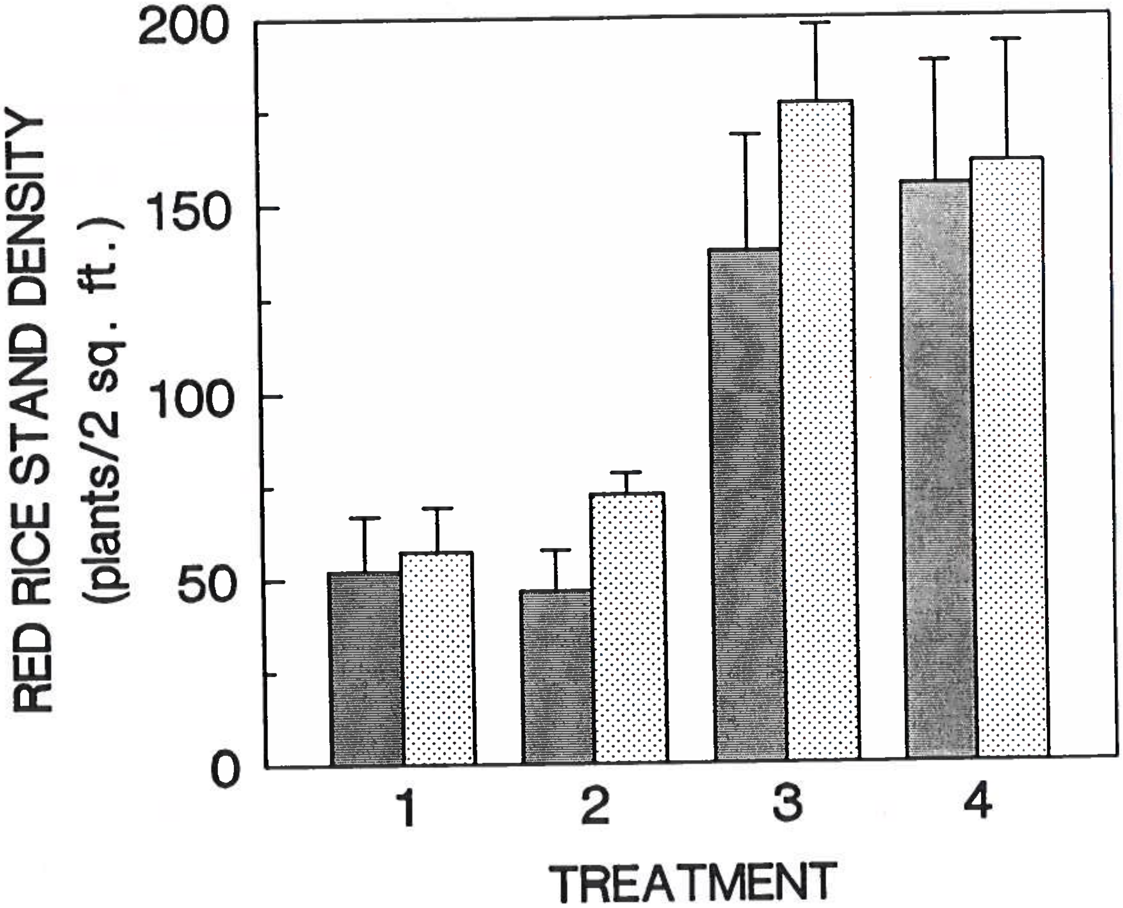


Figure 3. Effect of flushing on molinate performance in drill-seeded rice.

Flushing treatment:
- ▩ = flushed every three days until flooded
- ▨ = flushed only if necessary prior to flooding

Treatments:
- 1 = molinate, PPI and seed with protectant
- 2 = molinate, PPI and seed without protectant
- 3 = no preplant herbicide and seed with protectant
- 4 = no preplant herbicide and seed without protectant

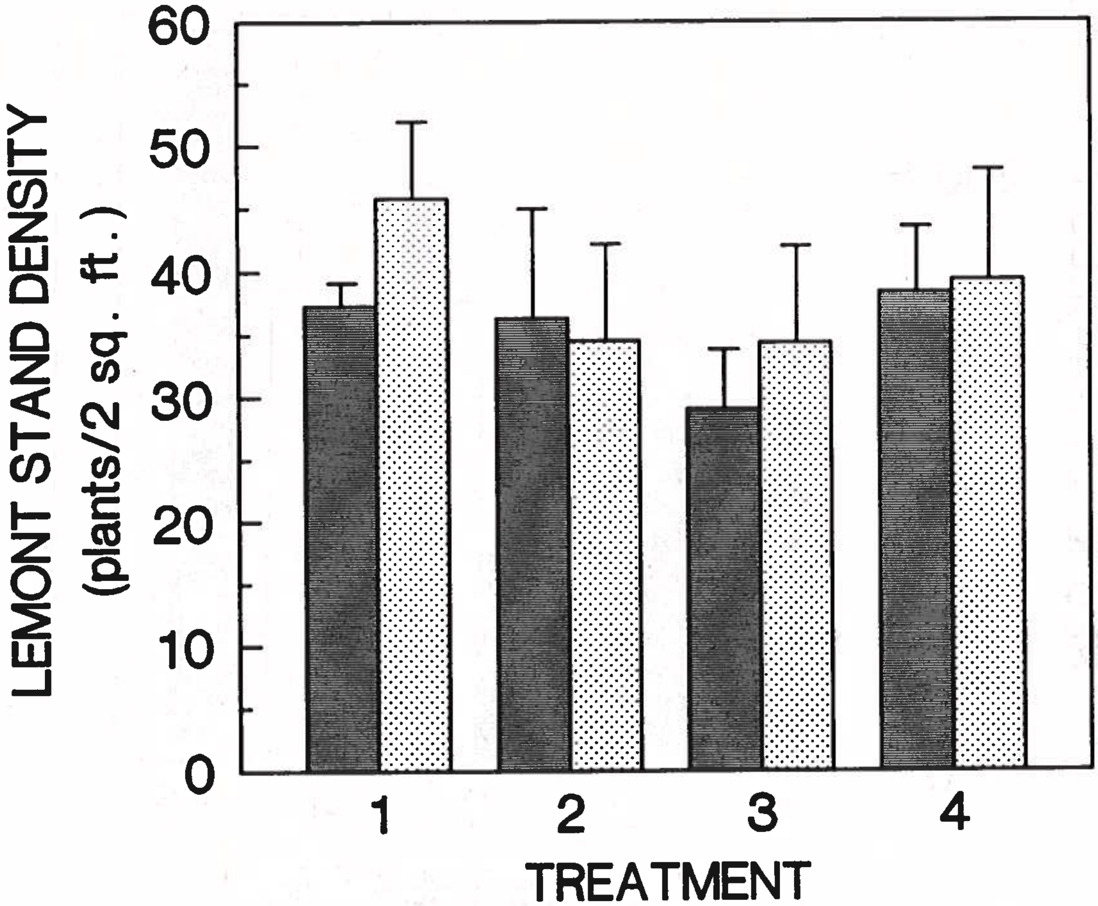


Figure 4. Effect of flushing on molinate performance in drill-seeded rice.

Flushing treatment:

■ = flushed every three days until flooded
░ = flushed only if necessary prior to flooding

Treatments:

1 = molinate, PPI and seed with protectant
2 = molinate, PPI and seed without protectant
3 = no preplant herbicide and seed with protectant
4 = no preplant herbicide and seed without protectant

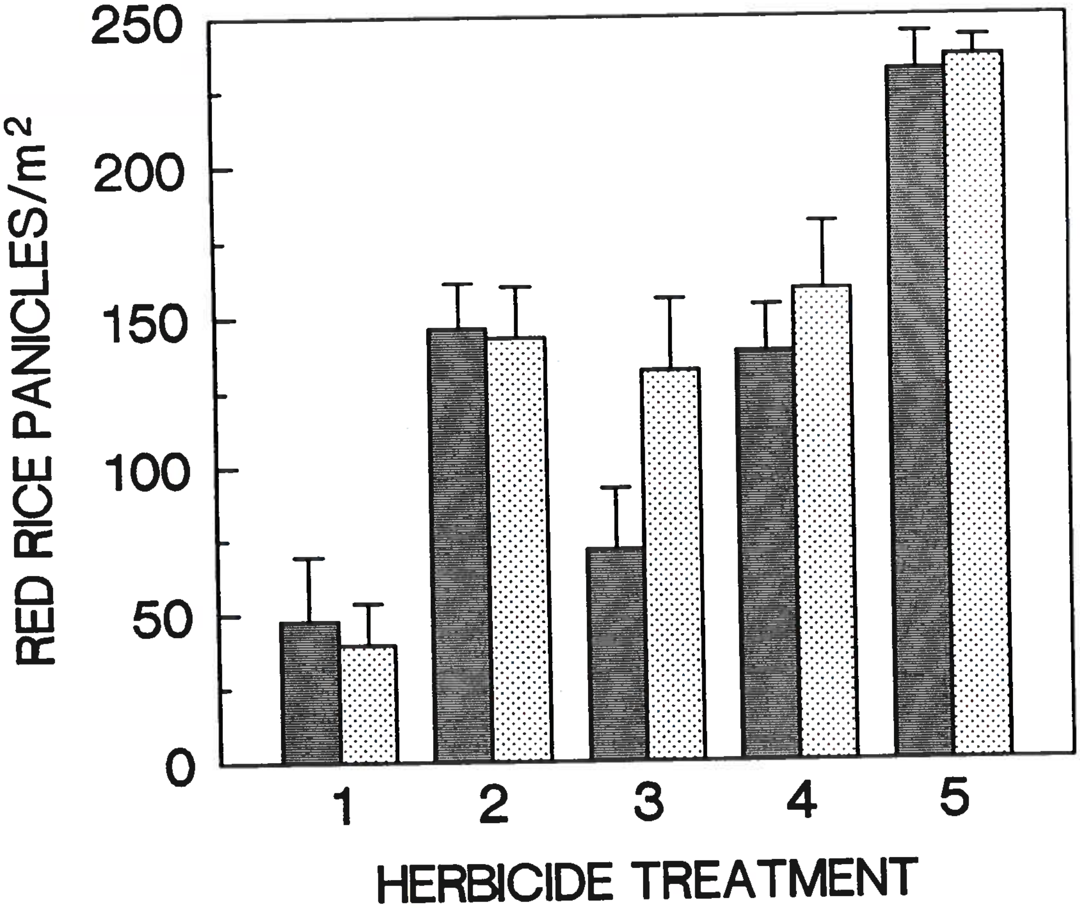


Figure 5. Effect of seedbed grooving on herbicide performance.

Seedbed preparation:

- ▨ = Normal seedbed
- ▨ = Grooved seedbed

Herbicide treatments:

1 = molinate, PPI
2 = thiobencarb, PPS before grooving
3 = thiobencarb, PPS after grooving
4 = thiobencarb + quinclorac, PPS after grooving
5 = no herbicide

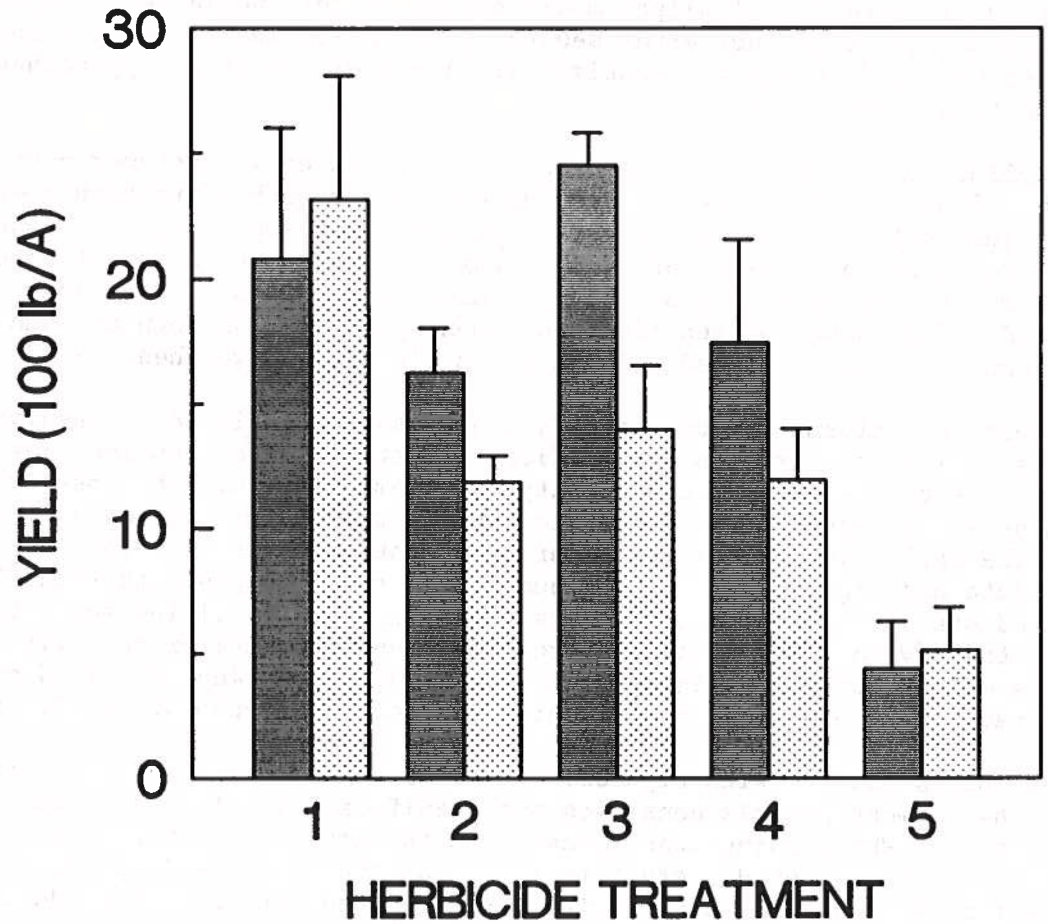


Figure 6. Effect of seedbed grooving on herbicide performance.

Seedbed preparation:

= Normal seedbed
= Grooved seedbed

Herbicide treatments:

1 = molinate, PPI
2 = thibencarb, PPS before grooving
3 = thiobencarb, PPS after grooving
4 = thiobencarb + quinclorac, PPS after grooving
5 = no herbicide

seedbed for planting, waiting until the red rice has emerged, and then using a broadspectrum nonpersistent herbicide to kill the red rice and other weeds prior to water seeding. A slight modification of this would be to apply a preemergence herbicide just after seedbed preparation and to delay planting until the herbicide could be inactivated. A mixture of these approaches was tried in this year's test.

Oxyfluorfen was applied preemergence and as an early postemergence treatment 2 or 4 weeks prior to planting whereas the other treatments were applied just before planting. Presprouted seed were sown, and the flood removed for stand establishment. The plots were reflooded and kept flooded until harvest. At maturity, a 1 sq. yd. area from each plot was hand harvested. The number of red rice and Lemont panicles was counted, and the Lemont panicles were threshed and the grain cleaned and weighed.

Treatment information and results are presented in Table 1. Analysis of the data indicated there was a significant treatment effect on red rice panicle density, Lemont panicle density, and Lemont yield. The most effective treatment in reducing red rice panicle density was the mixture of glufosinate and thiobencarb. Several of the other treatments containing glyphosate or glufosinate had significantly lower numbers of red rice panicles than the untreated stale seedbed check and were equivalent to the tilled seedbed check. None of the oxyfluorfen containing treatments applied earlier than five days before seeding provided a significant reduction in red rice panicle density. Quinclorac appears to have an antagonistic effect on glyphosate activity.

All plots treated with glyphosate or glufosinate five days prior to seeding had Lemont panicle densities not significantly different from the tilled check. Where quinclorac antagonized the action of glyphosate, the panicle density was not different from that of the stale seedbed check. It is obvious that where red rice competition was reduced, the Lemont produced more panicles and had higher yields.

In summary, the superior red rice control obtained with the mixture of glufosinate plus thiobencarb led to superior Lemont yields. This outstanding performance may be the result of the combined postemergence kill of the red rice by the mixture plus the preemergence activity of the thiobencarb. Regardless of the reason, this mixture performed better than the fresh seedbed check and the other herbicide treatments and certainly deserves further investigation.

Ropewick application of glyphosate

In short-statured cultivars, such as Lemont, it should be possible to use a ropewick applicator to apply glyphosate to red rice which is much taller without having an adverse effect on the short-statured cultivar.

This test was a split block design with four replicates with the ropewick treatments being superimposed perpendicular to preplant herbicide plots in water-seeded rice. The red rice was well headed at the time of the ropewick application. The recommended concentration of glyphosate was applied with a hand-carried ropewick applicator with one pass or two passes in opposite directions, and there was a no ropewick application check. The preplant

Table 1. Stale seedbed red rice control.[1/] Rice Research Station, South Farm, Crowley, LA. 1989

Herbicide	Rate	Time of treatment	Panicle density[2/] Red rice	Panicle density[2/] Lemont	Lemont[2/] yield
	(lb ai/A)	(days before seeding)	-(panicles / sq yd)-		(100 lb/A)
glyphosate + NH_4SO_4 [3/]	.5 + 1.7	5	165cde	154ab	11.5ba
glyphosate + thiobencarb	.5 + 4	5	155cde	144abc	13.0bc
glyphosate + quinclorac	.5 + .375	5	237ab	50cde	1.9d
glyphosate + oxyfluorfen	.5 + .2	5	190bcd	108bcd	8.2cd
glyphosate + oxyflourfen	.5 + .2	19	281a	30de	.7d
oxyfluorfen	.2	33	240ab	0e	0d
oxyfluorfen	.5	33	223abc	37de	2.4d
glufosinate	.5	5	124de	217a	18.4b
glufosinate + thiobencarb	.5 + 4	5	44f	223a	34.2a
glufosinate + quinclorac	.5 + .375	5	140de	155ab	16.1bc
glufosinate + oxyfluorfen	.5 + .2	5	184b-e	145abc	12.3bc

Continued

Table 1 (continued)

Herbicide	Rate	Time of treatment	Panicle density[2/]		Lemont[2/] yield
			Red rice	Lemont	
	(lb ai/A)	(days before seeding)	-(panicles / sq yd)-		(100 lb/A)
tilled check	-	-	111e	143abc	11.4bc
untilled check	-	-	274a	0e	0d

1/Seedbed prepared April 12, 1989. Preemergence treatments applied 33 days before seedling on April 14, 1989. Drained April 14, 1989. Treatments applied to 2-3 leaf red rice 19 days before planting on April 28, 1989. Treatments applied to tillering, 4-6 leaf red rice 5 days before planting on May 12, 1989. Tilled check prepared May 12, 1989. Flooded for seeding on May 15, 1989. Presprouted Lemont seeded at rate equivalent to 125 lb/A dry seed and test drained on May 17, 1989. Heavy rain on May 18, 1989. Permanent flood applied May 22, 1989. Fertilized on June 7, 1989 with 500 lb/A of 20-10-10.

2/Means within a column followed by the same letter are not significantly different at alpha = .01.

3/1% nonionic surfactant added.

treatments were molinate PPI at 4 lb ai/A, thiobencarb PPS at 4 lb ai/A, and a no preplant herbicide check.

At harvest, five red rice panicles were selected at random from the plot for determination of percentage of filled grain and percentage of germination of the filled grain. The red rice and Lemont were hand cut from a 1 sq. yd. area in each plot, the number of red rice panicles was counted, and the weight of Lemont grain from the threshed Lemont panicles was determined.

Results are presented in Table 2. Both preplant herbicide treatments and ropewick treatments had highly significant effects on the number of red rice panicles per square yard and there was a significant interaction (Table 2A.). The interaction appears to be due to the differences in the effect of the ropewick treatments on the red rice in the preplant herbicide plots. Both one and two passes of the ropewick applicator reduced the red rice panicle density in the no preplant herbicide plots. Only the two pass treatment reduced the red rice panicle density in the thiobencarb PPS treatment, and the ropewick treatments did not have a significant effect in the case of the molinate PPI treatment. This difference in response to the ropewick application following the various preplant treatments is probably a result of the effect of the density of the red rice on the growth of the red rice and its tillering.

The data on the effect of the treatments on the percentage of filled red rice grain (Table 2B.) indicate that only the ropewick treatments had a significant effect. Only 7.5% of the grains were filled in panicles from the plots receiving two passes with the ropewick applicator and 24.9% were filled in plots that received a single pass while 61.5% were filled in the plots which did not receive a ropewick application.

Analysis of the data on the percent germination of the filled red rice grains produced in the various plots (Table 2C.) indicates a highly significant ropewick effect, a significant preplant treatment effect and a significant interaction. In the case of a single pass with the ropewick applicator, the percentage germination following molinate PPI was significantly lower than that following thiobencarb PPS and both were significantly lower than the germination of filled grains from the no preplant herbicide treatment.

The Lemont yields (Table 2D.) were not affected by the ropewick application, but there was a highly significant effect of the preplant herbicide treatments on yield. Molinate treated plot yielded significantly more than the thiobencarb treated plots and both preplant herbicide treatments yielded more than the no preplant herbicide plots.

In summary, ropewick application of glyphosate soon after heading of red rice in short-statured cultivars may reduce red rice panicle density. The ropewick application significantly reduced the percentage of red rice grains that filled, and of those that filled a high percentage failed to germinate. In general, two passes was more effective than one pass. The ropewick application did not have an effect on Lemont yield. Thus, it would appear that application of glyphosate in this manner would have two benefits: 1) fewer filled grains to contaminate the harvested grain, thus a higher grade and 2) fewer filled grains capable of germination, thus less buildup of the red rice infestation of the soil due to shattering of viable red rice grains.

Table 2. Effect of preplant herbicides and ropewick application of glyphosate on red rice and Lemont.

A. Red rice panicles per sq. yd.

Preplant herbicide	Ropewick treatment None	1 Pass	2 Passes	Average
none	231.50	140.00	170.75	180.75
molinate PPI	47.75	42.50	32.25	40.83
thiobencarb PPS	146.00	122.75	98.75	122.50
average	141.75	101.75	100.58	--

B. Percentage of red rice grains that are filled.

Preplant herbicide	Ropewick treatment None	1 Pass	2 Passes	Average
none	73.6	34.4	7.3	38.5
molinate PPI	61.0	23.5	13.0	32.5
thiobencarb PPS	49.9	16.6	0.2	24.3
average	61.5	24.9	7.5	--

C. Percent germination of filled red rice grain.

Preplant herbicide	Ropewick treatment None	1 Pass	2 Passes	Average
none	28.5	43.3	5.3	25.7
molinate PPI	22.7	3.6	.5	8.9
thiobencarb PPS	29.9	21.4	0	15.8
average	25.7	22.7	1.9	--

D. Lemont yield (100 lb/A).

Preplant herbicide	Ropewick treatment None	1 Pass	2 Passes	Average
none	4.4	5.3	7.3	5.6
molinate PPI	20.8	23.9	22.7	22.4
thiobencarb PPS	16.3	14.2	13.9	14.8
average	13.8	14.4	14.6	--

Table 3. Schedule of activities for red rice control experiments at the south unit. Rice Research Station, Crowley, Louisiana. 1989.

Activity	Herbicide screening test	Effect of flushing test	Grooved seedbed test	Stale seedbed test	Ropewick application test
			date		
Seedbed preparation[1/]	4/12	4/12	4/24	4/12(5/12)	4/24
Seeding[2/]	4/13	4/13	4/28	5/17	4/28
Fertilization[3/]	5/9	5/9	5/9	6/7	5/9
Flushing[4/]	4/14 4/20 4/24	4/14, (4/17) 4/20, (4/23) 4/24	-	-	-
Flooding	5/11	4/29	5/3	5/22	5/3
Preplant treatments	4/12	4/12	4/24	4/14 4/28 5/12	4/24
Preemergence treatments	4/14	-	-	-	-
Postemergence treatments[5/]	5/9	-	-	-	-
Ropewick treatments	-	-	-	-	7/25

1/ Date in parenthesis indicates fresh seedbed check in stale seedbed test.

2/ Herbicide screening and effect of flushing tests were drill seeded with Lemont at 100 lb/A. Other tests were water seeded with presprouted Lemont at 125 lb/A.

3/ In all tests 500 lb/A of 20-10-10 was applied.

4/ Dates in parenthesis represent flushing dates only for plots receiving flushing at 3-day intervals. All plots flushed otherwise.

5/ Propanil applied aerially to all tests on 5/9.

Table 4. Herbicides tested in red rice studies at the Rice Research Station, Crowley, LA. 1989.

Name or code no. used in report	Chemical nature of active ingredient	Manufacturer
glufosinate	ammonium-DL-homoanalin-4-yl(methyl)phosphinate	Hoechst-Roussel
glyphosate	N-phosphonomethylglysine	Monsanto
molinate	S-ethyl hexahydro-1H-azepine-1-carbothioate	ICI
oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene	Rohm & Haas
propanil	N-(3,4-dichlorophenyl)propionamide	Rohm & Haas
quinclorac	3,7-dichloro-8-quinolinecarboxylic acid	BASF
thiobencarb	S-[(4-chlorophenyl)methyl]diethylcarbamothioate	Valent
V-53482	chemistry not released at this time	Valent

RICE WATER WEEVIL CONTROL: CARBOFURAN AND WATER MANAGEMENT

S.S. Quisenberry, J.F. Robinson, G.B. Trahan, and P.A. Bollich

Location: Rice Research Station, Crowley, LA.

Soil: Crowley silt loam.

Variety: 'Lemont'

Seeding Rate: 140 lb/A.

Planting Method and Date: Pregerminated rice seed, water seeded 25 May 1989.

Plot Size: 20 X 4 ft. Each plot was individually leveed to control chemical treatments and irrigation water.

Water Management: Flooded 24 May; drained 28 May; permanent flood 30 May. Water Management (Treatment 3)- water removal when rice water weevil (RWW) reached threshold (5 larvae/core) on 29 June. Water Mangement (Treatment 4)- delayed water removal on 6 July, 7 days after RWW threshold. Water management plots were reflooded 2 weeks after being drained.

Fertilization: 120-60-60 lb/A N-P-K applied 15 May with a motorized Gandy spreader. 40 lb/A NH_3SO_4 applied 2 August to water management plots (Treatments 3 and 4). 5.5 pints/A Zinc applied 20 June by airplane.

Herbicide: Thiobencarb 4 lb/A, applied 24 May with a CO_2 hand boom delivering 15 GPA @ 28 psi.

Insecticide: Carbofuran (3G) 0.5 lb/A applied 29 June to carbofuran treated plots (Treatments 1 and 2) with a shaker jar; applied 13 July to plots receiving a second application of carbofuran (Treatment 2).

Treatments: 1) Continuous flood with one application of carbofuran (Carb 1) when core samples indicated rice water weevil threshold level; 2) continuous flood with two applications of carbofuran (Carb 2); 3) water removal at threshold (W/Man 1); 4) delayed water removal, 7 days after RWW infestation levels reached threshold (W/Man 2); 5) No treatment (Control).

Experimental Design: Randomized block design with four replicates.

Harvested: 26 September.

Comments: Field research was conducted during 1989 to compare the use of carbofuran and water management as rice water weevil control tactics and to assess subsequent impact on rice yield. Rice water weevil larval populations in carbofuran and water managemant plots were lower than populations in control plots until 26 July (Figure 1). There was a sharp decline in larval populations in control plots after 31 July because roots were severely pruned and would not support larval populations. The plants in the carbofuran and water management plots were taller (3 to 6 inches) than plants in the control plots (Figure 2). The yield in the control treatment was lower (1500 to 2200 lb/A) than the yields in the carbofuran and water management treatments (Figure 3). The data indicates that water management has potential as a pest management tool for control of rice water weevil. The study will be repeated during the 1990 field season. Cost/benefit analyses of water management as a rice water weevil control tactic will be calculated for 1989 and 1990 by the Department of Agricultural Economics and Agribusiness.

Figure 1. RWW larvae per core in carbofuran & water management plots, 1989.

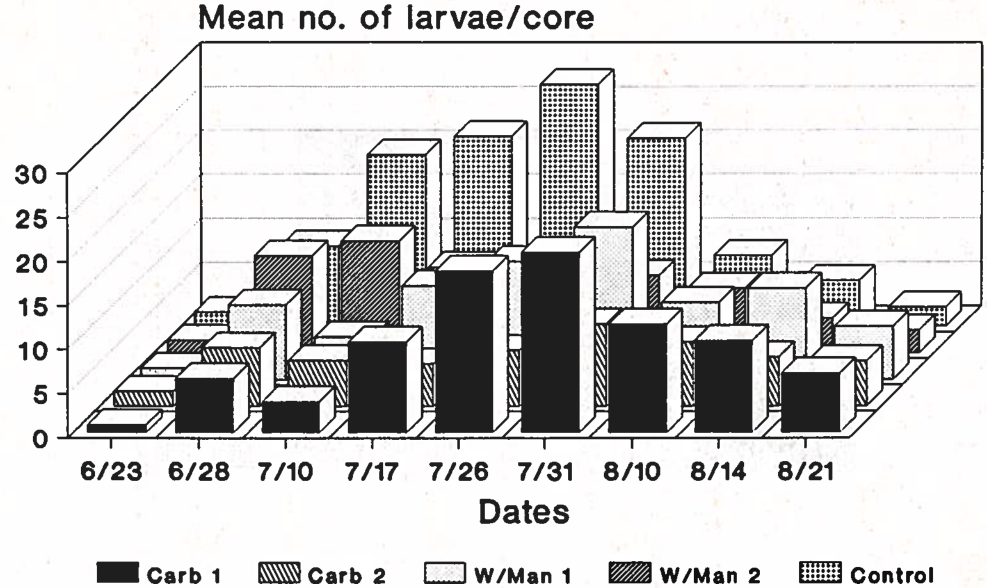


Figure 2. Plant height in carbofuran and water management plots, 1989.

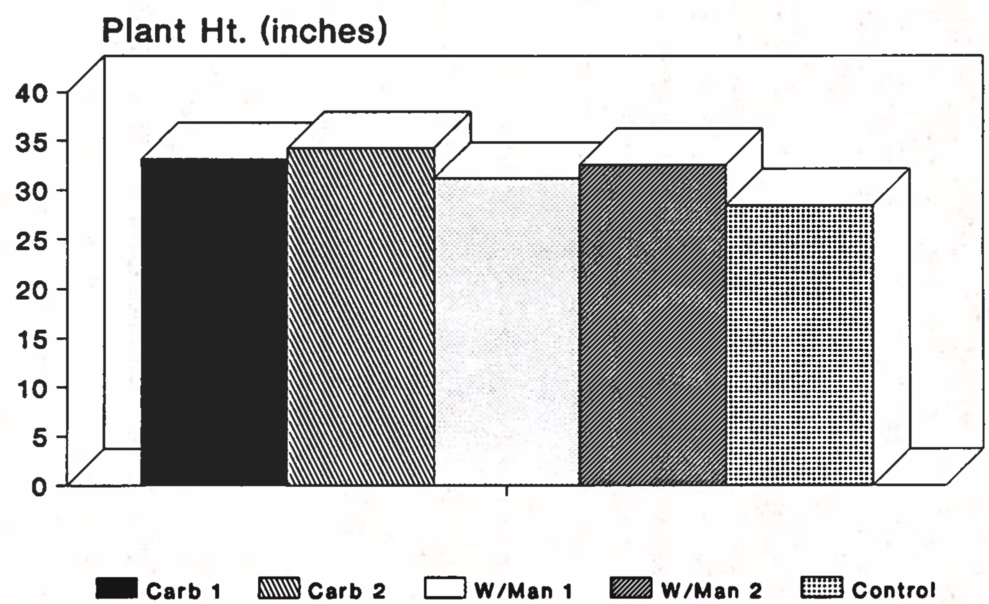
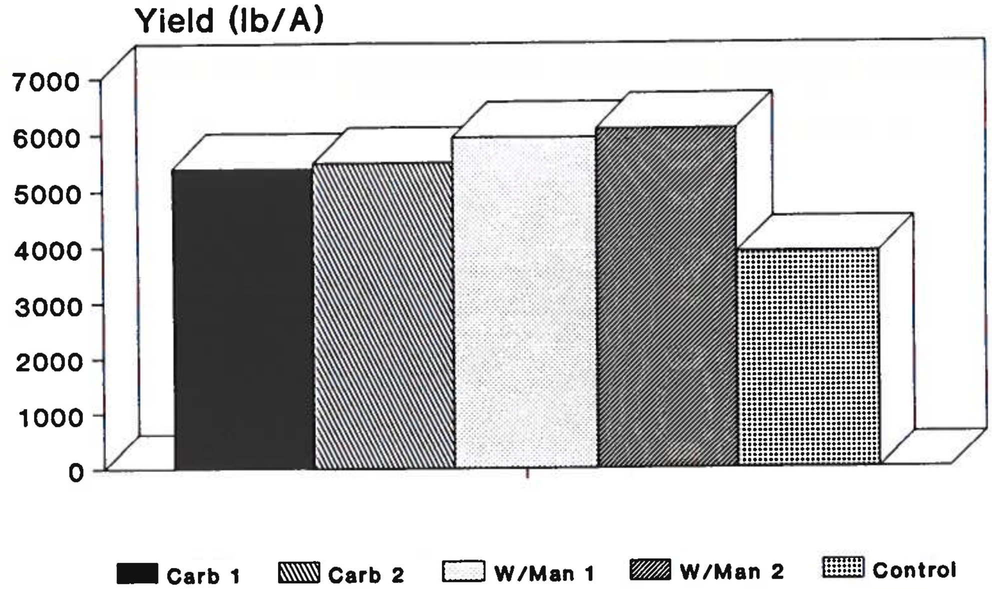


Figure 3. Yield in carbofuran and water management plots, 1989.



RICE WATER WEEVIL CONTROL: NEMATODES

S.S. Quisenberry, J.F. Robinson, G.B. Trahan, and P.A. Bollich

Location: Rice Research Station, Crowley, LA.

Soil: Crowley silt loam.

Variety: 'Mars'. Seeding Rate: 100 lb/A.

Planting Method and Date: Drill seeded with a KEM drill, 7 inch row spacing, 24 April 1989.

Plot Size: 14 X 4 ft. Each plot surrounded by metal barrier.

Water Management: Flushed 28 April & 12 May. Flooded 26 May. Drained 15 June to apply nematodes & re-flooded 19 June.

Fertilization: 30-60-60 lb/A N-P-K applied 24 April with a motorized Gandy spreader; 120 lb/A N applied 26 May by hand. 5.5 pints/A Zinc applied 20 June by airplane.

Herbicide: Propanil 4 lb/A applied 26 May with a CO_2 hand boom delivering 20 GPA @ 40 psi.

Insecticide: Carbofuran (3G) 0.5 lb/A applied 19 June with a shaker jar.

Nematodes: Nematodes (#9A$6AA137) 1 billion/A and 3 billion/A applied 15 June to moist soil with a CO_2 single nozzle hand boom delivering 139 GPA @ 20 psi.

Treatments: 1) Nematodes (N-25 1 billion/A); 2) Nematodes N-25 3 billion/A); 3) Carbofuran (3G); 4) No treatment (Control).

Experimental Design: Randomized block design with four replicates.

Harvested: 25 August.

Comments: Parasitic nematodes and carbofuran were compared as rice water weevil (RWW) control tactics. Carbofuran was effective in controlling RWW larvae below threshold level (5 larvae/core) after treatment with the insecticide (Figure 1). The second nematode treatment (3 billion/A) reduced RWW populations 21 %. Plant heights in carbofuran treated plots were taller than plants in nematode treated and control plots (Figure 2). Yield was also greater (700 to 1060 lb/A) in carbofuran treated plots as compared with nematode treated and control plots (Figure 3). Filter screens appeared to be clogged in the spray equipment after applying the nematode treatments. This could explain the lack of RWW control observed in the nematode treatments.

Figure 1. RWW larvae per core in nematode and carbofuran treated plots.

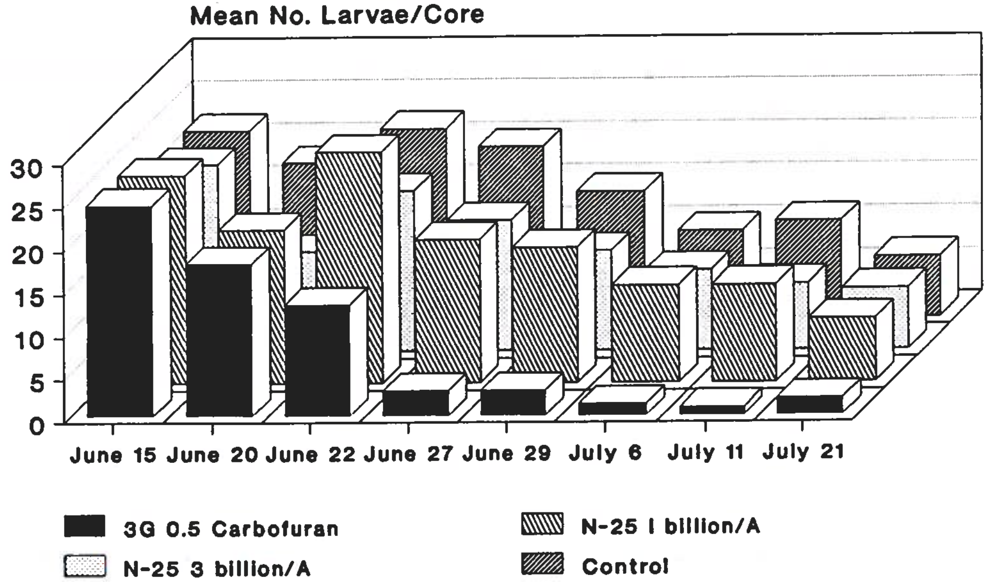


Figure 2. Plant height in nematode and carbofuran treated plots, 1989.

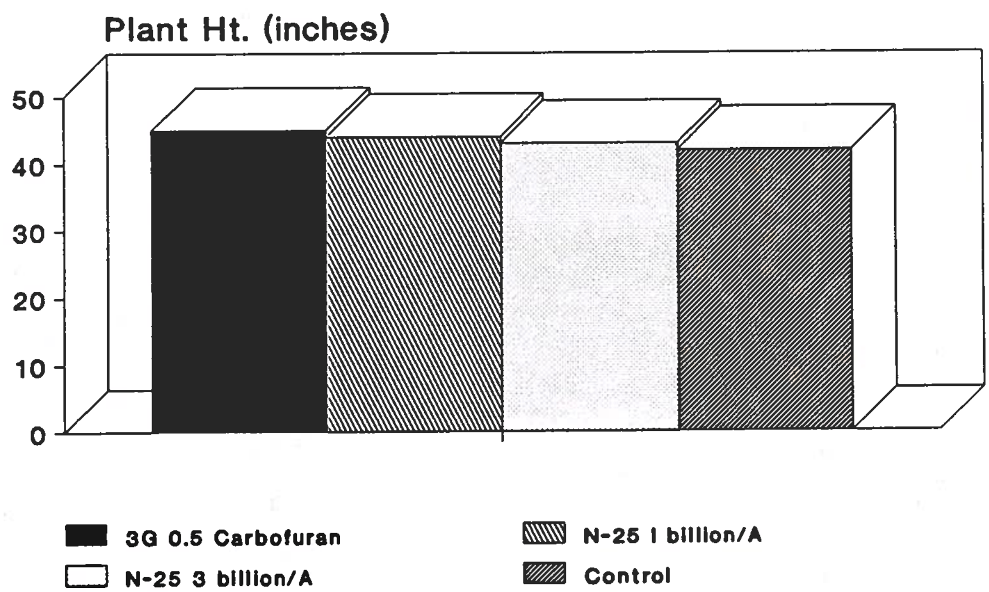
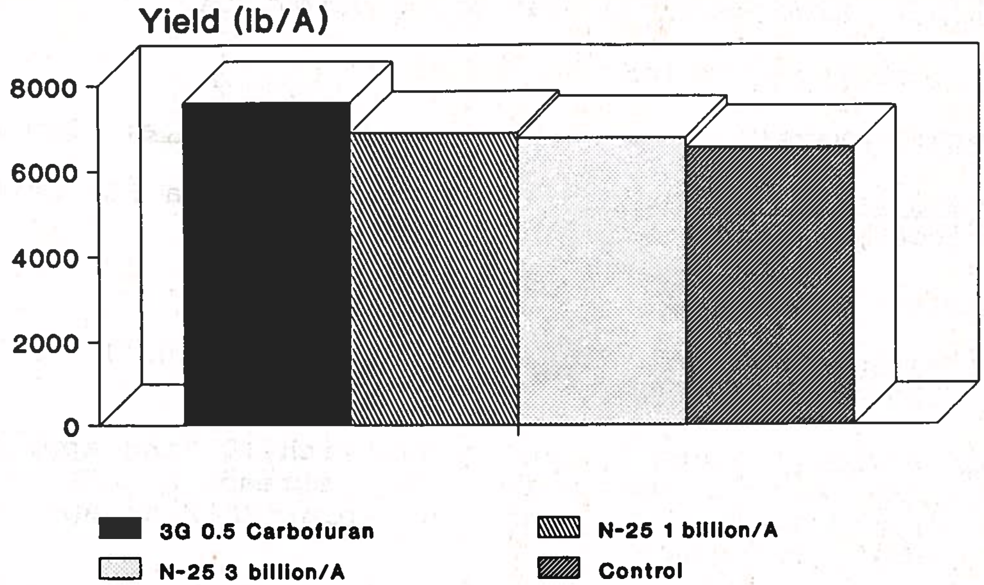


Figure 3. Yield in nematode and carbofuran treated plots, 1989.



RICE WATER WEEVIL CONTROL: ISOZOPHOS

S.S. Quisenberry, J.F. Robinson, G.B. Trahan, and P.A. Bollich

Location: Rice Research Station, Crowley, LA.

Soil: Crowley silt loam.

Variety: 'Mars'. Seeding Rate: 100 lb/A.

Planting Method and Date: Drill seeded with a KEM drill, 7 inch row spacing, 21 April 1989.

Plot Size: 14 X 4 ft.

Water Management: Flushed 28 April, 10 May, and 1 June. Flooded 13 June.

Fertilization: 30-60-60 lb/A N-P-K with 1% Zinc applied 21 April with a motorized Gandy spreader; 120 lb/A N applied 26 May by hand. 5.5 pints/A Zinc applied 20 June by airplane.

Herbicide: Propanil 4 lb/A applied 23 May with a CO_2 hand boom delivering 15 GPA @ 22 psi.

Insecticide: Carbofuran (3G) 0.6 lb/A; Isozophos (10G) 1.0 and 2.0 lb/A. Pre-flood applications 13 June and post-flood applications 30 June with a shaker jar.

Treatments: 1) Carbofuran (3G) pre-flood application (Carb PrF); 2) Carbofuran (3G) post-flood application (Carb PoF); 3) Isozophos (10G) 1 lb/A pre-flood application (Iso 1 PrF); 4) Isozophos (10G) 2 lb/A pre-flood application (Iso 2 PrF); 5) Isozophos 1 lb/A post-flood application Iso 1 PoF); 6) Isozophos 2 lb/A post-flood (Iso 2 PoF); 7) No treatment (Control).

Experimental Design: Randomized block design with four replicates.

Harvested: 18 September.

Comments: Pre-flood and post-flood applications of carbofuran (3G) and isozophos (10G) were compared for rice water weevil (RWW) control. All insecticide treatments reduced RWW as compared with the control (Figure 1). Carbofuran post-flood (Carb PoF) and isozophos post-flood (Iso 1 and Iso 2 PoF) treatments reduced larval populations below threshold (5 larvae/core) on 21 and 26 July. Heights of plants in control plots were shorter (1 to 4 inches) than in plots treated with insecticide (Figure 2). Yields in insecticide treated plots were 550 to 730 lb/A greater as compared with the control (Figure 3).

Figure 1. RWW larvae per core in isozophos and carbofuran treated plots.

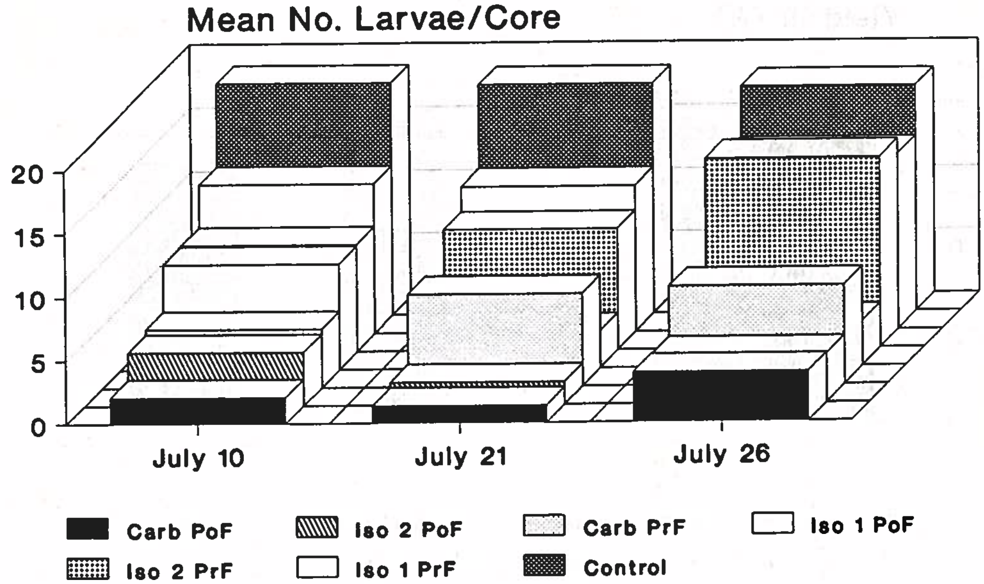


Figure 2. Plant height in isozophos and carbofuran treated plots, 1989.

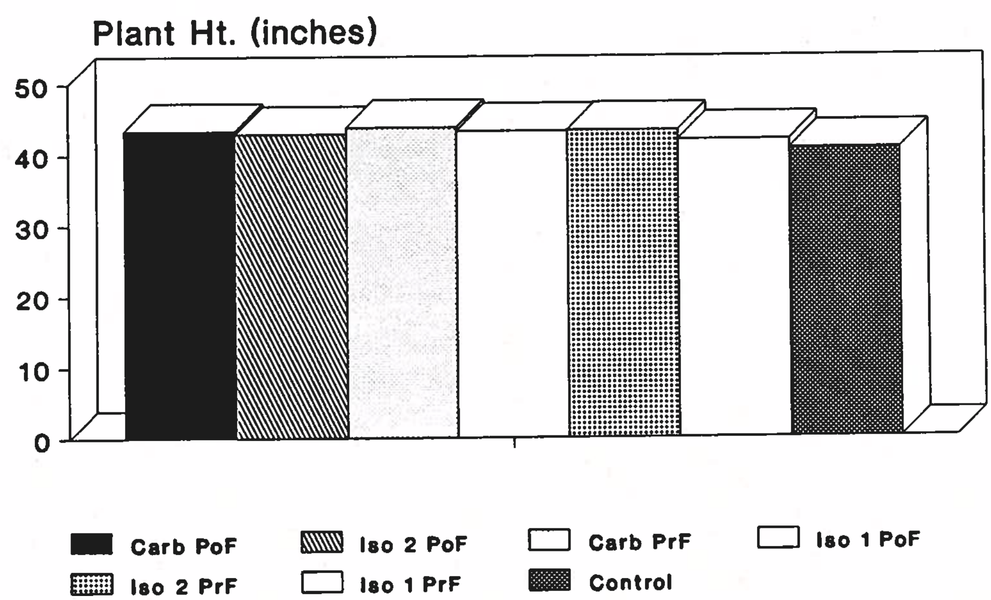
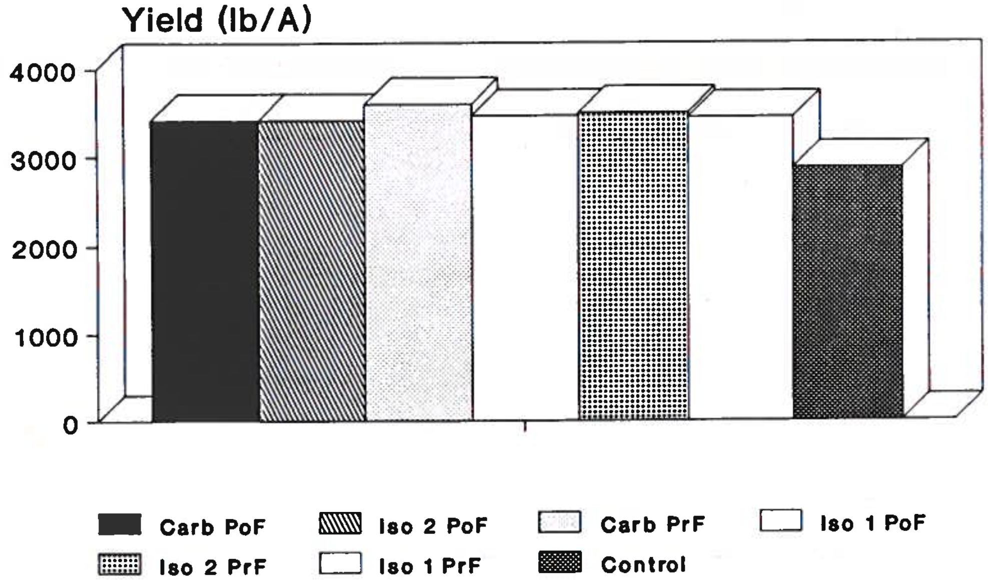


Figure 3. Yield in isozophos and carbofuran treated plots, 1989.



RICE WATER WEEVIL CONTROL: CARBOFURAN

S.S. Quisenberry, J.F. Robinson, G.B. Trahan, and P.A. Bollich

Location: Rice Research Station, Crowley, LA.

Soil: Crowley silt loam.

Variety: Test 1- 'Mars'; Test 2- 'Lemont'

Seeding Rate: 100 lb/A.

Planting Method and Date: Drill seeded with a KEM drill, 7 inch row spacing. Test 1- 24 April; Test 2- 2 May 1989.

Plot Size: 14 X 4 ft.

Water Management: Test 1- Flushed 28 April and 12 May. Flooded 26 May. Test 2- Flushed 10 May and 1 June. Flooded 13 June.

Fertilization: 30-60-60 lb/A N-P-K with 1% Zinc applied with a motorized Gandy spreader (Test 1- 2 May; Test 2- 15 May); 120 lb/A N with a 60 (pre-flood):40 (post-flood) split (Test 1- 26 May on pre-flood and 13 June on post-flood treatments; Test 2- 13 June on the pre-flood and 5 July on post-flood treatments); applied by hand. Control plots were fertilized on the same date the pre-flood treatments were applied (26 May). 5.5 pints/A Zinc applied by airplane (Test 1- 20 June; Test 2- 5 July).

Herbicide: Propanil 4 lb/A (Application dates Test 1 and Test 2- 23 May). Applied with a CO_2 hand boom delivering 15 GPA @ 22 psi.

Insecticide: Test 1- Carbofuran (4F) 1 lb/A applied as a foliar spray; Carbofuran (4F) impregnated on fertilizer @ 0.75 and 1 lb/A. Pre-flood applications 26 May and post-flood applications 13 June. Test 2- Carbofuran (3G) 0.6 lb/A applied as a granular; Carbofuran (4F) 1 lb/A applied as a foliar spray; Carbofuran (4F) impregnated on fertilizer @ 0.75 and 1 lb/A. Pre-flood applications applied 13 June and post-flood applications 5 July. Foliar spray applied with CO_2 backpack sprayer delivering 15 GPA @ 22 psi. Insecticide impregnated fertilizer applied by hand. Granular insecticide applied by shaker jar.

Treatments: Test 1- 1) Carbofuran (4F) impregnated on fertilizer, pre-flood application, 0.75 lb/A (4F 0.75 PrF); 2) Carbofuran (4F) impregnated on fertilizer, pre-flood application, 1 lb/A (4F 1.0 PrF); 3) Carbofuran (4F) imprgenated on fertilizer, post-flood application, 0.75 lb/A (4F 0.75 PoF); 4) Carbofuran (4F) impregnated on fertilizer, post-flood application, 1 lb/A (4F 1.0 PoF); 5) Carbofuran (4F) foliar spray, pre-flood application, 1 lb/A (4F 1.0 Foliar); 6) No treatment (Control). Test 2- Treatments 1 through 5 the same as Test 1; 6) Carbofuran (3G), post-flood application, 0.6 lb/A (3G 0.6 PoF); 7) No treatment.

Experimental Design: Randomized block design with four replicates.

Harvested: Test 1- 25 August; Test 2- 18 September.

Comments: Carbofuran application methodologies were compared in two field tests (Test 1 and Test 2) for rice water weevil (RWW) control. The application methodologies were carbofuran 4F impregnated on fertilizer with pre-flood and post-flood applications, carbofuran 4F applied as a pre-flood foliar spray, and carbofuran 3G applied as a post-flood granular.
The carbofuran treatments reduced RWW populations during the first test as compared with the control (Figure 1). The carbofuran 4F 1.0 PoF and 4F 1.0 Foliar treatments provided the greatest prolonged control. RWW population levels during the second test were lower than observed during the first test (Figure 2). All carbofuran treatments were effective in reducing RWW populations below population levels observed in the control. Carbofuran 4F 1.0 PoF, 4F 0.75 PoF, 4F 1.0 Foliar, and 3G 0.6 PoF were the most effective treatments. Plant heights were similar among all treatments during the first test (Figure 3). Yields were also similar, except for reduced yields in the carbofuran 4F 0.75 PoF and 4F 1.0 PoF treatments (Figure 4). Only minor differences in plant height and yield were observed among treatments during the second test (Figures 3 and 4).

Figure 1. RWW larvae per core in carbofuran treated plots, 1989; Test 1.

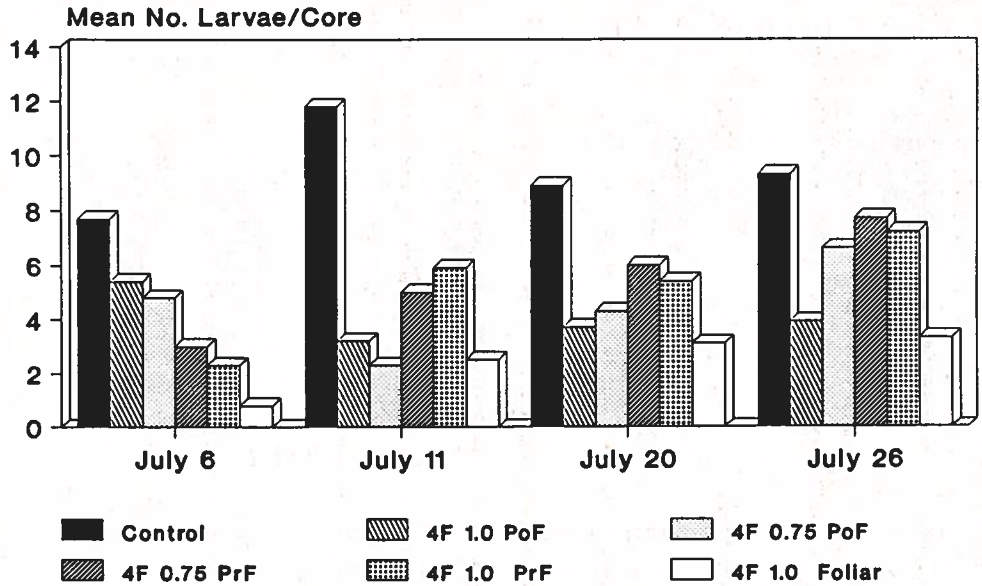


Figure 2. RWW larvae per core in carbofuran treated plots, 1989; Test 2.

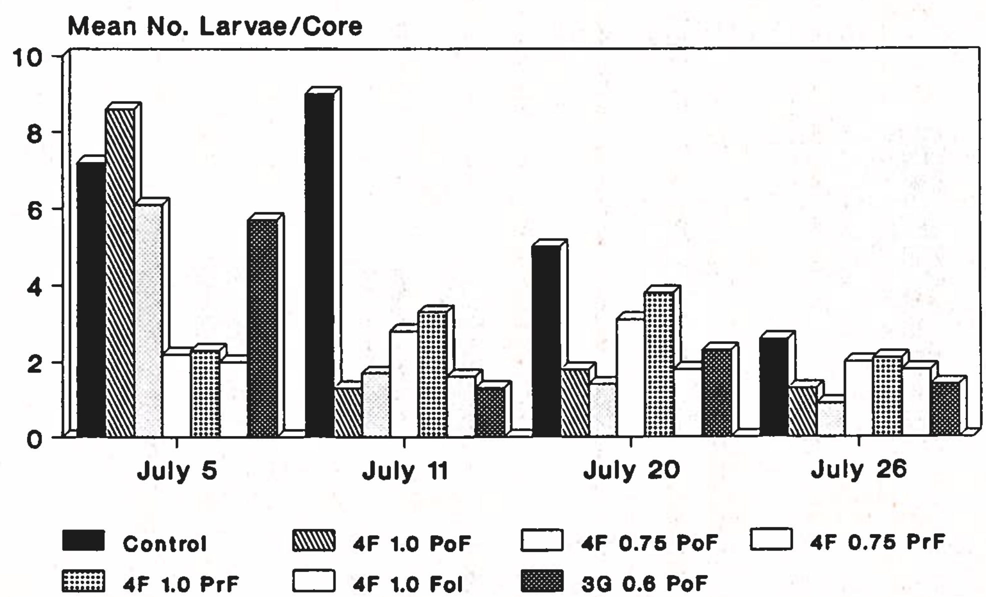


Figure 3. Plant height in carbofuran treated plots, 1989.

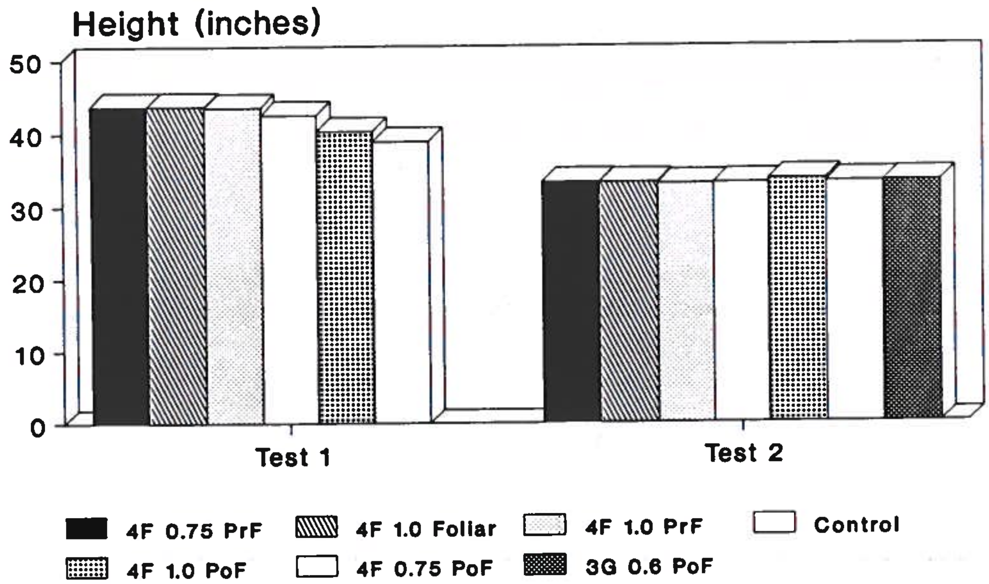
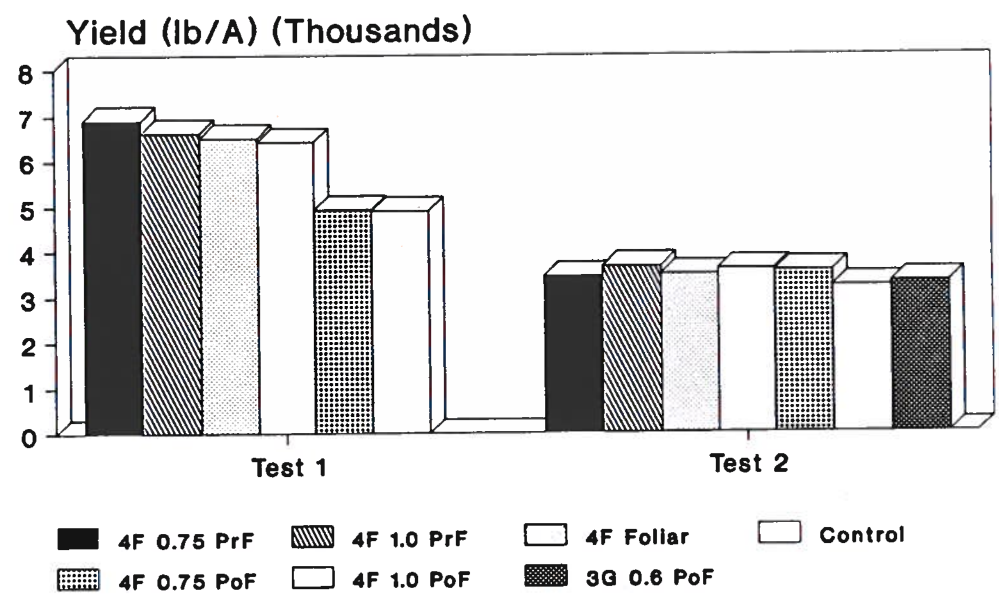


Figure 4. Yield in carbofuran treated plots, 1989.



RELATIONSHIP BETWEEN THE RICE WATER WEEVIL AND PYTHIUM SPP. IN THE DEVELOPMENT OF FEEDER-ROOT NECROSIS

R.A. Thompson, S.S. Quisenberry, J.F. Robinson, R.W. Schneider, G.B. Trahan and P.D. Bollich

Location: Rice Research Station, Crowley, LA.

Soil: Crowley silt loam

Variety: 'Lemont'

Seeding rate: Pregerminated seed water-seeded at 156.9 kg/ha

Planting Method: Broadcast - first experiment on 21 April, second experiment on 5 May 1989

Plot Size: 7.7 X 1.2 m

Water Management: Flushed at 7 days, flooded at 14 days

Fertilization: 672.5 kg a.i./ha 20-10-10

Herbicide: 4.5 kg a.i./ha of thiobencarb

Treatments: 1) Metalaxyl (1.77 liter/ha applied before flooding and seeding); 2) Carbofuran (0.56 kg/ha applied 10 May and 6 June for the first experiment, and 23 May and 6 June); 3) Metalaxyl + Carbofuran; 4) No chemical control.

Application Equipment: Metalaxyl and thiobencarb applied with a CO_2 hand boom delivering 20 gpa @ 40 psi; granular insecticide applied with a shaker jar; fertilizer applied with a motorized gandy.

Experimental Design: Randomized block design with four replicates

Comments: This year's work was a continuation of the study started in 1988. The relationship between the rice water weevil and Pythium spp. in the development of feeder root necrosis in water-seeded rice was evaluated in two field experiments that were planted earlier than 1988. The conditions at the time of planting were conducive for Pythium spp. development but the pathogenicity of the fungus declined rapidly by the third week of May when mean daily temperatures were above 25°C. In both experiments, plant stand was significantly reduced because of seed damping-off from Pythium spp. (Table 1). Even though there were initial stand differences among treatments, plant densities in all metalaxyl treated plots were above optimum 160 - 215 plants/m^2. This increased plant competition nullified the increased yield expected from the higher plant stands.

Rice water weevil populations were low, reaching critical levels late in the growing season when tillering had ceased (Fig. 1 A and B). Early planting allowed for avoidance of severe rice water weevil infestation, resulting in no significant yield differences among treatments (Table 2).

This investigation did not establish a relationship between the rice water weevil and Pythium spp. in the development of feeder root necrosis in water-seeded rice. Temperature conditions which promote Pythium disease development did not occur at the time when weevil populations reached damaging levels in the field.

Table 1. Plant stand at 21 days after planting, Rice Research Station, Crowley, LA, 1989[a]

	Plant stand (plants/m^2)	
Treatment[b]	Experiment 1	Experiment 2
M + CF	258a	280a
CF	182b	182b
M	258a	226ab
CK	172b	182b

Means followed by the same letter are not significantly different (P = 0.05; Duncan's [1955] multiple range test).
[a]Planting dates: Exper. 1 - 21 April, Exper. 2 - 5 May.
[b]M + CF = metalaxyl + carbofuran (metalaxyl @ 1.8 liter/ha, carbofuran @ 0.56 kg [AI]/ha), CF = carbofuran, M = metalaxyl, CK = control.

Table 2. Rice yield components in the first and second experiments; Rice Research Station, Crowley, LA. 1989

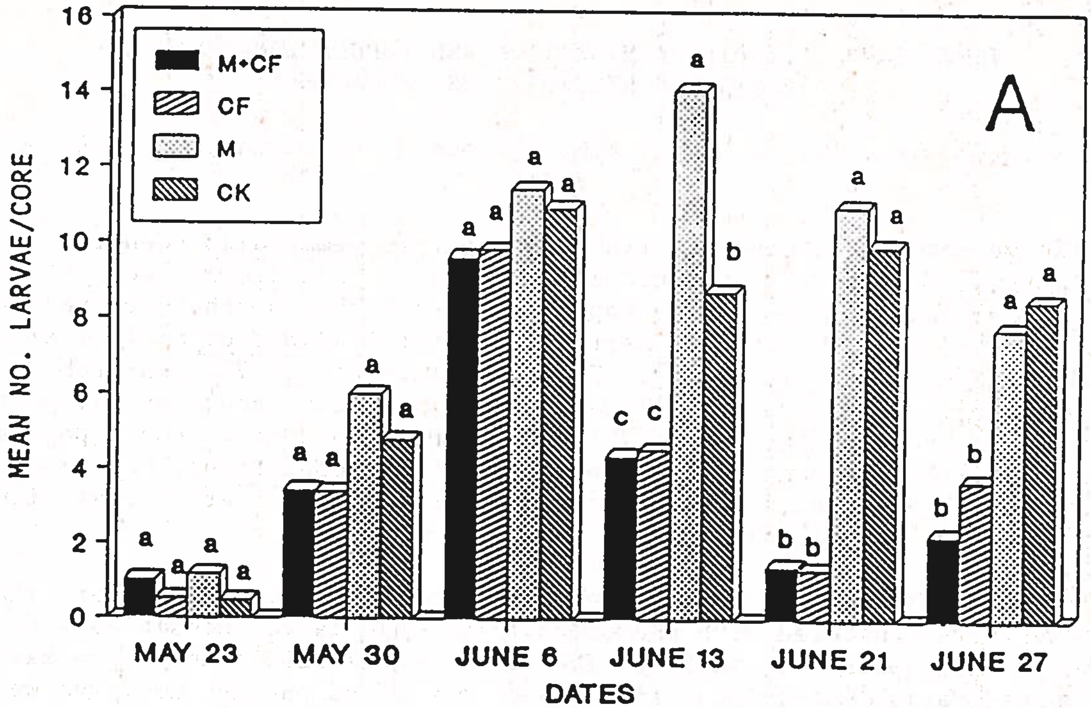
Treatment[a]	Plant ht (cm)	No. of panicles/ m^2	Wt/20 panicles (g)	Bulk wt/[b] m^2 (g)	Grain yield/ ha (kg)
Exper. 1[c]					
M + CF	85a	434ab	39a	1340a	7940.4a
CF	85a	446a	39a	1282a	7682.2a
M	80a	406a	40a	1204a	6713.8a
CK	82a	380b	42a	1156a	7036.6a
Exper. 2					
M + CF	86a	420a	35a	1478a	7144.2a
CF	86a	388a	35a	1422ab	7273.3a
M	77c	370a	33a	1254b	6221.0a
CK	80b	412a	36a	1452a	7337.9a

Grain at 12% moisture. Means followed by the same letter are not significantly different (P = 0.05; Duncan's [1955] multiple range test).

[a]M + CF = metalaxyl + carbofuran (metalaxyl @ 1.8 liter/ha, carbofuran @ 0.56 kg [AI]/ha), CF = carbofuran, M = metalaxyl, CK = control.

[b]Total above ground biomass at harvest.

[c]Exper. 1 and 2 planted 21 April and 5 May 1989, respect.



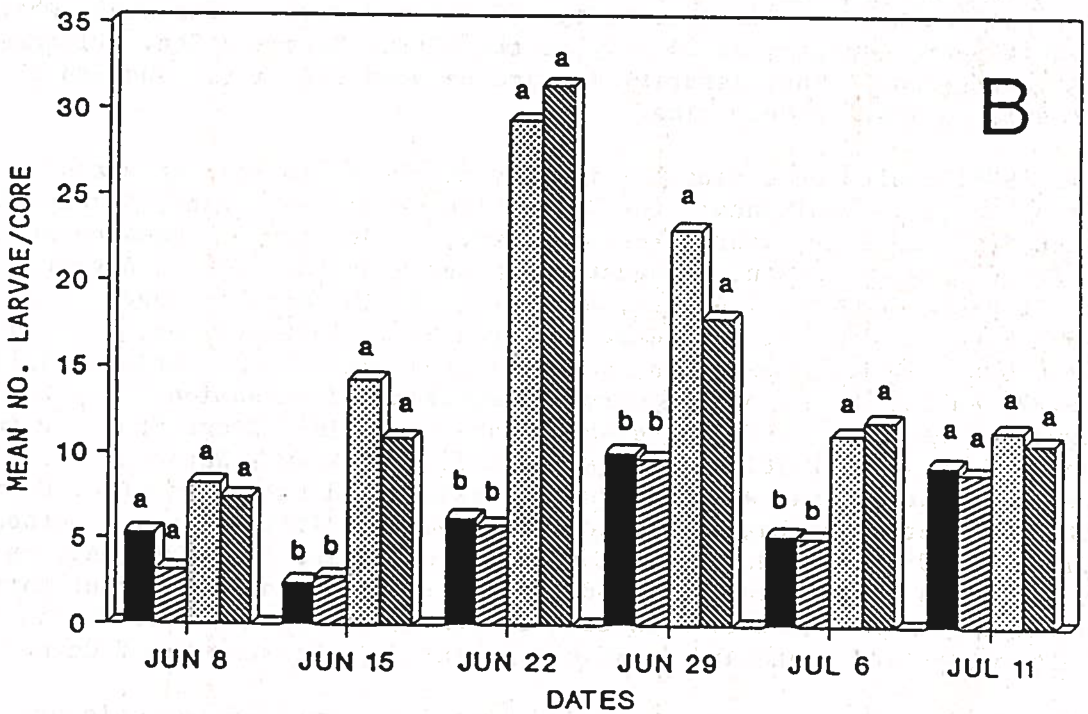


Fig. 1. Mean rice water weevil (RWW) larvae/core, Rice Research Station, Crowley, LA, 1989. (A) Experiment 1 (planted 21 April) and (B) Experiment 2 (planted 5 May). Treatments: M + CF = metalaxyl + carbofuran (metalaxyl @ 1.8 liter/ha, carbofuran @ 0.56 kg [AI]/ha), M = metalaxyl, CF = carbofuran, CK = control. Bars within date followed by the same letter are not significantly different (P = 0.05; Duncan's [1955] multiple range test).

VELVETBEAN CATERPILLAR MIGRATION AND POPULATION DYNAMICS:
A BASIS FOR REGIONAL PEST MANAGEMENT

B.M. Gregory, Jr., S.J. Johnson, A.M. Hammond, G.B. Trahan, and P.A. Bollich

The velvetbean caterpillar (VBC), Anticarsia gemmatalis Hubner (Lepidoptera: Noctuidae) is a chronic folivore and migratorial pest of numerous cultivated legumes (Leguminosae: Papilionideae) in the southern United States; e.g., soybean [Glycine max (L.) Merrill], peanut [Cajanus cajan (L.) Millsp.], and alfalfa [Medicago sativa L.]. The objectives of our VBC research in 1989 in Louisiana and Texas were to 1) determine the spatial and temporal patterns of larval and adult populations, 2) examine the magnitude of these populations, 3) determine the overwintering potential of these populations, and 4) examine abiotic variables (e.g., weather patterns, river systems, etc.) that might affect dispersal and migration.

In both wild and cultivated legumes, throughout the entire year, adult densities were monitored with pheromone traps, and larval densities were monitored with sweep-net samples. The first larvae were found on 24 May in Plaquemines Parish, Louisiana; five small larvae and one medium larva were swept from Vigna luteola (Jacq.) Benth. The first adults were captured on 4 July at the Rockefeller Wildlife Refuge (Cameron Parish, Louisiana), while the next adults were captured on 24 July at the Citrus Research Stn. (Plaquemines Parish, Louisiana). The disparity in time between the larval and adult captures is unclear at this time.

In 1989, adults were caught initially at the following sites and on the specified dates in Louisiana: the Rockefeller Wildlife Refuge, 4 July; Citrus Research Stn., 24 July; Iberia Research Stn., 27 July; Rice Research Stn., 31 July; Hammond Research Stn. 2 August; Dean Lee Research Stn., 2 August; Northeast Research Stn., 7 August; Ben Hur Research Farm, 10 August; Red River Research Stn., 22 August; Southeast Research Stn., 15 September; Rosepine Research Stn., 20 September; and in Texas: the Texas Point National Wildlife Refuge, 20 August; Texas A&M University Research and Extension Ctr., Beaumont, 28 August; USDA Southern Crops Research Laboratory in College Stn., 30 August; San Bernard National Wildlife Refuge, 6 October; Arkansas National Wildlife Refuge, 2 October; Texas A&M University Research and Extension Ctr., Corpus Christi, 28 September; Laguna Atascosa National Wildlife Refuge, 4 October. As from 1986 to 1988, the VBC population in Louisiana and in Texas (near the Texas-Louisiana border) demonstrated a southern to northern movement-pattern. As in 1988, the VBC population in eastern Texas, from San Bernard National Wildlife Refuge and southward, were all captured in September and October.

Based upon the numerous and varied data sets compiled for this project from 1986 to 1989, the project's results indicate that adults are migrating into Louisiana from south Florida. The most sophisticated technology we have utilized to investigate the migratorial pathways of VBC is a $250,000 satellite that belongs to Louisiana State University. Within a 4,000 mile radius of Baton Rouge, this satellite monitors atmospheric changes at eight different times per day and does so at several atmospheric levels. A backtrack analysis relative to 1988, demonstrated that adults could have migrated from south Florida. Mexico was no implicated as a emigrational pathway. A backtrack analysis with data collected in 1989 is currently in progress.

DISEASE CONTROL STUDIES

COMMERCIAL RICE FUNGICIDE TRIAL

D. Groth, M. Frey, J. Nugent, and M. Rush

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Lemont, 100 lb/A

Planting Method/Date: Drill seeded - Apr 7, 1989

Fertilization: 75-75-75, Apr 6; 90-0-0, May 1

Plot Size: 16 x 4 ft

Emergence Date: Apr 17

Water Management: Flushed, Apr 21; Permanent flood, May 2; Drained, July 25

Herbicides: 4 lb/A Propanil + 1.5 pt/A Basagran, Apr 28
2 oz/A Londax, May 9, July 12

Insecticides: 17 lb/A Furadan, May 17; 1.5 qt/A liquid Sevin, July 12

Fungicides: Various fungicides, rates, and timing -- See Table 1.

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: PI stage, June 5; Boot stage, June 16;
Heading stage, July 5

Harvest: Aug 8

Experimental Design: Randomized block design with five replications

Disease Ratings: Sheath blight severity (0-9 scale), July 19
Infestation levels (0-100%), July 19

Results: Table 1

Comments: Sheath blight severity was moderate, other diseases were low.

Table 1. Effects of rice foliar fungicides on sheath blight control and yield. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate a.i.[1]	Timing[2]	Sheath blight[3]	Sheath blight infestation[4]	Yield lb/A	Change from check
Uninoculated control	--	--	6.0	64	6980	523
Inoculated control	--	--	7.3	87	6457	0
Benlate 50DF	0.5 lb	B+H	6.0	63	7015	558
Benlate 50DF	0.5 lb	PI+B	7.3	88		488
Benlate 50DF	1 lb	B+H	5.5	63	7217	760
Rovral 4F	0.5 lb	B+H	6.0	50	7031	574
Rovral Chipco 2.5F	0.5 lb	B+H	5.8	50	7077	620
Rovral 4.0SC	0.5 lb	B+H	5.5	50	6828	371
Rovral 4.0SC	0.5/1 lb	PI+B	6.3	61	7045	588
Rovral 4.0SC	0.33 lb	PI+B+H	6.8	64	6992	535
Tilt 3.6EC	2.7 oz	PI+B	5.3	40	7192	736
Tilt 3.6EC	4.5 oz	2"+B	5.3	54	7594	1137
Tilt/Benlate	4.5/0.5 lb	B/H	4.8	54	7204	747
Tilt/Rovral	4.5/0.5 lb	B/H	4.8	63	7447	990
Folatec 3.8F	1.4 lb	B+H	6.5	54	6965	508
Topsin-M 70.8WP	.70 lb	B+H	7.3	80	6698	241
NTN19701 50WP	.25 lb	PI+B	5.0	42	7377	920
NTN19701 75WP	.25 lb	B+H	5.3	38	7575	1118
NTN19701/Benlate	.25/0.5 lb	B/H	6.3	59	7283	826
NTN19701/Penetrator	.25/.25 lb	B+H	5.8	49	7268	811
NTN19701/Rovral	.25/0.5 lb	B/H	5.0	50	7325	868
SN84364 50WP	.25 lb	PI+B	5.0	53	7704	1247
SN84364 50WP	.35 lb	PI+B	5.3	26	7555	1098
SN84364/Benlate	.25/0.5 lb	B/H	4.5	27	7599	1142
SN84364/Rovral	.25/0.5	B/H	4.0	39	7714	1257
SN84364+Triton CS-7	.25/.25	PI+B	4.8	49	7206	749
DPX-965 80DF	1 lb	B+H	6.3	69	6994	537
DPX-965 80DF	0.5 lb	B+H	6.8	76	6947	490
CGA-455 50WP	2.0 oz	PI+B	6.3	28	6851	394
CGA-455 50WP	3.0 oz	PI+B	5.5	56	7080	623
CGA-455 50WP	2.0 oz	B+H	5.5	46	7289	832
606EXP10002B 2.0SC	.18 lb	B+H	6.8	58	7020	563
263EXP10064A 1.7SC	.18 lb	B+H	5.8	69	7332	875
263EXP10064A 1.7SC	.27 lb	B+H	6.5	59	7301	844
263EXP10064A/Rovral	.18/0.5 lb	B+H	5.3	46	7353	896
Aliette 80WP	2.4 lb	B+H	7.0	77	6615	158
Aliette/Rovral	2.4/0.5 lb	B+H	6.3	57	7045	588
Aliette/Benlate	2.4/0.5 lb	B+H	6.3	73	7005	548
LSD (0.05)			1.3	23	602	

1 Rate in ai except where noted. Triton CS-7 at the rate of 16 oz/100 gal; ai = active ingredient.
2 Timing: PI = panicle initiation, B = boot (½" panicle), and H = heading.
3 Sheath blight rated on 0-9 scale where 0 = no disease and 9 = plants dead.
4 Percent tillers infected with sheath blight.

SHEATH BLIGHT YIELD LOSS AND SCOUTING METHODS

Location: Rice Research Station, Crowley, LA.

Soil Type: Crowley silt loam

Variety/Seed Rate: Lemont, Mars, Mercury, Tebonnet, Gulfmont, 100 lb/A

Planting Method/Date: Drill seeded, Apr 7, 1989

Fertilization: 75-75-75, Apr 6; 90-0-0, May 1

Plot Size: 16 x 4 ft

Emergence Date: Apr 18

Water Management: Flushed, Apr 21; Permanent flood, May 2

Herbicides: 4 qt/A Propanil + 1.5 pt/A Basagran, Apr 28
2 oz/A Londax, May 9, July 12

Insecticides: 17 lb/A Furadan, May 17; 1.5 lb/A liquid Sevin, July 12

Fungicides: NTN 19701, 0.5 lb/A at boot and heading -- See Table 2

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Date: Boot stage, June 13; Heading stage, July 10

Harvest: Aug 4

Experimental Design: Randomized block design with five replications

Disease Ratings: Sheath blight severity (0-9 scale)
Infestation levels (0-100%)

Results: Table 2

Comments: Sheath blight severity was moderate, other diseases were very low.

Table 2. Results of sheath blight yield loss and scouting experiment. Rice Research Station, Crowley, LA. 1989.

Variety ml inoc/plot	Percent tillers infected Tillering	Maturity	Sheath blight rating	Yield (lb/A)
Lemont				
0	2.2	84.6	6.0	6332.4
0 + fungicide	0.6	66.4	4.2	6916.2
25	7.2	82.6	6.8	5686.8
50	6.8	88.6	6.6	5924.6
75	9.8	92.4	7.0	5851.6
100	11.2	88.8	6.6	6004.4
125	17.6	92.0	7.0	5929.2
150	23.6	86.6	6.6	6128.8
Mercury				
0	0.6	43.0	3.0	6141.8
0 + fungicide	1.8	20.2	2.4	5742.6
25	3.4	45.4	4.0	6347.8
50	6.4	45.6	3.8	5461.4
75	6.2	45.8	3.6	6225.6
100	9.6	49.6	4.2	6027.2
125	9.4	47.0	4.6	6167.8
150	16.0	42.8	4.4	6149.2
Mars				
0	0.8	38.4	2.8	7216.6
0 + fungicide	0.2	13.6	2.0	7080.0
25	2.0	47.6	3.4	7468.0
50	2.8	49.0	3.8	7357.4
75	7.0	49.6	3.4	6687.0
100	6.4	55.4	3.8	7431.6
125	8.4	49.0	3.8	7416.4
150	9.2	50.8	3.8	7078.4
Tebonnet				
0	0.8	36.6	2.8	6364.0
0 + fungicide	0.0	26.6	2.6	6737.6
25	4.0	61.4	4.8	6632.0
50	5.4	62.0	4.4	5957.8
75	4.2	59.4	4.0	6409.0
100	5.6	66.4	5.0	6489.8
125	10.2	69.2	4.2	6186.4
150	9.4	60.4	4.6	6065.4

Table 2. Continued.

Variety ml inoc/plot	Percent tillers infected Tillering	 Maturity	Sheath blight rating	Yield (lb/A)
Gulfmont				
0	0.8	51.2	4.4	6652.4
0 + fungicide	3.2	29.8	3.2	6777.0
25	7.4	86.8	7.2	5997.4
50	11.8	84.2	6.8	5850.6
75	9.0	84.6	6.4	5384.8
100	12.8	87.6	6.6	5452.2
125	13.8	85.0	7.0	5887.8
150	20.4	83.8	6.4	5805.2

ROVRAL SPREADER STICKER STUDY

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Lemont, 100 lb/A

Planting Method/Date: Drill seeded, Apr 7, 1989

Fertilization: 75-75-75, Apr 6; 90-0-0, May 1

Plot Size: 16 x 4 ft

Emergence Date: Apr 17

Water Management: Flushed, Apr 21; Permanent flood, May 2; Drained, July 25

Herbicides: 4 lb/A Propanil + 1.5 pt Basagran, Apr 28
2 oz/A Londax, May 9 and July 12

Insecticides: 17 lb/A Furadan, May 17; 1.5 qt/A liquid Sevin, July 12

Fungicides: Various fungicides, rates and timing -- See Table 3.

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: Early boot stage, June 19; Heading stage, July 5

Harvest: Aug 4

Experimental Design: Randomized block design with four replications

Disease Ratings: Sheath blight severity (0-9 scale), July 19
Infestation levels (0-100%), July 19

Results: Table 3

Comments: Sheath blight severity was high, other diseases were very low.

Table 3. Effects of spray adjuvants on Rovral for control of sheath blight and yield response. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing[1]	Adjuvant[2]	Sheath blight[3]	Sheath blight infestation[4]	Yield (lb/A)	Change
Untreated control	---	7.0	67	6317	211
Rovral 4F, 0.5 lb, B+H	---	5.8	50	6838	310
"	+ Triton CS7	5.8	46	7131	603
"	+ Nu-film	5.3	49	6976	448
"	+ LFJ	5.5	62	7009	481
"	+ X77	4.8	55	7095	567
"	+ Triton B1956	5.8	55	6718	190
"	+ AG-98	5.8	49	7168	640
"	+ Buffer PS	5.8	54	6856	328
LSD (0=0.05)		0.9	19	542	

[1] B = Boot, H = Heading.

[2] Adjuvants added at 16 oz/100 gal.

[3] Sheath blight severity rated on 0-9 scale where 0 = no disease and 9 = plants dead.

[4] Percent tillers infected with sheath blight.

TIME OF FUNGICIDE APPLICATION

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Gulfmont, 100 lb/A

Planting Method/Date: Drill seeded, Apr 18, 1989

Fertilization: 60-60-60, Apr 17; 200-0-0, May 9

Plot Size: 16 x 4 ft

Emergence Date: Apr 28

Water Management: Flushed, Apr 21, Apr 25, and May 2; Permanent flood, May 10; Drained, Aug 10

Herbicides: 4 qt/A Propanil, May 9; 2 oz/A Londax, July 12

Insecticides: 1.5 lb/A liquid Sevin, July 12; 17 lb/A Furadan, June 6

Fungicides: Various fungicides, rate and timing -- See Table 4.

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: June 20, June 30, July 10

Harvest: Aug 25

Experimental Design: Randomized block design with four replications

Disease Ratings: Sheath blight severity (0-9 scale), Aug 18
Infestation levels (0-100%), Aug 18

Results: Table 4

Comments: Sheath blight severity was high, some blast was present, other diseases were very low.

Table 4. Effect of application time of day on efficacy of rice fungicides. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing[1]	Time of day[2]	Sheath blight[3]	Sheath blight infestation[4]	Yield (lb/A)	Change
Untreated control	---	7.8	90	5905	0
Tilt 3.6 EC, 2.7 oz, PI+B	8:00 AM	5.3	53	6895	990
	10:00 AM	5.8	65	7292	1387
	12:00 Noon	5.5	59	7335	1430
	2:00 PM	6.0	66	7205	1300
	4:00 PM	6.3	79	6815	910
	6:00 PM	5.8	67	7048	1143
Rovral 50 WP, 0.5 lb, B+H	8:00 AM	7.0	88	6959	1054
	10:00 AM	6.3	80	6479	574
	12:00 Noon	6.5	84	6994	1089
	2:00 PM	6.5	73	6864	959
	4:00 PM	7.0	91	7236	1331
	6:00 PM	6.8	89	7165	1260
Benlate 50 DF, 0.5 lb, B+H	8:00 AM	7.0	81	7415	1510
	10:00 AM	7.0	70	7014	1109
	12:00 Noon	6.3	89	7586	1681
	2:00 PM	6.3	72	7501	1596
	4:00 PM	6.3	70	7488	1583
	6:00 PM	6.8	86	6954	1049
LSD (P=0.05)		1.0	29	406	

1 PD = panicle differentiation, B = boot, and H = heading.
2 Time of fungicide application ± 15 min.
3 Sheath blight rated on 0-9 scale where 0 = no disease and 9 = plants dead.
4 Percent tillers infected with sheath blight.

	PD			Boot			Head		
	Wind	Rain	Dew	Wind	Rain	Dew	Wind	Rain	Dew
8:00 AM	N	-	H	H	-	H	L	-	H
10:00 AM	L	-	L	H	-	L	L	-	L
12:00 Noon	L	-	N	H	-	N	M	-	N
2:00 PM	L	-	N	H	-	N	H	-	N
4:00 PM	L	-	N	L	-	N	M	-	N
6:00 PM	L	-	N	L	-	N	M	-	N

Dew: H = heavy; L = moderate light; N = none.
Rain: + = rainfall in next 2 hours.
Wind: N = none; L = light; M = moderate; H = high wind conditions.

BENLATE SPREADER STICKER STUDY

Location: Rice Research Station, Crowley, LA

Soil type: Crowley silt loam

Variety/Seed Rate: Lemont, 100 lb/A

Planting Method/Date: Drill seeded, May 11, 1989

Fertilization: 50-50-50, May 11; 90-0-0, May 24

Plot Size: 16 x 4 ft

Herbicides: 4 qt/A Propanil + 1.5 pt/A Basagran, May 24;
2 oz/A Londax, July 12

Insecticides: 17 lb/A Furadan, June 6; 1.5 lb/A liquid Sevin, July 12

Fungicides: Various fungicides, rates, and timing -- See Table 5

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: Heading stage, July 21; Boot stage, July 10

Harvest: Aug 29

Experimental Design: Randomized block design with four replications

Disease Ratings: Sheath blight severity (0-9 scale), Aug 22
Infestation levels (0-100%), Aug 22

Results: Table 5

Comments: Sheath blight severity was very high, other diseases were low.

Table 5. Effect of adjuvants on Benlate control of sheath blight and yield of rice. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing	Sheath blight[1]	Sheath blight infestation[2]	Yield (lb/A)	Change
Untreated check	7.5	91	5013	0
Benlate 50 DF, 0.5 lb, B+H	6.8	70	6084	1071
Benlate 50 DF, 0.5 lb, B+H Ortho X77, .25 oz	6.5	76	6032	1019
Benlate 50 WP, 0.5 lb, B+H Surfex, .25 oz	6.5	65	5819	806
Benlate 50 DF, 0.5 lb, B+H LFJ, .25 oz	7.0	73	6031	1018
Benlate 50 DF, 0.5 lb, B+H Triton B1956, .25 oz	7.0	86	5661	648
Benlate 50 DF, 0.5 lb, B+H Triton CS-7, .25 oz	7.3	84	5764	751
Benlate 50 DF, 0.5 lb, B+H Nu-Film 17, .25 oz	6.5	76	5643	630
Benlate 50 DF, 0.5 lb, B+H AG-98, .25 oz	6.8	73	5809	796
Benlate 50 DF, 0.5 lb, B+H Buffer PS, .25 oz	6.0	56	5966	953
LSD (P=0.05)	1.2	20	542	---

[1] Sheath blight rated using 0-9 scale where 0 = no disease and 9 = plants dead.

[2] Percent tillers infected.

TILT ADJUVANT STUDY

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Lemont, 100 lb/A

Planting Method/Date: Drill seeded, May 11, 1989

Fertilization: 50-50-50, May 11; 90-0-0, May 24

Plot Size: 16 x 4 ft

Emergence Date: ???

Water Management: ???

Herbicides: 4 qt/A Propanil + 1.5 pt/A Basagran, May 24;
2 oz/A Londax, July 12

Insecticides: 17 lb/A Furadan, June 6; 1.5 qt/A liquid Sevin, July 12

Fungicides: Various fungicides, rates, and timing -- See Table 6

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: PD stage, June 30; Boot stage, July 10;
Heading stage, July 21

Harvest: Aug 29

Experimental Design: Randomized block design with four replications

Disease Ratings: Severity (0-9 scale), Aug 22
Infestation levels (0-100%), Aug 22

Results: Table 6

Comments: Severity was moderate, other diseases were low.

Table 6. Effect of adjuvants on Tilt control of sheath blight and yield of rice. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing	Sheath blight	Sheath blight infestation	Yield (lb/A)	Change
Untreated Check	7.8	88	4069	0
Tilt 3.6 EC, 2.7 lb, PI+B	6.3	89	4640	571
Tilt 3.6 EC, 2.7 lb, PI+B CS-7	7.0	78	4560	491
Tilt 3.6 EC, 2.7 lb, PI+B Nu-Film-17	7.0	77	4285	216
Tilt 3.6 EC, 2.7 lb, PI+B B1956	6.3	76	4653	584

FUNGICIDE-FERTILIZER STUDY 1989

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Lemont, Mercury, 100 lb/A

Planting Method/Date: Drill seeded, May 11, 1989

Fertilization: 50-50-50, May 11; 30-0-0, May 24

Plot Size: 16 x 4 ft

Herbicides: 4 qt/A Propanil + 1.5 pt/A Basagran, May 24;
2 oz/A Londax, May 31, July 12

Insecticides: 17 lb/A Furadan, June 6; 1.5 qt/A liquid Sevin, July 12

Fungicides: Various fungicides, rates, and timing -- See Table 7

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: PD stage, June 30; Boot stage, July 10;
Heading stage, July 21

Harvest: Aug 29

Experimental Design: Randomized block design with four replications

Disease Ratings: Severity (0-9 scale), Aug 23;
Infestation levels (0-100%), Aug 23

Results: Table 7

Comments: Severity was moderate, other diseases were low.

Table 7. Effect of nitrogen fertilization on performance of fungicide yield increases and disease control. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing[1]	Sheath blight[2]	Sheath blight infestation[3]	Yield (lb/A)
Untreated check, 30 lb N/A	7.8	93	4865
Untreated check, 90 lb N/A	7.5	98	5555
Untreated check, 150 lb N/A	6.5	78	5616
Rovral 4SC, 0.5 lb, B+H 30 lb N/A	6.3	63	5699
Rovral 4SC, 0.5 lb, B+H 90 lb N/A	6.5	67	5956
Rovral 4SC, 0.5 lb, B+H 150 lb N/A	6.5	80	5418
Tilt 3.6EC, 2.7 oz, PI+B 30 lb N/A	6.5	72	5334
Tilt 3.6EC, 2.7 oz, PI+B 90 lb N/A	6.8	76	5889
Tilt 3.6EC, 2.7 oz, PI+B 150 lb N/A	6.0	83	6130
Benlate 50DF, 0.5 lb, B+H 30 lb N/A	6.3	56	5863
Benlate 50DF, 0.5 lb, B+H 90 lb N/A	6.8	65	6615
Benlate 50 DF, 0.5 lb, B+H 150 lb N/A	5.8	76	6215
Tilt 3.6EC, 4.5 oz, B Benlate 50DF, 0.5 lb, H 30 lb N/A	6.3	82	5985
Tilt 3.6EC, 4.5 oz, B Benlate 50DF, 0.5 lb, H 90 lb N/A	6.3	72	6319
Tilt 3.6EC, 4.5 oz, B Benlate 50DF, 0.5 lb, H 150 lb N/A	5.8	68	6425

1 Fungicide and nitrogen treatments with fungicide rate as ai/A.
2 Sheath blight rated using 0-9 scale where 0 = no disease and 9 = plants dead.
3 Percent tillers infected.

RIDOMIL CULTURAL MANAGEMENT

D.E. Groth and R. Schneider

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Gulfmont, 120 lb/A

Planting Method/Date: Water seeded, flooded, Apr 20, 1989

Fertilization: 60-60-60, Apr 17; 50-0-0, May 9

Plot Size: 16 x 8 ft

Water Management: Flooded, Apr 19; Drained, Apr 24; Permanent flood, Apr 25

Herbicides: 4 qt/A Propanil, May 9; 2 oz/A Londax, July 12

Insecticides: 17 lb/A Furadan, May 17, June 6; 1.5 qt/A liquid Sevin, July 12

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: Ridomil 2EC, pre-flood, Apr 19; Ridomil 5G, post-flood, Apr 20; Ridomil 2EC, post-flood, Apr 25

Drained: Aug 3

Harvest: Aug 15

Experimental Design: Randomized block design with four replications

Disease Ratings: plts/ft^2, May 12; vigor (whole), May 16; heads/ft^2, Aug 15

Results: Table 8.

Comments: Severity was moderate, other diseases were low.

Table 8. Effect of water cultural management and application timing on Ridomil performance. Rice Research Station, Crowley, LA. 1989.

Treatment, rate, timing (Growth stage)	Vigor score[1]	Heads per ft^2	Yield (lb/A)
Untreated, clear (water)	5.8	28.5	6413
Untreated, muddy (water)	5.8	31.0	6514
Ridomil 2.0EC preflood, clear, 0.5 lb	6.8	28.0	6557
Ridomil 5.0GR into flood, clear, 10 lb	7.0	29.3	6175
Ridomil 2.0EC postflood/drained, clear, 0.5 lb	7.0	29.3	6657
Ridomil 2.0EC, preflood, muddy	6.5	29.8	6209
Ridomil 5.0GR into flood, muddy, 10 lb	6.8	31.5	6589
Ridomil 2.0EC postflood/drained, muddy, 0.5 lb	6.8	31.5	6364

1 Vigor score rated on 0-9 scale where 0 = no canopy cover and 9 = thick canopy cover.

WHEAT FUNGICIDE TRIAL - 1989

D. Groth, M. Frey, and J. Nugent

Location: Rice Research Station, Crowley, LA

Soil Type: Crowley silt loam

Variety/Seed Rate: Florida 302, Terral 812, 100 lb/A

Planting Method/Date: Kincaid row planter, Nov 9, 1989

Fertilization: 32-64-64 broadcast and incorporated prior to planting; 80-0-0 (21%), Feb 14

Plot Size: 4 x 25 ft

Herbicides: None

Insecticides: None

Fungicides: Various fungicides, rates, and timing -- See Table 9

Application Equipment: CO_2 backpack sprayer, 8002 tips, 10 gal/A

Application Dates: Mar 14, Mar 15, Mar 28, Mar 31

Harvest: May 15

Experimental Design: Randomized block design with four replications

Disease Ratings: Leaf rust and septoria leaf blotch, Apr 24; rated on 0-9 scales where 0 = no disease and 9 = maximum disease possible.

Results: Table 9

Comments: Septoria leaf blotch severity was moderate.

Table 9. Foliar fungicide control of Septoria leaf blotch on wheat. Rice Research Station, Crowley, LA. 1989.

Cultivar, treatment, and rate/A	Leaf rust (%)	Septoria leaf blotch[1] (%)	Yield (lb/A)	Test wt. (GM/600 ml)
Terral 812				
Unsprayed check	22.5	23.3	2838	440
Dithane M45 1.6 lb	10.0	12.0	2996	449
Bayleton 50DF, 2 oz	3.0	7.5	3075	440
Bayleton 50DF, 1 oz Dithane F, 1.6 lb	2.3	7.5	3039	439
Tilt 3.6EC, 1.8 oz	7.8	10.0	2753	446
HWG1608F 3.6EC, 1.8 oz	2.0	4.8	3100	441
HWG1608F 3.6EC, 2.7 oz	2.0	5.3	3360	442
Manzate F, 1.6 lb	13.0	13.8	3238	449
LSD (0=0.05)	0.7	0.9	194	
Florida 302				
Control	23.3	31.3	2919	443
Dithane M45, 1.6 lb	8.8	13.8	3383	431
Tilt 3.6EC, 1.8 oz	12.3	17.0	2786	429
Manzate F4.0, 1.6 lb	7.3	12.5	3092	433
HWG1608 F3.6, 2.7 oz	1.8	5.3	3607	433
HWG1608 F3.6, 1.8 oz	2.3	4.3	3302	418
Bayleton DF50, 1 oz Dithane F4.0, 1.6 lb	4.0	12.5	3161	428
Bayleton DF50, 2 oz	6.3	11.8	2683	430

[1] Diseases rated on 0-9 scale where 0 = no disease and 9 = maximum disease possible.

CHEMICAL CONTROL OF BLAST IN LOUISIANA[1]

G. D. Lindberg and M.C. Rush

INTRODUCTION

Chemical control of rice blast is one part of a broader program of chemical control of foliar diseases of rice. Coordination of all chemical control studies in rice provides better knowledge of the full capabilities of all of the materials that are used.

MATERIALS AND METHODS

The blast susceptible California rice cultivar M-201 was planted April 28, 1989. A randomized complete block design with five replicates were used for this test. The plots measured 4 ft x 20 ft with seven drill rows on a 7 inch spacing. All of the fertilizer was applied at the rate of 120-60-60 lb of total N, P, and K per acre. The chemicals were applied with a 2 nozzle (8002) boom at the rate of 20 gal/A and approximately 40 psi. Twenty-three fungicide rates were used with an application at the booting stage (June 23) and one at the heading stage (July 7) (Table 1). Four samples of 25 panicles in each plot were examined and the percentage rotten-neck and panicle blast was determined. The center four rows were harvested (46.7 sq. ft.) with a small-plot combine (August 11, 1989).

RESULTS AND DISCUSSION

Blast development was heavy in 1989. The test was grown on soil that had not been planted to rice for several years. This helped to increase blast severity. The unsprayed control plots had a mean of 85 percent of the panicles with panicle blast (Table 1). Nineteen of 23 fungicide treatments had significantly reduced panicle blast when compared to the unsprayed plots. Treatment with CPD 232740 1AS + Triton AG-98 reduced the percentage of panicles infected to as low as 17 percent and equaled the Beam 75WP treatment. Beam 75WP is the best blast fungicide commercially available in the world at this time. It is not labeled in the United States. Benlate 50DF at 1 or 2 lb/A at boot and heading also significantly reduced panicle blast (Table 1).

In the 1989 tests, 62 percent of the panicles in the unsprayed plots had "rotten-neck" blast (Table 2). Nineteen of 23 fungicide

---

[1] Mention of trade names of the fungicides or other chemicals described in this report are for identification purposes only and does not imply endorsement by Louisiana State University Agricultural Center.

Table 1. Effect of fungicidal spray applications on control of panicle blast of rice, (panicle blast (%), counted 8-2-89). Rice Research Station, Crowley, LA.

Treatment	Rate (1b or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]
Unsprayed Control	-	-	56	97	99	89	84	85.0
Benlate 50DF	1.00 1b	B,H	35	55	43	42	56	46.2**
Benlate 50DF	2.00 1b	B,H	21	35	25	42	38	32.2**
Beam 75WP	0.30 1b	B,H	18	23	31	44	38	30.8**
Champ Flowable	4.00 pt	B,H	42	48	52	40	48	46.0**
DPX-965-80DF	0.625 1b	B,H	41	61	27	49	79	51.4**
DPX-965-80DF	1.25 1b	B,H	46	29	51	39	60	45.0**
SAN 619 100SL + Triton AG-98	1.00 pt 0.80 pt	B,H -	95	62	53	76	76	72.4
CGA - 455 50WP	0.50 1b	B,H	64	51	68	56	62	60.2**
CGA - 455 50WP	0.75 1b	B,H	36	34	45	52	52	43.8**
EX10108A 15WP	1.20 1b	B,H	60	83	73	76	72	72.8
EX10108A 15WP	1.80 1b	B,H	63	60	74	82	66	69.0*
EX10064A 1.7SC	0.85 pt	B,H	52	82	54	62	70	64.0**
EX10064A 1.7SC	1.29 pt	B,H	42	56	66	49	54	53.4**
Aliette 80WP	3.00 1b	B,H	57	72	66	84	81	72.0

Continued.

Table 1. Continued.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]
Aliette 80WP and Rovral 4SC	3.00 lb 1.00 pt	B,H -	80	72	53	76	83	72.8
CPD 210699 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H -	68	49	63	55	77	62.4**
CPD 210699 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H -	26	44	33	43	64	42.0**
CPD 210699 1AS + Triton AG-98	7.20 pt 0.80 pt	B,H -	33	25	34	33	59	36.8**
CPD 232740 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H -	47	27	46	24	49	38.6**
CPD 232740 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H -	21	26	27	26	54	30.8**
CPD 232740 1AS + Triton AG-98	7.20 pt 0.80 pt	B,H -	10	19	12	19	25	17.0**
EX 210338 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H -	61	35	50	42	37	45.0**
EX 210575 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H -	47	63	90	44	62	61.2**
LSD 0.01 0.05								18.5 14.0

a/ B = boot stage (1 to 2 inch panicle), H = heading stage (80% of panicles emerging).
b/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

Table 2. Effect of fungicidal spray applications on control of neck blast of rice (rotten-neck blast %, counted 8-2-89). Rice Research Station, Crowley, LA.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]
Unsprayed Control	-	-	40	72	76	60	62	62.0
Benlate 50DF	1.00 lb	B,H	20	27	28	24	33	26.4**
Benlate 50DF	2.00 lb	B,H	10	19	17	28	15	17.8**
Beam 75WP	0.30 lb	B,H	9	5	10	19	12	11.0**
Champ Flowable	4.00 pt	B,H	28	26	35	19	21	25.8**
DPX-965-80DF	0.625 lb	B,H	30	38	15	32	42	31.4**
DPX-965-80DF	1.25 lb	B,H	31	8	33	22	34	25.6**
SAN 619 100SL + Triton AG-98	1.00 pt 0.80 pt	B,H -	79	46	28	59	45	51.4
CGA-455 50WP	0.50 lb	B,H	42	22	35	38	38	35.0**
CGA-455 50WP	0.75 lb	B,H	19	20	28	28	42	27.4**
EX10108A 15WP	1.20 lb	B,H	47	61	51	52	44	51.0
EX10108A 15WP	1.80 lb	B,H	32	52	52	63	30	45.8*
EX10064A 1.7SC	0.85 pt	B,H	37	62	29	49	44	44.2*
EX10064A 1.7SC	1.29 pt	B,H	21	24	41	35	35	31.2**
Aliette 80WP	3.00 lb	B,H	42	43	49	65	63	52.4

Continued.

Table 2. Continued.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]
Aliette 80WP and Rovral 4SC	3.00 lb 1.00 pt	B,H -	61	54	28	52	70	53.0
CPD 210699 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H -	41	25	43	27	59	39.0**
CPD 210699 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H -	11	27	17	24	48	25.4**
CPD 210699 1AS + Triton AG-98	7.20 pt 0.80 pt	B,H -	13	11	18	21	38	20.2**
CPD 232740 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H -	24	13	23	8	29	19.4**
CPD 232740 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H -	7	6	5	5	33	11.2**
CPD 232740 1AS + Triton AG-98	7.20 pt -	B,H -	6	3	4	3	5	4.2**
EX+10338 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H -	34	10	33	30	17	24.8**
EX 210575 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H -	32	39	54	20	38	36.6**
LSD 0.01 0.05								17.9 13.5

a/ B = boot stage (1 to 2 inch panicle), H = heading stage (80% of panicles emerging).
b/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability level.

treatments gave significant reductions in rotten-neck blast. Beam 75WP and the CPD232740 1As treatments reduced rotten-neck blast to 11 and 4 percent respectively.

Twelve of 23 fungicidal treatments had significantly increased yields over the unsprayed controls (Table 3). Beam 75WP and CPD 232740 1As increased yields by 1416 and 1948 lb/A, respectively; or by 42 and 58 percent.

Table 3. Effect of fungicidal spray applications on yield (in pounds/A) of blast infected M-201 rice. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]	Change from unsprayed (lb/A)
Unsprayed control	-	-	3460	3262	2008	3821	4264	3363	-
Benlate 50DF	1.00 lb	B,H	4890	4143	4144	4190	3702	4214*	851
Benlate 50DF	2.00 lb	B,H	5366	4286	4306	4178	5348	4697**	1334
Beam 75WP	0.30 lb	B,H	5296	5237	4944	4106	4311	4779**	1416
Champ Flowable	4.00 pt	B,H	3485	3274	2852	4217	4082	3582	219
DPX-965-80DF	0.625 lb	B,H	3717	2453	4283	3925	3517	3579	216
DPX-965-80DF	1.25 lb	B,H	4580	4493	3805	5183	4040	4420**	1057
SAN 619 100SL + Triton AG-98	1.00 pt 0.80 pt	B,H	2332	3546	3992	4413	2746	3406	43
CGA-455 50WP	0.50 lb	B,H	3934	4729	3717	4079	3587	4009	646
CGA-455 50WP	0.75 lb	B,H	6158	4210	3952	4811	4278	4682**	1319
EX10108A 15WP	1.20 lb	B,H	4027	3277	3270	4163	3395	3626	263
EX10108A 15WP	1.80 lb	B,H	3400	3587	2795	3450	4488	3544	181
EX10064A 1.7SC	0.85 pt	B,H	4102	2567	3171	3834	2101	3155	-208
EX10064A 1.7SC	1.29 pt	B,H	3996	3815	3314	4165	4637	3985	622
Aliette 80WP	3.00 lb	B,H	3408	3315	2653	3258	2859	3099	-264

Continued.

Table 3. Continued.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Rep I	Rep II	Rep III	Rep IV	Rep V	Mean[b/]	Change from unsprayed (lb/A)
Aliette 80WP and Rovral 4SC	3.00 lb 1.00 pt	B,H	2781	3744	3908	3615	3483	3506	143
CPD 210699 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H	3153	4308	3462	4186	3481	3718	355
CPD 210699 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H	4102	4078	4141	3853	4282	4091*	728
CPD 210699 1AS + Triton AG-98	7.20 pt 0.80 pt	B,H	4622	4636	3805	4520	3529	4222*	859
CPD 232740 1AS + Triton AG-98	1.76 pt 0.80 pt	B,H	4574	3983	4587	4052	3822	4204*	841
CPD 232740 1AS + Triton AG-98	3.60 pt 0.80 pt	B,H	4938	5141	5225	5764	5486	5311**	1948
CPD 232740 1AS + Triton AG-98	7.20 pt 0.80 pt	B,H	5437	4499	3867	4224	5071	4620**	1257
EX 210338 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H	4045	4333	3962	4133	4524	4199*	836
EX 210575 1EC + Triton AG-98	3.60 pt 0.80 pt	B,H	3539	2147	2619	4394	4472	3434*	71
LSD 0.01								951	
0.05								718	

a/ B = boot stage (1 to 2 inch panicle), H = heading stage (80% of panicles emerging).
b/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

FUNGICIDAL CONTROL OF RICE FOLIAR AND STEM DISEASES[1]

M. C. Rush, G. D. Lindberg, and D. E. Groth

INTRODUCTION

Field testing of foliar applications of fungicides for the control of disease caused by fungi was initiated in 1972. Theoretically, the fungal diseases occurring on rice in Louisiana can be controlled by foliar applications of fungicides. The diseases which are economically significant include blast (Pyricularia oryzae), brown spot (Bipolaris oryzae), narrow brown leaf spot (Cercospora oryzae), and leaf smut (Entyloma oryzae). These diseases are endemic in the Louisiana rice area becoming epidemic periodically. Certain of our presently grown commercial varieties are very susceptible to these diseases. Ultimately, control of these diseases will be by an integrated disease management system using a combination of pesticides, disease resistance, cultural practices, biological control, and legislative-regulatory procedures. It is important that effective fungicides are found, developed, and made available to Louisiana rice growers for use in disease management programs.

MATERIALS AND METHODS

A test was conducted at the Rice Research Station, Crowley, LA, during the 1989 season to screen fungicides for their efficacy in controlling foliar and stem diseases on Lemont rice. The tests were conducted on Crowley silt loam soil with a pH of 6.0. Plots were 20-ft, 7-row, drill strips with 7-inch row spacing and 14-inch alleys. Each treatment was replicated five times using a randomized complete block design. The plots in this test were inoculated with Rhizoctonia solani as previously described (2) and infections by the target fungi were from this inoculation or from natural sources of inoculum. Six hundred lb/A of 20-10-10 fertilizer was applied by a drill application to the test area at planting. Plots were planted April 28, 1989, and 4 lb/A of propanil was applied over the test area before applying the permanent flood. Fungicide applications were made at the green ring (June 15), early boot (July 2), and heading (July 17) stages of growth. Fungicides were applied in 20 gal/A of water with a backpack type CO_2 sprayer. The treatments were as indicated in Table 1.

Plots were rated for sheath blight and leaf smut incidence 5 days before harvest. Rating systems for the foliar diseases (1)

---

[1] Mention of trade names of the fungicides or other chemicals described in this report are for identification purposes only and does not imply endorsement by Louisiana State University Agricultural Center.

Table 1. Effects of foliar fungicides on sheath blight control and yield in 1989. Rice Research Station; Crowley, LA.

Treatment	Rate (lb or pt/A formulated)	Timing[2]	Yield (lb/A)	Change from unsprayed (lb/A)	Mean[3] % tillers infected at maturity	Mean[3] % tillers dead at maturity	Mean[3] disease rating at maturity (0-9)
Uninoculated	--	--	6533**	1625	12.8**	0**	0.8**
Inoculated - unsprayed	1 lb	--	4908	--	81.2	17.0	6.2
Benlate 50DF	1 lb	B,H	5857	949	64.4	7.5**	5.0
Benlate 50DF	2 lb	B,H	5003	95	52.8*	3.2**	3.6**
Benlate 50DF	2 lb	GR	5917*	1009	75.4	11.0*	5.4
Tilt 3.6 EC	0.38 pt	GR,B	5521	613	62.8	11.2*	5.4
Mon-24077 25WP	0.25 lb	GR,B	5724	816	50.4*	7.0**	4.6*
Mon-24077 25WP	0.5 lb	GR,B	6315*	1407	18.8**	1.5**	3.2**
Mon-24077 25WP	0.75 lb	GR,B	5773	865	40.0**	2.2**	3.2**
Mon-24077 25WP	1 lb	GR,B	5556	648	19.4**	0**	2.0**
Benlate 50DF + HB7923	1 lb 0.8 pt	B,H	5790	882	52.0*	2.5**	4.2**
Benlate 50DF + HM8703	1 lb 0.8 pt	B,H	5374	466	63.4	7.0**	4.6*

Continued

Table 1 (Cont'd)

Treatment	Rate (lb or pt/A formulated)	Timing	Yield (lb/A)	Change from unsprayed (lb/A)	Mean % tillers infected at maturity	Mean % tillers dead at maturity	Mean disease rating at maturity (0-9)
DPX-965-80DF	0.31 lb	B,H	5492	584	67.0	8.0**	4.8*
DPX-965-80DF	0.63 lb	B,H	5732	824	58.6	7.0**	5.0
DPX-965-80DF	0.94 lb	B,H	5450	542	69.0	2.7**	3.8**
DPX-965-80DF	1.25 lb	B,H	5599	691	51.2*	2.1**	3.2**
DPX-965-80DF	1.25 lb	GR	5116	208	65.6	16.0	6.4
BAS-480 00F 25WP	1 lb	GR	5352	444	41.6**	5.2**	4.2**
BAS-480 00F 25WP + Dash	0.6 lb 0.8 pt	GR	5375	467	46.8*	7.2**	4.8*
BAS-480 00F 25WP	0.6 lb	GR,B	5350	442	61.2	9.5**	5.8
BAS-480 00F 25WP	0.6 lb	GR,H	5652	744	30.4**	6.2**	4.2**
Tilt 3.6 EC and Rovral 50WP	0.38 pt 1 lb	GR H	5770	862	61.4	3.7**	4.2**
Tilt 3.6 EC	0.63 pt	B	5884	976	80.2	13.0	5.8
Exp. 10108A 15WP	1.2 lb	B,H	5409	501	68.4	0.2**	2.2**
Exp. 10108A 15WP	1.8 lb	B,H	4672	-236	42.4**	1.2**	3.6**

Continued

Table 1 (Cont'd)

Treatment	Rate (lb or pt/A formulated)	Timing[a]	Yield (lb/A)	Change from unsprayed (lb/A)	Mean[b] % tillers infected at maturity	Mean[c] % tillers dead at maturity	Mean[d] disease rating at maturity (0-9)
Exp. 10108A 15WP + Rovral 4SC	1.2 lb 1 pt	B,H	5914*	1006	47.8*	0.5**	2.6**
Exp. 10064A 1.7SC	0.85 pt	B,H	5202	294	61.0	1.5**	3.6**
Exp. 10064A 1.7SC	1.29 pt	B,H	5186	278	62.8	1.4**	3.2**
Exp. 10002B 2SC	0.75 pt	B,H	5390	482	73.6	8.5**	5.2
Rovral 4SC	1 pt	B,H	5470	562	72.0	3.9**	4.4*
Rovral 4SC + Exp. 10064A 1.7SC	1 pt 0.85 pt	B,H	5740	332	59.4	1.5**	2.6**
Rovral 50WP	1 lb	B,H	5906*	998	71.0	2.2**	3.8**
Rovral 2.0 OF	2 pt	B,H	5659	751	71.2	1.8**	3.8**
Rovral 4SC + Triton B1956	1 pt 1 pt	B,H	5452	544	68.6	4.7**	4.4*
Rovral 4SC + Triton CS-7	1 pt 2 pt	B,H	5590	682	62.4	2.0**	3.6**
Rovral 4SC + Nu-Film 17	1 pt 1 pt	B,H	5616	708	43.8**	2.0**	3.4**
Rovral 4SC + AG-98	1 pt 0.5 pt	B,H	5814	906	62.2	2.0**	3.2**

Continued

Table 1 (Cont'd)

Treatment	Rate (lb or pt/A formulated)	Timing[a]	Yield (lb/A)	Change from unsprayed (lb/A)	Mean[b] % tillers infected at maturity	Mean[b] % tillers dead at maturity	Mean[c] disease rating at maturity (0-9)
Benlate 50DF + HM 8703	1 lb 1.6 pt	B,H	5621	713	73.8	5.0**	4.6*
Tilt 3.6 EC and Benlate 50 DF	0.63 pt 1 lb	B H	6073*	1165	40.6**	2.2**	3.6**
Tilt 3.6 EC and Rovral 4SC	0.63 pt 1 pt	B H	5368	460	52.4*	0.2**	2.4**
Aliette 80 WP	3 lb	B,H	5479	571	53.0*	9.5**	4.8*
Aliette 80WP + Rovral 4SC	3 lb 1 pt	B,H	5871	963	79.2	1.7**	3.4**
San 619 100SL + Triton CS-7	0.62 pt 1 pt	GR,B	5685	777	72.6	7.5**	5.4
San 619 100SL + Triton CS-7	1 pt 1 pt	GR,B	5262	354	40.4**	10.0**	5.4
San 619 100SL + Triton CS-7	2 pt 1 pt	GR,B	6332**	1424	44.2**	4.0**	3.8**
Champ Flowable	4 pt	B,H	5248	340	65.4	1.0**	3.4**
CGA-455 50WP	0.5 lb	GR,B	5812	904	22.0**	2.0**	3.2**
CGA-455-50WP	0.75 lb	GR,B	5611	703	16.6**	3.0**	3.4**

Continued

Table 1 (Cont'd)

Treatment	Rate (lb or pt/A formulated)	Timing[s]	Yield (lb/A)	Change from unsprayed (lb/A)	Mean[t] % tillers infected at maturity	Mean[t] % tillers dead at maturity	Mean[t] disease rating at maturity (0-9)
CGA-455-50WP	0.5 lb	B,H	5568	660	23.2**	1.7**	3.6**
CGA-455-50WP	0.75 lb	B,H	6039*	1131	25.8**	0.5**	2.8**
Moncut 50WP	0.5 lb	GR,B	5007	99	52.0*	6.7**	4.6*
Moncut 50WP + Triton CS-7	0.5 lb 1 pt	GR,B	5132	224	48.4*	5.5**	4.2**
Moncut 50WP	0.7 lb	GR,B	5027	119	28.4**	5.5**	4.6*
Monceren 50WP	0.3 lb	B,H	5636	728	41.4**	0.4**	2.4**
Monceren 50WP + Triton CS-7	0.3 lb 1 pt	B,H	5272	364	32.8**	0.7**	2.8**
Monceren 50WP and Monceren 50WP + Benlate 50DF	0.3 lb 0.3 lb 0.5 lb	B H	5596	688	41.2*	1.2**	3.2**
LSD 0.01			1307		35.9	6.7	1.9
LSD 0.05			991		27.2	5.1	1.4

[s] GR=green-ring stage of growth (first internode elongating), B=boot stage (1-2 inch panicle), H=heading stage (80-90% of panicles emerging).

[t] Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

were previously reported. The plots were harvested with a small-plot combine on August 23. Rough rice weights were corrected to 12% moisture.

RESULTS AND DISCUSSION

Eight of 54 fungicidal treatments gave significant increases in yield (Table 1). There was a 1625 lb/A difference in yield between the inoculated control and the uninoculated (healthy) control plots. This yield difference was caused by the sheath blight in the inoculated plots. The SAN 619 100SDL + Triton CS-7 treatment at 2 pints and 1 pint respectively yielded 1424 lb/A over the inoculated control. This treatment returned 88 percent of the loss due to sheath blight. Mon-214077 25WP at 0.5 lb formulated per acre at greenring and boot gave a 1407 lb/A increase or an 87 percent return of yield over the inoculated control. Additional fungicidal compounds giving more than 1000 lb/A increases included Benlate 50DF, Exp. 10108A 15WP + Rovral 4SC, Tilt 3.6EC followed by Benlate 50DF, and CGA-455 50WP. These compounds all gave significant reductions in the amount of sheath blight in treated plots (Table 2). The Mon-24077 50WP reduced the percentage tillers infected at maturity from 81.2 in the inoculated control to 18.8. Twenty-eight of 54 fungicidal compounds significantly reduced the percentage of tillers infected at maturity.

Only leaf smut, of the three leaf spot diseases normally present in these tests, was rated in 1989. The levels of brown spot and narrow brown spot were too low to rate. Forty-four of 54 fungicidal treatments significantly reduced leaf smut ratings (Table 2). The Exp. 10064A 1.7SC, SAN 619 100SL, and Champ Flowable compounds eliminated leaf smut from treated plots.

Disease pressure was high early in the season following heavy rains. Rainfall was light from mid-July through mid-August with rains again in the later part of August. Sheath blight and leaf spot development was low during much of the growing season due to the dry period.

LITERATURE CITED

1. Groth, D. E. and M. C. Rush. 1985. Rice disease assessment keys. Ann. Prog. Rpt., Rice Res. Sta., La. Agr. Expt. Sta., LSU Agricultural Center 77:250-257.

Table 2. Effects of foliar fungicides on control of leaf smut. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Mean[b/] Disease Rating
Uninoculated	--	--	6.2
Inoculated Control	--	--	7.0
Benlate 50DF	1 lb	B,H	4.6*
Benlate 50DF	2 lb	B,H	4.2*
Benlate 50DF	2 lb	GR	5.4
Tilt 3.6 EC	0.38 pt	GR,B	0.6**
Mon-24077 25WP	0.25 lb	GR,B	4.2*
Mon-24077 25WP	0.5 lb	GR,B	4.0*
Mon-24077 25WP	0.75 lb	GR,B	2.8**
Mon-24077 25WP	1 lb	GR,B	1.8**
Benlate 50DF	1 lb	B,H	4.0*
+ HB7923	0.8 pt	--	
Benlate 50DF	1 lb	B,H	2.8**
+ HM8703	0.8 pt	--	
DPX-965-80 DF	0.31 lb	B,H	6.0
DPX-965-80 DF	0.63 lb	B,H	4.8
DPX-965-80 DF	0.94 lb	B,H	4.8
DPX-965-80 DF	1.25 lb	B,H	4.6*
DPX-965-80 DF	1.25 lb	GR	3.8**
BAS-480 00F 25WP	1 lb	GR	3.2**
BAS-480 00F 25WP	0.6 lb	GR	3.4**
+ Dash	0.8 pt	--	
BAS-480 00F 25WP	0.6 lb	GR,B	1.2**
BAS-480 00F 25WP	0.6 lb	GR,H	3.6**
Tilt 3.6 EC	0.38 pt	GR	4.8
and Rovral 50WP	1 lb	H	
Tilt 3.6 EC	0.63 pt	B	1.2**
Exp. 10108A 15WP	1.2 lb	B,H	0.4**
Exp. 10108A 15WP	1.8 lb	B,H	0.2**
Exp. 10108A 15WP	1.2 lb	B,H	0**
+ Rovral 4SC	1 pt	--	
Exp. 10064A 1.7SC	0.85 pt	B,H	0**
Exp. 10064A 1.7SC	1.29 pt	B,H	0**
Exp. 10002B 2SC	0.75 pt	B,H	1.8**
Rovral 4SC	1 pt	B,H	4.4*
Rovral 4SC	1 pt	B,H	0**
+ Exp. 10064A 1.7SC	0.85 pt	--	
Rovral 50WP	1 lb	B,H	2.8**
Rovral 2.0 OF	2 pt	B,H	3.0**
Rovral 4SC	1 pt	B,H	3.2**
+ Triton B1956	1 pt	--	
Rovral 4SC	1 pt	B,H	4.4*
+ Triton CS-7	2 pt	--	

Continued

Table 2. (Cont'd)

Treatment	Rate (lb or pt/A formulated)	Timing[a/]	Mean[b/] Disease Rating
Rovral 4SC	1 pt	B,H	3.6**
+ Nu-Film 17	1 pt	--	
Rovral 4SC	1 pt	B,H	5.0
+ AG-98	0.5 pt	--	
Benlate 50DF	1 lb	B,H	2.2**
+HM8703	1.6 pt	--	
Tilt 3.6 EC	0.63 pt	B	0.4**
and Benlate 50DF	1 lb	H	
Tilt 3.6 EC	0.63 pt	B	0.6**
and Rovral 4SC	1 pt	H	
Aliette 80WP	3 lb	B,H	4.2*
Aliette 80WP	3 lb	B,H	4.8
+ Rovral 4SC	1 pt	--	
San 619 100SL	0.62 pt	GR,B	2.4**
+ Triton CS-7	1 pt	--	
San 619 100SL	1 pt	GR,B	0.4**
+ Triton CS-7	1 pt	--	
San 619 100SL	2 pt	GR,B	0**
+ Triton CS-7	1 pt	--	
Champ Flowable	4 pt	B,H	0**
CGA-455 50WP	0.5 lb	GR,B	5.2
CGA-455-50WP	0.75 lb	GR,B	4.8
CGA-455-50WP	0.5 lb	B,H	3.8**
CGA-455-50WP	0.75 lb	B,H	3.4**
Moncut 50WP	0.5 lb	GR,B	2.6**
Moncut 50WP	0.5 lb	GR,B	3.8**
+ Triton CS-7	1 pt	--	
Moncut 50WP	0.7 lb	GR,B	2.2**
Monceren 50WP	0.3 lb	B,H	4.4*
Monceren 50WP	0.3 lb	B,H	4.4*
+ Triton CS-7	1 pt	--	
Monceren 50WP	0.3 lb	B	6.2
and Monceren 50WP	0.3 lb	H	
+ Benlate 50DF	0.5 lb	--	
LSD 0.01			3.1
LSD 0.05			2.4

[a/]GR = green-ring stage (first internode elongating), B = boot stage (1 to 2 inch panicle), H = heading stage (80-90% of panicles emerging).

[b/]Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

CHEMICAL CONTROL OF RICE SEEDLING DISEASES[1]

M. C. Rush and Richard Dunand

INTRODUCTION

Seed-rot and damping-off diseases are common in the Southern rice area causing stand reduction and irregularities in water-planted and, to a lesser extent, drill-planted rice. Losses are incurred directly through the costs of replanting and indirectly through the inefficient use of space and light in irregular stands, and by increased competition with weeds. Rice seed germination and growth of seedlings is often poor under the weather conditions normally encountered in March and early April in the Southern rice area. Considerable damage to water-planted seed is encountered under these cool weather conditions regardless of the seed-treatment fungicides used. The fungi causing seed rotting and water-mold in water-seeded rice included species of *Achlya*, *Pythium*, and *Fusarium*. Drill-seeded rice can be injured by several seedborne fungi including *Helminthosporium oryzae*, *Curvularia lunata*, *Fusarium roseum*, and *Fusarium moniliforme*. Soilborne pathogens like *Rhizoctonia solani*, *Sclerotium rolfsii*, and *Pythium* spp. can also cause seedling blight.

Theoretically, seed and seedling diseases of rice can be economically controlled by seed-treatment fungicides. For this reason, a program to develop more effective fungicidal seed treatments has been conducted at the LSU Rice Research Station since the early 1970's. Fungicides or formulation of fungicides are field screened in experimental tests each year. Those formulations performing well in the experimental tests are advanced to further field testing in subsequent years.

MATERIALS AND METHODS

A single lot of Lemont rice seed was treated in February and the first week in March 1989 with fungicides at the rates listed in Table 1. The formulated fungicides were placed into water (2 ml/0.25 lb seed) in glass jars, stirred with a magnetic stirrer bar until in suspension, and the suspended material was used to coat the inside of each jar. Weighed seed samples were poured into the coated jars, shaken by hand for 1 to 2 minutes, and placed onto a jar mill to revolve for 10 minutes. Treated seed were stored in heavy manila seed envelopes until planted.

---

[1]Mention of trade names of the seed protectant fungicides described in this paper is for identification purposes only and does not imply endorsement by the Louisiana Agricultural Experiment Station, Louisiana State University Agriculture Center.

Table 1. Experimental chemicals used in the 1989 experimental seed-protectant fungicide tests at the Rice Research station, Crowley, LA.

Fungicide or Combination	Manufacturer or Supplier
Kocide SD	Griffin Corporation
Manex II	Griffin Corporation
Vitavax 200 FF	Gustafson, Incorporated
Thiram 42S	Gustafson, Incorporated
Vitavax 200 + Dithane F-45	Gustafson, Inc. + Rohm & Haas Co.
Gus FA 12 + Gus FM 12	Gustafson, Incorporated
Gus FA 22 + Gus FM 12	Gustafson, Incorporated
Dithane F-45	Rohm and Haas Company
Nusan 30	Wilbur-Ellis Chemical Company
Nusan 30 + Apron	Wilbur-Ellis + Gustafson, Inc.
Champion SD	Agtrol Chemical Products
Zinc Starter	Agtrol Chemical Products
Champ Flowable	Agtrol Chemical Products
Experimental N6FW	Agtrol Chemical Products
Experimental N6Fl	Agtrol Chemical Products
Champion SD + Zinc Starter	Agtrol Chemical Products
Champion Flowable + Zinc Starter	Agtrol Chemical Products
Experimental N6FW + Zinc Starter	Agtrol Chemical Products
Experimental N6Fl + Zinc Starter	Agtrol Chemical Products
Thiram 42S + Gus 92-01 Binder	Gustafson, Incorporated
Vitavax 200 FF + Dithane F-45	Gustafson, Inc. + Rohm & Haas
Gus FA22 + Gus FM12 + Gus 92-01 Binder	Gustafson, Incorporated
Vitavax 200FF + Gus 92-01 Binder	Gustafson, Incorporated
Anchor FL	Gustafson, Incorporated
Apron FL	Gustafson, Incorporated
Dithane F-45 FL	Rohm and Haas Company
Dithane DF	Rohm and Haas Company
Monceren 75% WP	Mobay Corporation Agricultural Chemical Division
Manzate 200 Flowable	E.I. DuPont de Nemours & Co.,(Inc.)
Moncut 50 WP	NOR-AM Chemicals Company
Monceren 75 WP + Apron FL	Mobay Corp. + Gustafson, Inc.
Moncut 50 WP + Apron FL	NOR-AM Chem. Co. + Gustafson, Inc.
ABG-3109A	Abbott Laboratories
ABG-3109B	Abbott Laboratories
Kocide SD + ABG-3109A	Griffin Corp. + Abbott Lab.
Manex II + ABG-3109A	Griffin Corp. + Abbott Lab.
Vitavax 200 FF + ABG-3109A	Gustafson Inc. + Abbott Lab.
Dithane F-45 + ABG-3109A	Rohm & Haas Co. + Abbott Lab.
Nusan 30 + ABG-3109A	Wilbur-Ellis + Abbott
Apron FL + ABG-3109A	Gustafson, Inc. + Abbott Lab.
Champion SD + ABG-3109A	Agtrol Chem. Prod. + Abbott Lab.
ABG-3110A	Abbott Laboratories
ABG-3111A	Abbott Laboratories
ABG-3110B	Abbott Laboratories
ABG-3111B	Abbott Laboratories

Simulated water- and drill-seeded methods were used to plant treated seed at the Rice Research Station, Crowley, LA. Water-seeded tests consisted of 58 treatments with five replications of 200 presoaked seeds per plot. Seed were soaked in five volumes of tap water for 24 to 30 hours before planting. Plots consisted of cylinders 1-ft high and 2-ft in diameter made of 1/8-inch mesh hardware cloth. After planting, each cylinder was covered with 1/2-inch mesh hardware cloth to keep out birds and rats. The cylinders were arranged in a completely randomized block design, 2-ft apart within blocks, with a 6-ft alley between blocks. The treated seeds were planted in 4 to 5 inches of water.

Two individually leveed plot areas were planted at each planting date using identical procedures. In one plot area, the water was removed after 3 days and the plots were flushed as needed. In the other plot area, the flood was maintained at 2 to 4 inches until 3 days before the stands were counted.

Drill-planted plots consisted of the same 58 treatments planted in single 10-ft rows with 200 seeds per row in an individually leveed area. Plots were replicated five times in a randomized complete block design in each test. Rows were spaced 10 inches apart within blocks with 6-ft alleys between blocks. Seeds were planted with a drop-seeder.

RESULTS AND DISCUSSION

Fourteen of 35 seed-protectant fungicide treatments gave significant stand increases in the water-seeded, drained and flushed test (Table 2). The best treatments increased stands by about 25 percent of that produced by untreated seeds. Seeds treated with growth regulators tended to give significant decreases in stand (Table 2). The growth regulating compounds (formulations of gibberelic acid) were phytotoxic across all concentrations used.

In the water-seeded, continuous flood test 18 of 35 fungicide treatments gave significant stand increases (Table 3). Stands were increased up to 37 percent over that produced by untreated seeds. The growth regulator treatments were less damaging in this test, but stands produced by seeds treated with these compounds (3109A, 3109B, 3110A, and 3110B) were similar to the stand of the control (untreated).

In the drill-seeded test, 15 of 35 seed-protectant fungicide treatments gave significant stand improvement with stands increased up to 26 percent of that produced by untreated seeds (Table 4).

All of the growth regulator treatments reduced stand with most treatments showing significant phytoxicity.

In the water-seeded, drained and flushed test only one fungicide, Zinc Starter, showed a significant reduction in seedling height after about 30 days of growth (Table 5). The growth

Table 2. Effect of seed-protectant fungicides and growth regulators on stand in water-seeded, drained rice (water-seeded on 4-21-89, drained in 3 days, and flushed as needed, stand counts on 5-23-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Control (untreated)	-	64	93	107	113	90	93.4	-	46.7
Kocide SD	6.0	103	86	128	127	124	113.6*	21.6	56.8
Manex II	4.0	97	116	111	124	126	114.8*	22.9	57.4
Vitavax 200 FF	4.0	94	96	112	104	79	97.0	3.8	48.5
Thiram 42S	3.3	83	123	104	96	87	98.6	5.5	49.3
Vitavax 200 + Dithane F-45	3.0 3.2	79	123	132	130	107	114.2*	22.2	57.1
GUS FA12 + GUS FM12	0.125 0.25	86	103	95	102	114	100.0	7.0	50.0
GUS FA22 + GUS FM12	0.5 0.5	69	89	89	104	72	84.6	-9.4	42.3
Dithane F-45	6.0	110	113	115	127	108	114.6*	22.6	57.3
Nusan 30	1.25	80	84	103	112	64	88.6	-5.1	44.3
Nusan 30 + Apron	1.25 2.0	88	108	99	129	127	110.2*	17.9	55.1
Nusan 30 + Apron	1.0 2.0	98	97	95	119	102	102.2	9.4	51.1

Continued.

Table 2. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Champion SD	4.0	78	94	130	142	112	111.2*	19.0	55.6
Zinc Starter	6.0	77	89	122	111	73	94.4	1.0	47.2
Champ Flowable	4.0	103	103	137	132	106	116.2**	24.4	58.1
Experimental N6FW	4.0	94	116	120	140	123	118.6**	26.9	59.3
Experimental N6Fl	4.0	102	113	116	122	112	113.0*	20.9	56.5
Champion SD + Zinc Starter	4.0 6.0	106	124	107	125	93	111.0*	18.8	55.5
Champion Flowable + Zinc Starter	4.0 6.0	106	74	128	134	84	105.2	12.6	52.6
Experimental N6FW + Zinc Starter	4.0 6.0	94	86	121	139	110	110.0*	14.9	53.7
Experimental N6Fl + Zinc Starter	4.0 6.0	98	98	130	101	79	101.2	8.3	50.6
Thiram 42S + GUS 92-01 Binder	3.3 0.25	88	94	113	112	63	94.0	0.6	47.0
GUS FA22 + GUS FM12	0.25 0.25	72	53	121	91	116	90.6	-2.9	45.3
Dithane F-45 FL	3.2	88	122	108	131	106	111.0*	18.8	55.5

Continued.

Table 2. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Vitavax 200 FF + Dithane F-45	3.0 3.2	100	112	118	115	102	109.4	17.1	54.7
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	83	93	104	117	103	100.0	7.0	50.0
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	90	77	122	120	120	105.8	13.2	52.9
Anchor FL	0.75	85	83	90	110	92	92.0	-1.4	46.0
Apron FL	0.75	101	86	113	117	118	107.0	14.5	53.5
Dithane F-45 FL	4.0	110	98	105	138	112	112.6*	20.5	56.3
Dithane DF	4.0	86	112	114	123	114	109.8*	17.5	54.9
Monceren 75% WP	2.5	76	73	107	109	85	90.0	-3.6	45.0
Manzate 200 FL	6.0	91	85	109	134	114	106.6	14.1	53.3
Moncut 50 WP	4.0	94	87	108	108	107	100.8	7.9	50.4
Monceren 75 WP + Apron FL	2.5 0.75	101	111	96	130	104	108.4	16.0	54.2
Moncut 50 WP + Apron FL	4.0 0.75	93	106	103	123	113	107.6	15.2	53.8
ABG-3109A	50 PPM	63	87	67	74	49	68.0(-)**	-27.1	34.0

Continued.

Table 2. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
ABG-3109A	25 PPM	81	63	77	79	68	73.6(-)*	-21.1	36.8
ABG-3109A	12.5 PPM	73	74	105	95	82	85.8	-8.1	42.9
ABG-3109B	50 PPM	56	85	72	67	51	66.2(-)**	-29.1	33.1
ABG-3109B	25 PPM	65	74	83	86	61	73.8(-)*	-20.9	36.9
ABG-3109B	12.5 PPM	71	78	84	99	91	84.6	-9.4	42.3
Kocide SD + ABG-3109A	6.0 50 PPM	74	92	83	89	79	83.4	-10.7	41.7
Manex II + ABG-3109A	4.0 50 PPM	68	62	72	82	68	70.4(-)**	-24.6	35.2
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	76	88	73	78	76	78.2	-16.2	39.1
Dithane F-45 + ABG-3109A	6.0 50 PPM	75	83	84	98	83	84.6	-9.4	42.3
Nusan 30 + ABG-3109A	1.25 50 PPM	59	79	84	72	62	71.2(-)**	-23.7	35.6
Apron FL + ABG-3109A	0.75 50 PPM	59	68	75	76	80	71.6(-)**	-23.3	35.8
Champion SD + ABG-3109A	4.0 50 PPM	61	82	90	11	98	68.4(-)**	-26.7	34.2

Continued.

Table 2. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	63	73	75	75	91	75.4(-)*	-19.2	37.7
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	68	83	82	76	70	75.8(-)*	-18.8	37.9
ABG-3110A	50 PPM	62	88	74	72	48	68.8(-)**	-26.3	34.4
ABG-3110A	25 PPM	66	74	76	75	110	80.2	-14.1	40.1
ABG-3110A	12.5 PPM	67	87	87	92	61	78.8	-15.6	39.4
ABG-3111A	50 PPM	54	62	60	54	89	63.8(-)**	-31.6	31.9
ABG-3111A	25 PPM	63	59	66	95	65	69.6(-)**	-25.4	34.8
ABG-3111A	12.5 PPM	50	72	61	81	55	63.8(-)**	-31.6	31.9
ABG-3110B	25 PPM	54	95	80	73	71	74.6(-)*	-20.1	37.3
ABG-3111B	25 PPM	51	68	75	77	80	70.2(-)**	-24.8	35.1
LSD 0.01							21.6		
0.05							16.4		

a/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) propability levels.

Table 3. Effect of seed-protectant fungicides and growth regulators on stand in water-seeded, continuous flood rice (water-seeded on 4-21-89, stand counts on 5-23-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Control (untreated)	-	83	85	96	92	88	88.8	-	44.4
Kocide SD	6.0	78	125	109	84	120	103.2	16.2	51.6
Manex II	4.0	77	99	92	111	131	102.0	14.8	51.0
Vitavax 200 FF	4.0	70	87	116	104	92	93.8	5.6	46.9
Thiram 42S	3.3	68	100	117	90	113	97.6	9.9	48.8
Vitavax 200 + Dithane F-45	3.0 3.2	83	94	94	92	118	96.2	8.3	48.1
GUS FA12 + GUS FM12	0.125 0.25	85	122	111	98	119	107.0*	20.4	53.5
GUS FA22 + GUS FM12	0.5 0.5	76	92	90	90	88	87.2	-1.8	43.6
Dithane F-45	6.0	87	124	118	105	122	111.2**	25.2	55.6
Nusan 30	1.25	69	86	106	95	102	91.6	3.1	45.8
Nusan 30 + Apron	1.25 2.0	91	114	87	102	120	102.8	15.7	51.4
Nusan 30 + Apron	1.0 2.0	98	121	102	101	105	105.4*	18.6	52.7

Continued.

Table 3. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Champion SD	4.0	102	117	113	96	131	111.8**	25.9	55.9
Zinc Starter	6.0	93	104	108	101	112	103.6	16.6	51.8
Champ Flowable	4.0	122	132	100	98	118	114.0**	28.3	57.0
Experimental N6FW	4.0	103	143	146	106	109	121.4**	36.7	60.7
Experimental N6F1	4.0	102	126	127	114	140	121.8**	37.1	60.9
Champion SD + Zinc Starter	4.0 6.0	129	130	123	94	121	119.4**	34.4	59.7
Champion Flowable + Zinc Starter	4.0 6.0	111	111	141	120	131	122.8**	38.2	61.4
Experimental N6FW + Zinc Starter	4.0 6.0	107	104	101	99	129	108.0*	21.6	54.0
Experimental N6F1 + Zinc Starter	4.0 6.0	93	119	133	121	128	118.8**	33.7	59.4
Thiram 42S + GUS 92-01 Binder	3.3 0.25	92	110	109	106	125	108.4**	22.0	54.2
GUS FA22 + GUS FM12	0.25 0.25	86	70	103	115	110	96.8	9.0	48.4
Dithane F-45 FL	3.2	106	109	105	105	137	112.4**	26.5	56.2

Continued.

Table 3. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Vitavax 200 FF + Dithane F-45	3.0 3.2	101	112	98	103	148	112.4**	26.6	56.3
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	95	112	98	93	115	102.6	15.5	51.3
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	88	82	87	96	128	96.3	8.4	48.3
Anchor FL	0.75	81	95	91	86	101	90.8	2.2	45.4
Apron FL	0.75	103	111	77	97	115	100.6	13.2	50.3
Dithane F-45 FL	4.0	108	104	105	99	124	108.0*	21.6	54.0
Dithane DF	4.0	109	121	121	113	118	116.4**	31.0	58.2
Monceren 75% WP	2.5	94	96	93	75	113	94.2	6.0	47.1
Manzate 200 FL	6.0	96	112	85	109	144	109.2**	22.9	54.6
Moncut 50 WP	4.0	83	86	96	96	116	95.4	7.4	47.7
Monceren 75 WP + Apron FL	2.5 0.75	106	112	86	117	96	103.4	16.4	51.7
Moncut 50 WP + Apron FL	4.0 0.75	104	108	120	116	117	113.0**	27.2	56.5
ABG-3109A	50 PPM	81	79	89	92	82	84.6	-4.7	42.3

Continued.

Table 3. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
ABG-3109A	25 PPM	97	71	85	89	85	85.4	-3.8	42.7
ABG-3109A	12.5 PPM	96	79	98	97	112	96.4	8.5	48.2
ABG-3109B	50 PPM	110	67	84	83	83	85.4	-3.8	42.7
ABG-3109B	25 PPM	103	67	104	79	89	88.4	-0.5	44.2
ABG-3109B	12.5 PPM	91	74	82	91	107	89.0	0.2	44.5
Kocide SD + ABG-3109A	6.0 50 PPM	118	111	102	96	103	106.0*	19.3	53.0
Manex II + ABG-3109A	4.0 50 PPM	94	78	90	91	104	91.4	2.9	45.7
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	89		87	97	84	88.6	-0.2	44.3
Dithane F-45 + ABG-3109A	6.0 50 PPM	82	107	95	102	105	98.2	10.5	49.1
Nusan 30 + ABG-3109A	1.25 50 PPM	86	71	96	95	97	89.0	0.2	44.5
Apron FL + ABG-3109A	0.75 50 PPM	91	97	108	86	92	94.8	6.7	47.5
Champion SD + ABG-3109A	4.0 50 PPM	103	101	105	109	105	104.6*	17.7	52.3

Continued.

Table 3. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds)					Mean[a]	Change from control (%)	Stand (%)
		1	2	3	4	5			
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	94	76	82	98	85	87.0	-2.0	43.5
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	78	89	79	87	112	89.0	0.2	44.5
ABG-3110A	50 PPM	76	80	76	91	82	81.0	-8.7	40.5
ABG-3110A	25 PPM	106	68	89	95	96	90.8	2.2	45.4
ABG-3110A	12.5 PPM	98	88	96	98	103	96.6	11.0	48.3
ABG-3111A	50 PPM	89	80	76	91	83	83.8	-5.6	41.9
ABG-3111A	25 PPM	79	62	73	88	85	77.4	-12.8	38.7
ABG-3111A	12.5 PPM	105	80	73	89	116	92.6	4.2	46.3
ABG-3110B	25 PPM	87	83	94	93	101	91.6	3.1	45.8
ABG-3111B	25 PPM	107	76	91	72	89	87.0	-2.0	43.5
LSD 0.01							19.6		
0.05							14.9		

a/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

Table 4. Effect of seed-protectant fungicides and growth regulators on stand in drill-seeded rice (drill seeded on 4-20-89, stand counts on 5-23-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Control (untreated)	-	113	96	88	112	106	103.0	-	51.5
Kocide SD	6.0	128	118	119	110	118	118.6*	15.1	59.3
Manex II	4.0	134	134	103	123	118	122.4**	18.8	61.2
Vitavax 200 FF	4.0	130	130	113	121	110	120.8**	17.2	60.4
Thiram 42S	3.3	133	134	110	121	151	129.8**	26.0	64.9
Vitavax 200 + Dithane F-45	3.0 3.2	133	122	129	121	119	124.8**	21.1	62.4
GUS FA12 + GUS FM12	0.125 0.25	119	94	99	89	95	99.2	-3.6	49.6
GUS FA22 + GUS FM12	0.5 0.5	108	81	93	102	96	96.0	-6.7	48.0
Dithane F-45	6.0	136	126	116	124	135	127.4**	23.6	63.7
Nusan 30	1.25	110	104	93	96	113	103.2	0.1	51.6
Nusan 30 + Apron	1.25 2.0	112	125	94	101	106	107.6	4.4	53.8
Nusan 30 + Apron	1.0 2.0	98	121	116	92	91	103.6	0.5	51.8
Champion SD	4.0	121	137	109	88	144	119.8*	16.3	59.9

Continued.

Table 4. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Zinc Starter	6.0	108	109	89	103	92	100.2	-2.7	50.1
Champ Flowable	4.0	115	120	108	96	124	112.6	9.3	56.3
Experimental N6FW	4.0	119	132	103	100	96	110.0	6.7	55.0
Experimental N6Fl	4.0	125	113	117	112	121	117.6*	14.1	58.8
Champion SD + Zinc Starter	4.0 6.0	120	107	109	118	126	116.0	12.6	58.0
Champion Flowable + Zinc Starter	4.0 6.0	111	109	134	117	123	118.8*	15.3	59.4
Experimental N6FW + Zinc Starter	4.0 6.0	121	103	94	93	132	108.6	5.4	54.3
Experimental N6Fl + Zinc Starter	4.0 6.0	137	113	137	109	111	121.4**	17.8	60.7
Thiram 42S + GUS 92-01 Binder	3.3 0.25	122	98	100	116	100	107.2	4.0	53.6
GUS FA12 + GUS FM12	0.125 0.25	107	118	115	106	125	114.2	10.8	57.1
GUS FA22 + GUS FM12	0.25 0.25	109	93	88	114	117	104.2	1.1	52.1
Dithane F-45 FL	3.2	137	122	105	113	139	123.2**	19.6	61.6

Continued.

Table 4. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
Vitavax 200 FF + Dithane F-45	3.0 3.2	128	121	100	118	133	120.0*	16.5	60.0
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	107	119	92	114	125	111.4	8.1	55.7
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	132	103	109	129	120	118.6*	15.1	59.3
Anchor FL	0.75	91	99	80	100	104	94.8	-7.9	47.4
Apron FL	0.75	102	114	84	105	128	106.6	3.4	53.3
Dithane F-45 FL	4.0	104	110	109	92	113	105.6	2.5	52.8
Dithane DF	4.0	122	122	111	103	128	117.2*	13.7	58.6
Monceren 75% WP	2.5	101	107	71	90	114	96.6	-6.2	48.3
Manzate 200 FL	6.0	121	139	106	122	125	122.6**	19.0	61.3
Moncut 50 WP	4.0	95	107	112	98	106	103.6	0.5	51.8
Monceren 75 WP + Apron FL	2.5 0.75	95	106	102	95	88	97.2	-5.6	48.6
Moncut 50 WP + Apron FL	4.0 0.75	109	114	119	112	105	111.8	8.5	55.9
ABG-3109A	50 PPM	70	66	78	76	77	73.4(-)**	-28.7	36.7

Continued.

Table 4. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds) 1	2	3	4	5	Mean[a/]	Change from control (%)	Stand (%)
ABG-3109A	25 PPM	75	78	92	92	87	84.8(-)**	-17.6	42.4
ABG-3109A	12.5 PPM	83	121	90	73	113	96.0	-6.7	48.0
ABG-3109B	50 PPM	87	63	66	61	83	72.0(-)**	-30.0	36.0
ABG-3109B	25 PPM	81	75	89	89	98	86.4(-)*	-16.1	43.2
ABG-3109B	12.5 PPM	78	90	69	96	107	88.0(-)*	-14.5	44.0
Kocide SD + ABG-3109A	6.0 50 PPM	92	84	80	81	86	84.6(-)**	17.8	42.3
Manex II + ABG-3109A	4.0 50 PPM	103	105	92	94	111	101.0	-1.9	50.5
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	110	76	90	84	77	87.4(-)*	-15.1	43.7
Dithane F-45 + ABG-3109A	6.0 50 PPM	113	117	89	105	109	106.6	3.4	53.3
Nusan 30 + ABG-3109A	1.25 50 PPM	90	83	79	76	87	83.0(-)**	-19.4	41.5
Apron FL + ABG-3109A	0.75 50 PPM	84	72	78	84	94	82.4(-)**	-20.0	41.2
Champion SD + ABG-3109A	4.0 50 PPM	105	101	84	96	98	96.8	-6.0	48.4

Continued.

Table 4. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (stand counts/200 seeds)					Mean[a/]	Change from control (%)	Stand (%)
		1	2	3	4	5			
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	78	79	78	93	116	88.8(-)*	-19.8	44.4
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	92	90	94	96	92	92.8	-9.9	46.4
ABG-3110A	50 PPM	83	83	67	74	71	75.6(-)**	-26.6	37.8
ABG-3110A	25 PPM	91	112	63	92	95	90.6	-12.0	45.3
ABG-3110A	12.5 PPM	73	78	85	75	81	78.4(-)**	-23.8	39.2
ABG-3111A	50 PPM	73	76	73	67	89	75.6(-)**	-26.6	37.8
ABG-3111A	25 PPM	87	102	77	77	95	87.6(-)*	-14.9	43.8
ABG-3111A	12.5 PPM	71	86	76	79	68	76.0(-)**	-26.2	38.0
ABG-3110B	25 PPM	72	94	82	85	93	85.2(-)**	-17.2	42.6
ABG-3111B	25 PPM	76	87	101	82	86	86.4(-)*	-16.1	43.2
LSD 0.01							17.1		
0.05							13.0		

a/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) propability levels.

Table 5. Effect of seed-protectant fungicides and growth regulators on height in water-seeded, drained rice (water-seeded on 4-21-89, drained in 3 days, and flushed as needed, height measured on 5-26-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a/]	Change from control (%)
Control (untreated)	-	20.3	19.4	18.7	18.0	19.4	19.2	0
Kocide SD	6.0	19.1	19.2	19.9	20.3	17.1	19.1	-0.5
Manex II	4.0	22.1	15.7	17.6	17.8	18.2	18.2	-5.2
Vitavax 200 FF	4.0	20.5	15.5	19.4	15.9	19.1	18.0	-6.3
Thiram 42S	3.3	19.3	17.3	18.2	21.8	20.3	19.3	0.5
Vitavax 200 + Dithane F-45	3.0 3.2	20.6	17.3	14.9	21.2	16.1	18.0	-6.3
GUS FA12 + GUS FM12	0.125 0.25	19.2	23.2	22.3	19.8	21.4	21.1	9.9
GUS FA22 + GUS FM12	0.5 0.5	18.9	19.9	17.2	18.6	19.0	18.7	-2.6
Dithane F-45	6.0	19.6	23.6	21.6	17.5	18.9	20.2	5.2
Nusan 30	1.25	20.1	23.3	18.3	19.7	19.8	20.2	5.2
Nusan 30 + Apron	1.25 2.0	17.2	16.0	20.1	15.1	20.1	17.7	-7.8
Nusan 30 + Apron	1.0 2.0	19.3	19.0	18.0	16.0	15.7	17.6	-8.3

Continued.

Table 5. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean[a/]	Change from control (%)
		1	2	3	4	5		
Champion SD	4.0	17.6	21.4	18.0	18.5	22.4	19.5	1.6
Zinc Starter	6.0	16.1	18.1	17.0	17.3	15.6	16.8(-)*	-12.5
Champ Flowable	4.0	16.4	18.2	18.8	20.2	15.5	17.8	-7.3
Experimental N6FW	4.0	14.7	17.9	19.9	19.3	21.8	18.7	-2.6
Experimental N6F1	4.0	17.0	17.3	16.9	20.0	18.2	17.8	-7.3
Champion SD + Zinc Starter	4.0 6.0	17.3	17.0	19.1	20.4	17.7	18.3	-4.7
Champion Flowable + Zinc Starter	4.0 6.0	16.0	19.4	18.7	17.5	22.1	18.7	-2.6
Experimental N6FW + Zinc Starter	4.0 6.0	16.9	19.8	18.4	20.4	19.9	19.0	-1.0
Experimental N6F1 + Zinc Starter	4.0 6.0	16.1	19.2	18.5	18.7	20.6	18.6	-3.1
Thiram 42S + GUS 92-01 Binder	3.3 0.25	19.2	17.1	17.9	18.1	19.4	18.3	-4.7
GUS FA22 + GUS FM12	0.25 0.25	19.1	19.2	17.5	23.0	16.0	18.9	-1.6
Dithane F-45 FL	3.2	20.2	16.7	19.6	19.8	19.8	19.2	0.0

Continued.

Table 5. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean[a/]	Change from control (%)
		1	2	3	4	5		
Vitavax 200 FF + Dithane F-45	3.0 3.2	18.2	22.1	17.3	19.6	19.9	19.4	1.0
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	18.8	18.4	17.9	18.2	18.3	18.3	-4.7
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	17.5	18.7	17.7	19.9	19.0	18.5	-3.6
Anchor FL	0.75	19.0	20.0	18.1	19.9	18.5	19.1	-0.5
Apron FL	0.75	17.8	20.6	19.0	18.7	16.9	18.6	-3.1
Dithane F-45 FL	4.0	20.1	15.8	17.4	18.9	16.4	17.7	-7.8
Dithane DF	4.0	17.0	20.6	16.8	19.6	17.2	18.2	-5.2
Monceren 75% WP	2.5	19.0	17.8	17.9	19.1	19.4	18.6	-3.1
Manzate 200 FL	6.0	19.7	18.8	23.3	22.1	16.7	20.1	4.7
Moncut 50 WP	4.0	21.0	19.4	17.3	18.4	19.0	19.0	-1.0
Monceren 75 WP + Apron FL	2.5 0.75	19.9	21.2	20.3	19.4	15.7	19.3	0.5
Moncut 50 WP + Apron FL	4.0 0.75	16.2	20.4	18.0	15.2	19.6	17.8	-7.3
ABG-3109A	50 PPM	16.5	19.9	17.8	16.3	18.2	17.7	-7.8

Continued.

Table 5. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a/]	Change from control (%)
ABG-3109A	25 PPM	18.2	22.2	16.7	19.9	16.1	18.6	-3.1
ABG-3109A	12.5 PPM	17.0	18.6	17.9	15.8	18.3	17.5	-8.9
ABG-3109B	50 PPM	20.3	18.9	19.6	14.4	19.3	18.5	-3.6
ABG-3109B	25 PPM	17.0	19.0	18.9	19.1	22.8	19.3	0.5
ABG-3109B	12.5 PPM	18.2	17.2	16.0	18.9	20.8	18.2	-5.2
Kocide SD + ABG-3109A	6.0 50 PPM	17.9	20.6	18.4	18.3	18.4	18.7	-2.6
Manex II + ABG-3109A	4.0 50 PPM	17.2	17.4	17.9	18.0	24.1	18.9	-1.6
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	17.4	19.1	18.8	19.0	20.4	18.9	-1.6
Dithane F-45 + ABG-3109A	6.0 50 PPM	19.0	20.7	18.4	19.9	19.0	19.4	1.0
Nusan 30 + ABG-3109A	1.25 50 PPM	17.5	17.4	17.6	19.9	17.9	18.0	-6.3
Apron FL + ABG-3109A	0.75 50 PPM	18.6	16.8	23.0	17.7	20.9	19.4	1.0
Champion SD + ABG-3109A	4.0 50 PPM	15.8	17.1	15.0	18.9	20.8	17.5	-8.9

Continued.

Table 5. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean[a/]	Change from control (%)
		1	2	3	4	5		
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	17.0	17.9	15.8	20.6	16.6	17.5	-8.9
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	15.4	17.8	16.5	17.7	20.1	17.5	-8.9
ABG-3110A	50 PPM	16.0	18.3	17.1	18.5	15.5	17.0	-11.5
ABG-3110A	25 PPM	16.3	18.2	17.2	17.4	14.7	16.7(-)*	-13.0
ABG-3110A	12.5 PPM	16.5	22.1	18.3	17.6	20.1	18.9	-1.6
ABG-3111A	50 PPM	18.9	19.7	17.8	21.5	17.6	19.1	-0.5
ABG-3111A	25 PPM	20.6	19.8	17.2	17.8	21.0	19.2	0.0
ABG-3111A	12.5 PPM	19.3	18.3	15.1	18.3	15.7	17.3	-9.9
ABG-3110B	25 PPM	21.4	18.3	18.9	17.7	16.9	18.6	-3.1
ABG-3111B	25 PPM	19.0	19.2	19.3	18.9	15.9	18.4	-4.2
LSD 0.01							NS	
0.05							2.2	

a/ Means marked with asterisks were significantly different at the 0.01 (**) or 0.05 (*) probability levels.

regulator treatments did not significantly increase seedling height after 30 days. Most of the treatments had reduced height when compared to seedlings from untreated seeds.

In the water-seeded, continuous flood test, both fungicides and growth regulator treatments tended to give slight, nonsignificant reductions in seedling height (Table 6).

The seedlings from drill-seeding were most affected by fungicide treatment of seeds (Table 7). Five of the fungicide treatments gave slight, nonsignificant reductions in height.

Gibberelic acid (GA) has been reported (1) to increase seedling height when seeds of the semi-dwarf cultivar Lemont are treated. This allowed seedlings to emerge faster and more successfully. In this study a thin stand (20 seeds/linear foot) was used and the elongated seedlings were weakened and they did not emerge as well as seedlings from untreated seeds. At higher seeding rates, the seedlings en mass or as a group can push through the soil crust even if the seedlings are thinner and weaker. Treatment with a combination of fungicide-growth regulator did not improve performance over either type of treatment alone.

LITERATURE CITED

1. Dunand, R., R. Dilly, Jr., and G. Meche. 1987. Plant growth regulator research in rice: gibberellin-enhanced emergence in rice. Ann. Prog. Rpt., Rice Res. Sta., LA Agri. Expt. Sta., LSU Agricultural Center 79:145-147.

Table 6. Effect of seed-protectant fungicides and growth regulators on height in water-seeded, continuous flood rice (water-seeded on 4-21-89, continuous flood, height measured on 5-26-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean	Change from control (%)
Control (untreated)	-	24.9	20.2	26.7	25.0	22.5	23.9	0.0
Kocide SD	6.0	26.4	23.1	22.2	21.8	23.1	23.3	-2.5
Manex II	4.0	25.5	26.0	22.9	23.5	21.3	23.8	-0.4
Vitavax 200 FF	4.0	25.3	23.8	23.1	23.6	22.9	23.7	-0.8
Thiram 42S	3.3	24.8	22.5	23.7	22.6	22.3	23.1	-3.3
Vitavax 200 + Dithane F-45	3.0 3.2	27.1	25.2	23.1	21.9	22.1	23.8	-0.4
GUS FA12 + GUS FM12	0.125 0.25	27.2	24.7	22.8	21.5	22.4	23.7	-0.8
GUS FA22 + GUS FM12	0.5 0.5	25.7	25.9	23.3	20.4	23.8	23.8	-0.4
Dithane F-45	6.0	26.3	26.3	24.6	23.3	21.5	24.4	2.1
Nusan 30	1.25	25.6	23.9	23.2	25.0	23.2	24.1	0.8
Nusan 30 + Apron	1.25 2.0	25.3	25.2	23.7	24.1	23.8	24.4	2.1
Nusan 30 + Apron	1.0 2.0	25.7	24.0	22.3	22.0	22.1	23.2	-2.9

Continued.

Table 6. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean	Change from control (%)
		1	2	3	4	5		
Champion SD	4.0	24.4	21.9	23.7	23.6	21.5	23.0	-3.8
Zinc Starter	6.0	25.7	23.4	23.9	21.0	23.7	23.5	-1.7
Champ Flowable	4.0	24.7	21.8	22.9	24.2	23.5	23.4	-2.1
Experimental N6FW	4.0	25.6	24.3	23.7	24.5	21.3	23.8	-0.4
Experimental N6Fl	4.0	23.3	24.7	22.5	21.6	22.1	22.8	-4.6
Champion SD + Zinc Starter	4.0 6.0	23.7	22.8	25.4	22.4	22.6	23.3	-2.5
Champion Flowable + Zinc Starter	4.0 6.0	25.4	22.6	23.7	23.0	20.7	23.0	-3.8
Experimental N6FW + Zinc Starter	4.0 6.0	24.5	26.0	22.3	22.7	20.6	23.2	-2.9
Experimental N6Fl + Zinc Starter	4.0 6.0	24.9	24.3	23.2	21.2	25.0	23.7	-0.8
Thiram 42S + GUS 92-01 Binder	3.3 0.25	23.8	23.6	25.6	21.6	20.8	23.0	-3.8
GUS FA22 + GUS FM12	0.25 0.25	24.6	23.0	22.3	21.5	23.8	23.0	-3.8
Dithane F-45 FL	3.2	26.3	24.3	24.7	23.9	19.5	23.7	-0.8

Continued.

Table 6. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean	Change from control (%)
Vitavax 200 FF + Dithane F-45	3.0 3.2	25.9	24.5	24.0	21.9	25.5	24.3	1.7
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	25.7	24.2	22.9	23.0	21.1	23.3	-2.5
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	27.0	22.5	24.0	23.1	23.3	23.9	0.0
Anchor FL	0.75	26.0	24.6	24.3	23.2	23.0	24.2	1.3
Apron FL	0.75	24.1	25.1	25.4	25.3	22.5	24.4	2.1
Dithane F-45 FL	4.0	26.4	24.3	23.9	22.2	22.4	23.8	-0.4
Dithane DF	4.0	27.1	23.9	23.1	25.9	25.1	25.0	4.6
Monceren 75% WP	2.5	26.8	24.4	23.6	23.0	21.8	23.9	0
Manzate 200 FL	6.0	26.7	22.4	23.9	21.3	20.6	22.9	-4.2
Moncut 50 WP	4.0	29.5	23.0	22.4	21.9	21.7	23.7	-0.8
Monceren 75 WP + Apron FL	2.5 0.75	26.2	21.6	22.5	23.7	21.8	23.1	-3.3
Moncut 50 WP + Apron FL	4.0 0.75	24.7	24.0	23.4	22.4	24.0	23.7	-0.8
ABG-3109A	50 PPM	25.0	24.0	24.1	22.9	23.9	23.9	0

Continued.

Table 6. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean	Change from control (%)
ABG-3109A	25 PPM	26.2	22.1	23.0	23.8	23.6	23.7	-0.8
ABG-3109A	12.5 PPM	26.3	23.5	21.4	21.0	23.2	23.0	-3.8
ABG-3109B	50 PPM	26.7	25.3	23.0	25.2	23.7	24.7	3.3
ABG-3109B	25 PPM	27.2	22.1	22.9	25.8	23.6	24.3	1.7
ABG-3109B	12.5 PPM	25.1	20.9	25.6	27.3	24.0	24.5	2.5
Kocide SD + ABG-3109A	6.0 50 PPM	25.4	24.3	26.2	24.8	24.6	25.0	4.6
Manex II + ABG-3109A	4.0 50 PPM	24.1	22.6	25.5	23.4	21.5	23.4	-2.1
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	25.3	26.2	23.1	23.4	22.8	24.1	0.8
Dithane F-45 + ABG-3109A	6.0 50 PPM	22.9	25.6	25.3	23.9	22.7	24.0	0.4
Nusan 30 + ABG-3109A	1.25 50 PPM	25.2	26.9	23.3	23.0	23.4	24.3	1.7
Apron FL + ABG-3109A	0.75 50 PPM	25.7	23.5	22.7	23.7	23.4	23.8	-0.4
Champion SD + ABG-3109A	4.0 50 PPM	24.3	23.0	22.9	21.6	24.2	23.2	-2.9

Continued.

Table 6. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean	Change from control (%)
		1	2	3	4	5		
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	24.9	24.3	21.0	26.4	24.5	24.2	1.3
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	25.2	24.9	24.3	24.5	25.8	24.9	4.2
ABG-3110A	50 PPM	25.7	23.4	24.8	23.1	24.6	24.3	1.7
ABG-3110A	25 PPM	26.2	24.6	23.4	22.2	22.5	23.7	-0.8
ABG-3110A	12.5 PPM	24.5	26.2	24.4	25.0	22.3	24.4	2.1
ABG-3111A	50 PPM	27.1	24.8	23.1	23.4	21.3	23.9	0
ABG-3111A	25 PPM	25.2	22.2	21.8	27.4	22.2	23.7	-0.8
ABG-3111A	12.5 PPM	27.5	23.5	23.2	23.1	23.1	24.0	0.4
ABG-3110B	25 PPM	26.1	24.0	22.9	22.2	22.4	23.5	-1.7
ABG-3111B	25 PPM	26.5	23.8	22.9	24.1	26.3	24.7	3.3
LSD 0.05							NS	

Table 7. Effect of seed-protectant fungicides and growth regulators on height of drill-seeded rice (drill-seeded on 4-20-89, height measured on 5-26-89). Rice Research Station, Crowley, LA.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a/]	Change from control (%)
Control (untreated)	-	19.2	19.0	15.7	18.3	21.5	18.7	0.0
Kocide SD	6.0	22.3	18.7	17.6	16.4	18.5	18.7	0.0
Manex II	4.0	19.6	20.0	20.3	19.9	18.0	19.5	4.3
Vitavax 200 FF	4.0	20.4	19.2	19.5	14.8	17.9	18.3	-2.1
Thiram 42S	3.3	17.3	17.9	16.1	14.4	17.4	16.6(-)*	-11.2
Vitavax 200 + Dithane F-45	3.0 3.2	18.4	16.9	20.1	14.6	17.1	17.4	-6.9
GUS FA12 + GUS FM12	0.125 0.25	21.0	20.4	17.9	15.5	16.6	18.2	-2.7
GUS FA22 + GUS FM12	0.5 0.5	18.3	15.9	18.2	16.3	18.6	17.4	-6.9
Dithane F-45	6.0	19.3	18.9	17.5	17.2	20.2	18.6	-0.5
Nusan 30	1.25	18.4	17.8	15.1	14.3	16.9	16.5(-)*	-11.8
Nusan 30 + Apron	1.25 2.0	19.4	15.1	16.1	14.8	16.3	16.3(-)*	-12.8
Nusan 30 + Apron	1.0 2.0	19.3	17.8	18.5	17.6	17.1	18.0	-3.7
Champion SD	4.0	16.3	20.4	17.7	17.1	20.6	18.4	-1.6

Continued.

Table 7. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a/]	Change from control (%)
Zinc Starter	6.0	19.3	19.6	18.2	16.5	17.3	18.1	-3.2
Champ Flowable	4.0	21.2	20.2	18.2	12.9	17.9	18.0	-3.7
Experimental N6FW	4.0	21.3	19.0	15.7	15.4	17.9	17.8	-4.8
Experimental N6Fl	4.0	19.0	16.8	17.7	15.8	18.8	17.6	-5.9
Champion SD + Zinc Starter	4.0 6.0	18.8	17.5	17.3	14.3	17.3	17.0	-9.1
Champion Flowable + Zinc Starter	4.0 6.0	19.3	18.7	17.5	15.1	18.8	17.8	-4.8
Experimental N6FW + Zinc Starter	4.0 6.0	20.0	18.6	12.8	16.4	15.9	16.7(-)*	-10.7
Experimental N6Fl + Zinc Starter	4.0 6.0	20.7	17.0	15.2	16.4	18.7	17.6	-5.9
Thiram 42S + GUS 92-01 Binder	3.3 0.25	19.9	17.4	17.3	16.6	18.1	17.8	-4.8
GUS FA22 + GUS FM12	0.25 0.25	18.7	17.2	18.1	15.1	18.3	17.4	-6.9
Dithane F-45 FL	3.2	18.0	15.4	20.3	15.8	16.5	17.2	-8.0
Vitavax 200 FF + Dithane F-45	3.0 3.2	16.5	17.0	16.8	16.3	16.5	16.6(-)*	-11.2

Continued.

Table 7. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a/]	Change from control (%)
GUS FA22 + GUS FM12 + GUS 92-01 Binder	0.25 0.25 0.25	21.2	16.8	14.7	17.3	16.3	17.2	-8.0
Vitavax 200 FF + GUS 92-01 Binder	4.0 0.25	17.5	18.8	20.7	13.6	15.5	17.2	-8.0
Anchor FL	0.75	20.7	19.0	15.4	18.7	20.5	18.8	0.5
Apron FL	0.75	18.5	16.9	16.8	15.0	19.0	17.2	-8.0
Dithane F-45 FL	4.0	21.3	19.4	17.5	15.2	16.3	17.9	-4.3
Dithane DF	4.0	17.2	19.8	17.6	15.3	15.3	17.0	-9.1
Monceren 75% WP	2.5	18.4	18.2	19.3	16.1	18.4	18.0	-3.7
Manzate 200 FL	6.0	18.2	20.4	20.8	13.7	20.7	18.7	0.0
Moncut 50 WP	4.0	18.2	18.7	18.5	17.4	20.6	18.6	-0.5
Monceren 75 WP + Apron FL	2.5 0.75	21.1	20.0	20.1	16.5	19.5	19.4	3.7
Moncut 50 WP + Apron FL	4.0 0.75	18.4	19.6	19.9	17.5	20.3	19.1	2.1
ABG-3109A	50 PPM	18.1	17.6	17.6	17.5	19.2	18.0	-3.7
ABG-3109A	25 PPM	19.1	18.9	18.6	15.3	16.4	17.6	-5.9

Continued.

Table 7. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm) 1	2	3	4	5	Mean[a]	Change from control (%)
ABG-3109A	12.5 PPM	19.4	18.5	18.5	15.2	17.2	17.7	-5.3
ABG-3109B	50 PPM	19.7	20.5	17.1	18.9	20.3	19.3	3.2
ABG-3109B	25 PPM	20.2	18.9	17.5	18.1	17.8	18.5	-1.1
ABG-3109B	12.5 PPM	20.3	19.4	20.0	15.6	19.6	18.9	1.1
Kocide SD + ABG-3109A	6.0 50 PPM	20.2	18.3	19.9	15.8	16.2	18.0	-3.7
Manex II + ABG-3109A	4.0 50 PPM	19.6	19.4	18.4	16.5	19.1	18.6	-0.5
Vitavax 200 FF + ABG-3109A	4.0 50 PPM	20.1	16.4	19.0	18.3	16.0	17.9	-4.3
Dithane F-45 + ABG-3109A	6.0 50 PPM	19.6	19.4	17.3	18.2	18.2	18.5	-1.1
Nusan 30 + ABG-3109A	1.25 50 PPM	18.9	18.1	19.6	19.3	16.0	18.3	-2.1
Apron FL + ABG-3109A	0.75 50 PPM	19.9	18.4	17.8	16.9	17.9	18.1	-3.2
Champion SD + ABG-3109A	4.0 50 PPM	21.5	18.1	15.9	15.3	17.8	17.7	-5.3
Vitavax 200 FF + ABG-3109A	4.0 25 PPM	21.9	19.8	19.8	13.9	17.3	18.5	-1.1

Continued.

Table 7. Continued.

Treatment	Rate (oz or fl oz/cwt formulated)	Rep (Height in mm)					Mean[a/]	Change from control (%)
		1	2	3	4	5		
Vitavax 200 FF + ABG-3109A	4.0 12.5 PPM	20.8	17.8	17.7	17.6	16.8	18.1	-3.2
ABG-3110A	50 PPM	19.9	17.5	17.3	15.6	17.1	17.4	-6.9
ABG-3110A	25 PPM	19.0	21.1	15.3	14.2	18.2	17.5	-6.4
ABG-3110A	12.5 PPM	19.1	16.5	19.4	16.1	17.4	17.7	-5.3
ABG-3111A	50 PPM	19.1	16.5	17.0	16.9	17.4	17.3	-7.5
ABG-3111A	25 PPM	19.2	15.8	15.9	18.5	17.2	17.3	-7.5
ABG-3111A	12.5 PPM	16.6	17.0	20.3	16.3	16.5	17.3	-7.5
ABG-3110B	25 PPM	17.5	21.4	18.5	12.0	19.7	17.8	-4.8
ABG-3111B	25 PPM	19.2	18.9	15.4	15.5	17.4	17.2	-8.0
LSD 0.05							1.9	

a/ Means marked with asterisks were significantly different at the 0.05 (*) probability level.

ROTATIONAL CROPS RESEARCH[1/]

R.J. Habetz

Soybeans [*Glycine max* (L.) Merr.] are a major agronomic crop in Louisiana. Southwest Louisiana, where soybeans are grown primarily as a rotational crop with rice, is one of the major soybean producing areas in the state. Some of the soybean acreage is double cropped with wheat (*Triticum aestivum* L.). In recent years, grain sorghum [*Sorghum bicolor* (L.) Moench] acreage has increased. In the southwest area, grain sorghum may serve as an alternate crop to soybeans and may fit well into a rotation system with rice. Soybean, grain sorghum, and wheat varieties differ in their adaptability to soil types and climatic conditions. Consequently, variety trials are conducted at locations throughout the state to aid producers in selecting varieties best adapted to their area. Studies are conducted at the Rice Research Station each year to compare performance of newly released and established soybean, grain sorghum, and wheat varieties, weed control material, and to determine the impact of integrating these alternate crops into rotation systems with rice.

1/ This research is partially supported by funds provided by the Louisiana Soybean an Grain Research and Promotion Board.

SOYBEAN VARIETY TEST

R.J. Habetz, B.G. Harville, W. Hall

Location: Rice Research Station

Soil Type: Crowley silt loam

Seeding Rate: 10 seed/row ft

Planting Date: May 25, 1989

Row Spacing: 32 in

Fertilizer: 0-80-80 ($N-P_2O_5-K_2O$) banded at planting

Plot Size: 4 rows x 30 ft

Treated: 2.0 pt/A Dual broadcast after planting

Insecticide: None

Rainfall: 1st week after planting, 0 in; 2nd week, 3.44 in; 3rd week, 5.05 in

Harvested: At maturity for each variety

Experimental Design: Randomized complete block with four replications

Comments: Large amounts of rainfall that kept the varieties of Group V under water for 3 days caused a reduction in their yield. Adequate rainfall throughout the growing season for Groups VI and VII seemed to show an increase in their yield, but never were they completely under water for an extended period of time. Eight varieties produced more than 50.0 bu/A, with Hartz 7190 having an average yield of 59.3 bu/A (Table 1). The average of Groups VI and VII which consisted of 75 varieties had an overall average of 44.6 bu/A and 44.3 bu/A, respectively. Comparing 3-year averages, which is used to recommend varieties, 13 varieties produced more than 40 bu/A with Hartz 6686 showing a 3-year average of 53.7 bu/A and Asgrow 6785 51.7 bu/A. There was no disease pressure of any kind for the 1989 growing season.

Table 1. Performance of commercial varieties grown on a Crowley silt loam soil at the Rice Research Station, Crowley, LA. 1989.

Maturity group and variety/brand	Yield per acre	Three-year (1987-89) average yield	Date matured	Plant height at maturity	Height of lower pod above ground	Lodging[1/]
	-(bu)-	--(bu/A)--		--(in)--	--(in)---	
Group V						
Pioneer 9592	47.6	-	10/3	16	4	1.0
Terra-Vig 505	47.6	47.4	9/29	19	4	1.0
LA88-6025	45.3	-	10/9	24	4	1.0
Terra-Vig 515	43.3	-	10/4	21	4	1.0
LA88-6023	41.8	-	10/9	23	4	1.0
Coker 6995	40.7	-	9/29	21	4	1.0
Bedford	40.5	-	10/4	24	5	1.0
Asgrow 5979	39.9	-	9/29	17	4	1.0
Hartz 5240	39.6	-	9/25	16	4	1.0
Deltapine 105	39.5	44.6	10/3	18	3	1.0
FFR 565	39.1	37.5	10/2	21	4	1.0
Hutchenson	38.8	-	9/24	20	5	1.0
Coker 485	38.8	41.7	9/29	20	4	1.0
Pioneer 9581	37.9	39.9	9/29	19	4	1.0
LA88-5012	37.3	-	10/7	26	4	1.0
LA88-465	36.4	-	10/4	22	4	1.0
Wilstar 550	36.0	44.7	9/27	18	4	1.0
Buckshot 507	35.7	-	9/29	20	5	1.0
Riverside 577	35.5	42.4	10/3	19	3	1.0
Deltapine 415	35.3	44.8	9/24	17	4	1.0
HSC 579	33.5	-	9/29	18	4	1.0
Stone	32.0	37.2	9/29	19	4	1.0
Pioneer 9591	31.8	-	9/25	16	4	1.0
Agratech 575	31.2	38.2	9/25	16	3	1.0
LA88-5014	30.8	-	10/7	25	4	1.0
Bay	26.9	38.6	9/22	18	3	1.0
Agratech 525	22.6	-	9/22	15	4	1.0
CV (%)	17.1					
LSD (0.05)	9.0					
Group VI						
Hartz 6686	54.3	53.7	10/11	28	4	1.0
Hartz 6200	52.7	47.3	10/3	31	6	1.0
Pioneer 9641	52.3	45.6	10/9	28	5	1.0
Asgrow 6785	50.8	51.7	10/11	32	5	1.0
B2J	50.4	43.0	10/5	27	4	1.0
LA88-6051	48.8	-	10/9	36	6	1.0

Continued.

Table 1. Continued.

Maturity group and variety/brand	Yield per acre	Three-year (1987-89) average yield	Date matured	Plant height at maturity	Height of lower pod above ground	Lodging[1/]
	-(bu)-	--(bu/A)--		--(in)--	--(in)---	
Group VI (continued)						
Asgrow 6297	48.6	-	10/12	22	4	1.0
Spartan	48.3	-	10/16	38	5	1.0
S69-54	48.2	47.4	10/11	28	5	1.0
At Exp 0695	48.1	-	10/11	32	4	1.0
Sharkey	47.8	-	10/11	36	4	1.0
LA77-9729	47.4	-	10/11	36	6	1.0
Ring Around 606	46.8	47.8	10/11	34	5	1.0
FFR 646	46.3	-	10/13	31	4	1.0
Cajun	45.7	-	10/12	24	4	1.0
Riverside 699	45.3	45.3	10/11	26	4	1.0
Davis	44.9	47.6	10/12	36	5	1.0
LA88-6055	44.6	-	10/13	35	5	1.0
Riverside 677	44.3	-	10/16	27	4	1.0
Buckshot 603	44.2	-	10/13	30	4	1.0
EHJU 5	44.1	-	10/11	30	4	1.0
LA87-6002	44.0	-	10/11	36	4	1.0
FFR 695	43.6	-	10/15	21	4	1.0
Twiggs	43.5	-	10/3	26	4	1.0
Pioneer 9691	43.3	-	10/11	28	4	1.0
Baldwin	42.2	39.0	10/11	30	4	1.0
LA88-6013	42.0	-	10/11	31	5	1.0
Hartz 6570	41.9	-	10/9	29	5	1.0
EHJU 7	41.6	-	10/11	34	6	1.0
LA77-8519	41.5	-	10/9	34	4	1.0
Buckshot 604	41.5	-	10/9	27	5	1.0
R1-11	41.4	-	10/13	32	4	1.0
Deltapine 726	41.2	-	10/13	32	5	1.0
FFR 606	41.2	-	10/5	30	5	1.0
LA87-6001	41.0	-	10/13	36	4	1.0
LA87-6011	40.9	-	10/9	32	5	1.0
LA87-6010	40.9	-	10/9	33	4	1.0
LA87-6012	40.3	-	10/9	34	5	1.0
LA88-6024	40.2	-	10/11	30	4	1.0
LaMarr	40.2	-	10/11	28	4	1.0
EHJU 11	40.1	-	10/11	30	4	1.0
Lloyd	37.8	-	10/13	33	5	1.0
CV (%)	6.7					
LSD (0.05)	4.2					

Continued.

Table 1. Continued.

Maturity group and variety/brand	Yield per acre	Three-year (1987-89) average yield	Date matured	Plant height at maturity	Height of lower pod above ground	Lodging[1/]
	-(bu)-	--(bu/A)--		--(in)--	--(in)---	
Group VII						
Hartz 7190	59.3	-	10/24	39	6	1.0
Stonewall	54.3	-	10/16	29	4	1.0
Hartz 7585	50.5	-	10/16	26	4	1.0
Pioneer 9711	49.8	-	10/13	32	4	1.0
Agratech 700	49.7	45.1	10/16	34	6	1.0
Pioneer 9791	48.8	43.5	10/16	32	4	1.0
HSC 721	48.5	-	10/13	27	4	1.0
LA78-5286	48.1	-	10/22	28	4	1.0
Riverside 757	47.6	-	10/16	28	5	1.0
Asgrow 7986	47.5	45.8	10/24	31	5	1.0
Rally	47.2	-	10/20	26	4	1.0
LA79-1133	47.1	-	10/16	31	6	1.0
Asgrow 7258	46.7	-	10/16	29	5	1.0
Hartz 7126	46.6	45.3	10/16	31	6	1.0
Buckshot 703	46.0	-	10/18	26	5	1.0
EHJU 1 P	45.6	-	10/16	26	4	1.0
LA79-11123	45.3	-	10/22	28	4	1.0
Starr	43.1	36.9	10/16	33	4	1.0
Colquitt	42.8	-	10/16	24	3	1.0
LA78-17908	42.3	-	10/17	30	4	1.0
DPX-878	42.0	-	10/22	31	5	1.0
Deltapine 417	41.9	-	10/16	28	4	1.0
Terra-Vig 708	41.6	-	10/18	34	6	1.0
Pioneer 9751	41.1	-	10/16	28	4	1.0
Terra-Vig 727	40.3	-	10/16	32	6	1.0
LA79-1004	39.9	-	10.18	41	4	1.0
LA87-7010	39.8	-	10/16	28	4	1.0
EHJU-3	38.5	-	10/18	29	4	1.0
LA87-7030	37.7	-	10/16	32	4	1.0
Terra Vig 717	36.8	-	10/16	32	6	1.0
LA87-7022	36.3	-	10/21	38	4	1.0
LA87-7032	36.1	-	10/16	35	4	1.0
LA79-11682	35.5	-	10/20	33	6	1.0
CV (%)	6.1					
LSD (0.05)	3.8					

GRAIN SORGHUM VARIETY TEST

R.J. Habetz, M.S. Kang, and W. Hall

Location: Rice Research Station

Soil Type: Crowley silt loam

Planting Date: Apr 19, 1989

Row Spacing: 32 in

Fertilizer: 40-80-80 ($N-P_2O_5-K_2O$) banded at planting; 80-0-0 (21%) on May 30

Plot Size: 4 rows x 30 ft

Treated: 3 pt/A atrazine applied broadcast after planting

Rainfall: 1st week after planting, 0 in; 2nd week, .20 in; 3rd week, 1.72 in

Harvested: Sept 1

Experimental Design: Randomized complete block with four replications

Comments: In 1989, 24 early and medium maturity, and 15 full season bird susceptible grain sorghum hybrid varieties were evaluated. For the early and medium varieties, 6 varieties had a yield of over 5000 pounds (Table 1), with Cargill 1022 showing the highest at 5382 pounds. For the full season varieties nine showed yields above 4000 pounds (Table 2) with DK-64 (4586 lb/A), S-9750 (4573 lb/A) and Capehart Champion (4547 lb/A) having the highest yields.

Topaz had the highest 2- (5116 lb/A) and 3-year (4799 lb/A) average for the early and medium varieties (Table 1). In the full season varieties, GS-712 had the highest 2- and 3-year average yields which were 4946 lb/A and 4571 lb/A, respectively.

There were no disease pressure in 1989 so no ratings were made.

Table 1. Performance of early and medium maturity, bird susceptible grain sorghum hybrids at the Rice Research Station, Crowley, LA. 1989.

Company/Brand	Hybrid	Yield 1989	Yield 2-year average	Yield 3-year average	Grain moisture	Heading date
		---------(lb/A)--------			---(%)--	-(days)-
Cargill Seed	1022	5382	4491	4394	13.5	71
Pioneer Hi-Bred Int.	8222	5124	5052	4256	12.9	67
Asgrow Seed	Topaz	5112	5116	4799	13.5	69
Cargill Seed	4462	5104	4851	4109	13.0	66
Pioneer Hi-Bred Int.	8230	5049	4752	----	13.4	67
Hyperformer Seed	HSC Cherokee	5020	4902	4470	13.3	77
Pioneer Hi-Bred Int.	8333	4974	4936	4364	12.8	68
Big Crop Seed	HT 126 DR	4955	4771	4426	12.4	68
Capehart Seed	Contender	4936	4842	4528	12.5	76
Triumph Seed	TR 65-G	4851	----	----	13.3	69
Triumph Seed	Two 70-D	4626	4903	----	12.5	73
Delta and Pine Land	G-522 DR	4580	4766	4532	12.6	69
Oro Hybrids	ORO XTRA	4537	4454	----	12.8	74
New Northrup King	2665	4511	4942	4699	12.9	79
Cargill Seed	847	4501	----	----	13.2	75
Delta and Pine Land	G-1602	4462	4317	3908	12.9	70
Big Crop Seed	TORO Optima	4456	----	----	12.6	68
DeKalb-Pfizer Genetics	DK-50	4432	4627	4459	14.5	74
Cargill Seed	R1090	4430	4708	3926	12.6	68
DeKalb-Pfizer Genetics	M565	4424	4623	4441	13.2	72
New Northrup King	KS 780	4289	4468	----	12.5	77
Hyperformer Seed	1225 DR	4285	4655	4337	12.5	75
Pennington Ent.	Penngrain DR	3935	----	----	12.8	78
New Northern King	KS 737	3812	4146	----	12.9	68
Mean		4653			13.0	
CV (%)		11.6			4.4	
LSD (0.05)		759			0.8	

Table 2. Performance of full-season, bird susceptible grain sorghum hybrids at the Rice Research Station, Crowley, LA. 1989.

Company/Brand	Hybrid	Yield 1989	Yield 2-yr avg.	Yield 3-yr avg.	Grain moisture	Heading date
		-----(lb/A)-----			---(%)--	(days)
DeKalb-Pfizer Genetics	DK-64	4586	4853	4490	13.9	68
New Northrup King	S-9750	4573	4479	4224	12.8	76
Capehart Seed	Capehart Champion	4547	4819	4343	12.9	70
Cargill Seed	6670	4419	4618	4369	12.6	78
Asgrow Seed	GS 712	4373	4946	4571	12.4	72
SeedTec	ST-D701G	4340	4726	4556	12.8	69
Capehart Seed	Capehart Challenger	4326	4511	4261	12.7	72
HyPerformer Seed	1330DR	4237	4708	4362	12.8	71
Delta and Pine Land	RA-787	4162	4340	4118	12.8	72
Delta and Pine Land	G-1711	3920	4326	4205	12.9	77
Cargill Seed	DR 1125	3889	4265	4167	12.3	73
DeKalb-Pfizer Genetics	X-732	3763	----	----	13.0	78
HyPerformer Seed	HSC Wings	3705	4352	4129	12.5	73
Oro Hybrids	ORO G XTRA	3671	----	----	12.6	77
Delta and Pine Land	6012XS	3404	----	----	13.2	77
Mean		4128			12.8	
CV (%)		11.6			2.7	
LSD (0.05)		683			0.5	

WHEAT VARIETY TEST

R.J. Habetz and S.A. Harrison

Location: Rice Research Station

Soil Type: Crowley silt loam

Seeding Rate: 90 lb/A

Planting Date: Nov 9, 1988

Fertilizer: 30-90-90 ($N-P_2O_5-K_2O$) broadcast and incorporated prior to planting; 80-0-0 (21%) on Feb 14, 1989 applied 40-0-0 (21%) more to high management test on Mar 8

Fungicide: Applied 2.0 lb/A Dithane M-45 plus 2.0 oz/A Bayleton to high management test on Mar 10 and 2nd application on Mar 24

Plot Size: 4 x 40 ft

Harvested: May 17

Experimental Design: Randomized complete block with four replications

Comments: Two wheat variety test were conducted in 1989, consisting of a conventional and high management test, with the high management test receiving an additional topdressing and disease control measures. The acreage yield of all varieties for 1989 under conventional and high management conditions was 32.1 bu/A and 43.5 bu/A, respectively. Terral 101 had the highest yield (45.8 bu/A) (Table 1), EH 8505, Coker 9877, FFR 525, Coker 983, and Coker 9766 also yielded greater than 40 bu/A under conventional management. FFR 525 (65.0 bu/A) had the highest yield under high management, followed by Terral 101 (62.0 bu/A). The average increase in yield under high management was 11.4 bu/A. Leaf rust was severe on susceptible varieties. Eleven varieties had 0% leaf rust under conventional management, while four varieties had 50% or greater leaf rust.

The average yield of 12 entries tested for 3 years under conventional management at Crowley was 47.5 bu/A (Table 2). Florida 302 had the highest 3-year mean yield (60.4 bu/A), Coker 9766, Coker 983, Terral 812, and McNair 1003 all had 3-year mean yields of greater than 50 bu/A under conventional management. Coker 9877 had the highest 2-year mean yield (59.7 bu/A). Coker 9766, Florida 302, Coker 983, Terral 812, and McNair 1003 had 2-year mean yields of over 50 bu/A.

The average test weight was 56.3 and 57.0 lb/bu for 3 and 2 year means, respectively.

Table 1. Performance of entries in the wheat performance trials under conventional and high management systems at the Rice Research Station, Crowley, LA. 1989.

Variety	Yield[1/] C	Yield[1/] H	Test weight[2/] C	Test weight[2/] H	Maturity date[3/]	Plant height	Leaf rust[4/] C	Leaf rust[4/] H	Xanth[5/] C	Xanth[5/] H	Septoria C	Septoria H
	---(bu/A)---		---(lb/bu)--				----(%)-----		---(rate)--		---(rate)--	
Terral 101	45.8	62.0	54.8	54.5	124	33	0	0	3.0	2.0	3.5	3.5
EH 8505	45.3	49.8	54.8	55.7	119	30	10	15	2.0	2.0	6.5	4.0
Coker 9877	44.1	56.6	55.3	55.5	120	31	0	0	2.5	2.0	4.5	3.5
FFR 525	42.7	65.0	56.2	56.4	121	35	5	0	3.0	2.0	4.0	2.5
Coker 983	42.4	51.7	57.0	57.5	121	26	10	3	2.0	2.0	4.0	3.5
Coker 9766	40.9	56.3	55.7	55.2	118	29	0	0	2.0	2.0	4.0	3.0
Terral 817	39.5	50.5	55.8	56.3	118	33	0	0	2.0	2.0	3.5	3.5
Terral 812	38.6	44.6	56.2	56.2	119	29	3	3	3.5	2.5	4.5	3.5
Florida 302	37.7	52.2	55.8	55.6	119	29	0	3	2.0	2.0	5.5	4.0
McNair 1003	33.0	53.8	55.2	54.7	120	29	55	23	2.5	2.0	6.5	4.0
Traveler	32.7	40.3	55.7	55.9	117	27	8	0	2.0	2.5	5.0	4.5
Keiser	30.7	49.3	54.6	54.5	121	32	0	0	2.0	2.0	3.5	3.0
Terral 102	30.6	46.8	55.2	55.3	118	31	60	15	2.0	2.0	5.5	4.0
Coker 9323	27.6	43.5	55.2	55.2	116	25	0	0	2.0	2.0	4.0	4.5
Coker 916	26.6	44.2	54.5	54.7	123	33	60	18	2.0	2.0	3.0	2.5
Coker 9227	24.5	26.9	56.6	55.5	118	28	0	0	2.0	2.0	4.5	2.5
Florida 301H	24.2	26.5	55.3	55.1	106	28	10	20	2.0	2.0	5.5	3.5
Coker 9733	23.3	22.6	55.5	56.1	120	31	0	0	2.0	3.0	6.5	4.0
Florida 301	23.2	32.0	55.7	55.9	105	30	8	3	2.0	2.0	4.5	2.5
Florida 303	21.6	30.2	55.8	55.5	106	25	0	0	2.0	2.0	5.0	5.0
Fl 7927-G29	20.6	26.5	56.4	55.9	106	28	0	0	2.5	2.0	5.0	4.0
Hartz 2440	10.6	25.5	54.0	52.1	126	33	50	33	2.0	2.0	3.0	2.5
Mean	32.1	43.5	55.5	55.4	117.3	29.6	12.6	6.0	2.2	2.1	4.6	3.5
CV (%)	16	16	1	1	0	4	66	66	19	19	21	21
LSD (0.10)	7.3	7.3	0.9	0.9	-	1.4	7.4	7.4	0.5	0.5	1.0	1.0

1/ Yields for conventional (C) and high (H) management adjusted to 13% moisture. 2/ Test weight for conventional (C) and high (H) management. 3/ Days after Dec. 31 until 50% of heads are physiologically mature. 4/ Percent coverage of upper three leaves rated on modified Cobb's scale. 5/ Xanthomonas (bacterial streak) rated on scale of 1 to 9, where 1 indicates no disease and 9 indicates severe disease on the head and flag leaf. 6/ Septoria leaf and glume blotch rated on a scale of 1 to 9 where 1 indicates no disease and 9 indicates severe disease on the head and flag leaf.

Table 2. Performance of entries in the wheat performance trials under conventional management for 3 years, 1987-89, at the Rice Research Station, Crowley, LA.

Variety	Yield[1] x3	Yield[1] x2	Test weight x3	Test weight x2	Leaf rust[2/] x3	Leaf rust[2/] x2	Stem rust[3/] x2	Xanth[4/] x3	Xanth[4/] x2	Septoria[5/] x2
	--(bu/A)---		--(lb/bu)--		------(%)------			-------(rate)-------		
Florida 302	60.4	56.8	55.7	56.6	2	0	0	4.3	4.2	4.0
Coker 9766	56.6	57.0	55.9	56.8	1	0	16	4.8	4.2	3.8
Coker 983	53.6	53.8	57.9	58.8	0	11	10	4.5	4.0	3.5
Terral 812	52.7	52.6	56.0	57.4	4	5	8	5.2	5.0	4.9
McNair 1003	51.5	50.0	55.7	56.1	32	36	13	4.9	4.4	4.1
Keiser	46.7	45.9	55.5	56.0	10	5	4	4.5	4.0	4.2
Coker 9323	45.7	44.7	56.7	56.6	8	6	12	5.0	4.2	5.4
Terral 817	45.6	46.2	56.5	57.4	3	2	5	4.2	4.1	3.5
Coker 916	44.0	35.8	54.7	55.0	36	50	21	4.2	4.0	4.1
Coker 9227	41.1	41.1	57.8	58.2	1	0	6	5.3	4.2	3.5
Coker 9733	39.0	42.3	56.4	57.5	0	0	0	5.8	4.4	3.0
Florida 301	33.4	34.5	56.6	57.3	10	15	0	4.4	4.4	3.8
Coker 9877	----	59.7	----	56.8	--	0	0	4.0	4.0	4.9
Traveler	----	54.6	----	57.9	--	4	0	4.4	4.4	5.2
Florida 303	----	34.6	----	57.1	--	0	8	4.5	4.5	5.0
Florida 301H	----	29.0	----	56.6	--	22	0	4.5	4.5	5.6
Mean	47.5	46.2	56.3	57.0	9.8	9.8	8.0	4.8	4.3	4.3
CV (%)	11	11	3	1	51	61	104	12	13	24
LSD (0.10)	3.6	4.3	1.1	0.7	4.9	7.2	10.2	0.6	0.7	1.2

1/ Yields adjusted to 13% moisture. Means for 3 and 2 years, respectively.
2/ Percent coverage of upper three leaves rated on a modified Cobb's scale.
3/ Percent coverage on a modified Cobb's scale.
4/ Xanthomonas (bacterial streak) rated on a 1 to 9 scale where 1 indicates no disease and 9 indicates severe disease on the head and flag leaf.
5/ Septoria leaf and glume blotch rated on a 1 to 9 scale; where 1 indicates no disease and 9 indicates severe disease on the head and flag leaf.

OFF-STATION VARIETY TEST

(Larry Lejeune Farm)

R.J. Habetz and B.G. Harville

Environmental conditions, soil type, disease and weed pressure vary at different locations. For these reasons, an off-station soybean variety test was conducted at the Larry Lejeune farm near Elton.

The test consisted of 20 recommended varieties for southwest Louisiana and eight Louisiana Agricultural Experiment Station experimental lines. Varieties were planted on May 26 at a seeding rate of approximately 60 lb/A on a silty clay type soil. Plots were four 32-inch rows 30 feet in length. A randomized complete block design with four replications was used. Fertilizer at a rate of 0-80-80 ($N-P_2O_5-K_2O$) was banded on each side of the row at planting. A tank mix of linuron (Lorox) at 2.0 pt/A and metolachlor (Dual) at 2.0 pt/A was surface applied after planting. On June 20, fomesafen (Reflex) at 1.5 pt/A was applied overtop for further weed control. Varieties were combine harvested at maturity. Seed yield was calculated from yield per plot and adjusted to 13% moisture. Agronomic characteristics, including plant height and lower pod height, were measured.

Ten varieties had a yield above 30 bushels with Hartz 6686 (35.8 bu/A) yielding the highest, followed closely by Coker 6727 (34.8 bu/A), Riverside 699 (33.6 bu/A), and Riverside 577 (33.5 bu/A), respectively. Large amounts of rainfall slightly depressed yields but with the exception of Wilstar 550 and Pioneer 9581 stands were adequate.

Table 1. Performance of soybean varieties grown on a silty clay type soil at the Larry Lejeune Farm, Pine Island, LA. 1989.

Variety/brand	Yield per acre	Date matured	Plant height at maturity	Height of lower pod above ground
	-(bu)-		-----------(in)-----------	
Coker 485	24.8	10/1	21	3
Deltapine 105	24.1	9/21	22	4
Deltapine 415	31.1	9/20	23	4
Pioneer 9581	27.0	10/1	20	4
Riverside 577	33.5	10/1	25	4
Terra-Vig 505	32.9	9/22	26	4
Wilstar 550	27.8	9/21	16	2
LA 5902-465	25.8	10/2	22	5
Asgrow 6785	28.4	10/3	26	5
Davis	24.9	10/3	20	4
Hartz 6686	35.8	10/10	21	4
S69-54	27.9	10/3	25	4
Riverside 699	33.6	10/3	30	6
Terra-Vig 616	27.1	10/7	25	5
Ring Around 606	27.3	10/3	28	6
LA 6902-9729	31.0	10/3	30	4
LA 6912-8519	24.0	10/3	28	4
Agratech 700	25.2	10/9	24	4
Asgrow 7986	32.7	10/12	22	3
Coker 6727	34.8	10/6	22	3
Hartz 7126	23.5	10/8	22	4
Pioneer 9791	32.6	10/6	24	3
Ransom	28.5	10/7	22	4
LA 7903-5286	24.8	10/8	24	5
LA 7905-11123	32.6	10/10	22	4
LA 7908-11682	26.2	10/10	26	4
LA 7910-1133	28.6	10/9	22	4
Hartz 8112	23.6	10/12	27	5
CV (%)	20.4			
LSD (0.05)	8.2			

SOYBEAN WEED CONTROL RESEARCH

R.J. Habetz

INTRODUCTION

Southwest Louisiana has an abundance of weed species, some not commonly found in other areas of the state. Our climatic conditions are favorable to prolific weed growth and subsequent competition with crop species. We have a unique situation at the Rice Research Station in that a large portion of the soybean growers in the southwest drill-plant their soybeans. Also, at times, we get large amounts of rainfall which can cause herbicide injury and expense of replanting.

Selected weed areas on the Rice Research Station were used and had uniform weed populations. Weed species evaluated for control were: pitted morningglory (*Ipomea lacunosa* L.), cocklebur (*Xanthium strumarium* L.), sicklepod (*Cassia obtusifolia* L.), and annual grasses. Specific information on location, soil type, variety, row spacing, treatment data, sprayer type, etc., for each experiment is individually presented followed by a table of results.

Weed control and crop injury ratings for all experiments are based on a scale of 0 to 100%, where 0 equals no control or crop injury and 100 equals complete control or crop injury. In the crop tolerance and stale seedbed test, crop yields were obtained and adjusted to 13% moisture.

Experiment: Soybean tolerance to pre- and postemergence herbicides

Location: Rice Research Station

Soil Type: Crowley silt loam

Variety/Seeding Rate: Centennial, 50 lb/A

Planting Date: May 26, 1989

Row Spacing: 32 inches

Fertilizer: 0-80-80 banded at planting

Plot Size: 3 rows x 25 ft (treat 2 rows)

Treated: May 26 (PES); June 21 (POT)

Crop Size: V3 (10-12 in)

Sprayer: Tractor compressed air - 20 GPA, 11003 nozzles, 25 psi

Rated: July 5, July 19

Rainfall: 1st week after planting, .69 in; 2nd week, 2.75 in; 3rd week, 5.05

Experimental Design: Randomized complete block, four replications

Table 1. Soybean tolerance to pre- and postemergence herbicides. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate of application	Application time	Photo-toxicity 7/5	Photo-toxicity 7/19	Mature plant height	Mature pod height	Yield
	-(lb ai/A)-		---(%)--		-----(in)----		(bu/A)
Lexone (75% DF)	0.56	PES	11	16	28	4	34.2
Scepter (1.5 EC)	0.125	PES	5	5	28	4	38.9
Scepter/Scepter	0.125/0.125 1/	PES/POT	6	7	30	4	38.1
Scepter	0.125 1/	POT	4	5	29	4	39.3
Canopy (75% DF)	0.56	PES	10	8	29	4	39.0
Canopy/Classic (25% DF)	0.56/.008 1/	PES/POT	6	4	28	4	36.7
Classic	.008 1/	POT	5	5	29	4	37.0
Classic	.012 1/	POT	9	5	26	4	35.4
Cadre (2 EC)	.063 1/	POT	51	26	21	2	30.2
Cadre	.032 1/	POT	29	13	22	3	34.8
Cadre	.016 1/	POT	16	12	25	4	35.1
Cobra (2 EC)	0.20 1/	POT	17	18	27	4	34.8
Cobra	0.20 2/	POT	12	5	27	4	33.9
Blazer (2 EC)	0.50 1/	POT	10	4	28	4	35.6
Reflex (2 EC)	.375 1/	POT	2	3	30	4	39.2
Pursuit (2 EC)	.063 1/	POT	2	2	32	4	40.8
Check	----		0	1	34	5	41.7
CV (%)			34.5	90.1	10.1	17.6	7.9
LSD (0.05)			5.6	10.4	4.0	1.0	4.1

1/ X-77 nonionic surfactant added at 0.25% (v/v) to post overtop treatments.
2/ Agridex crop oil concentrate added at 1 pt/A.

Experiment: Stale seedbed test

Location: Rice Research Station

Soil Type: Crowley silt loam

Variety/Seeding Rate: Centennial, 50 lb/A

Planting Date: May 10

Row Spacing: 30 inches

Fertilizer: None

Plot Size: 3 rows x 25 ft (treat 2 rows)

Treated: May 10 (PES, burndown); June 6 (POT)

Crop Size: V1 (4 in) burndown grasses and weeds (3-4 in)

Weed Size: CB (4-6 in); PMG (3 in); AG (3-4 in)

Sprayer: Tractor compressed air - 20 GPA, 11003 nozzles, 25 psi

Rated: July 11

Rainfall: 1st week after planting, .5 in; 2nd week, 5.50; 3rd week, 0.0 in

Experimental Design: Randomized complete block, four replications

Table 2. Annual grasses (AG), cocklebur (CB), and pitted morningglory (PMG) control, and soybean injury (I) using pre- and postemergence herbicides in a stale seedbed. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate of application	Application time	Weed control/ phytotoxicity 7/11 AG	CB	PMG	I	Yield
	-(lb ai/A)-		-----------(%)-----------				(bu/A)
Gramoxone Super/Dual[1/]	0.38/2.00	PES	59	77	82	3	26.1
Gram. Sup./Dual/Canopy[1/]	0.38/2.00/0.56	PES	96	96	96	27	22.2
Gram. Sup./Dual/Scepter[1/]	0.38/2.00/.125	PES	76	93	91	4	24.9
Gram. Sup./Dual/Sencor[1/]	0.38/2.00/0.56	PES	94	78	79	0	26.3
Gram. Sup./Fusilade 2000/Reflex[1/]	0.38/.188/0.38	PES/POT/POT	96	98	99	0	33.6
Gram. Sup./Dual/Storm[2/]	0.38/2.00/0.75	PES/PES/POT	80	94	95	1	24.7
Roundup/Dual[1/]	1.00/2.00	PES	78	86	86	1	28.5
Roundup/Dual/Canopy[1/]	1.00/2.00/0.56	PES	93	92	92	25	17.9
Roundup/Dual/Scepter[1/]	1.00/2.00/.125	PES	76	95	92	1	24.2
Roundup/Dual/Sencor[1/]	1.00/2.00/0.56	PES	92	90	90	1	29.1
Roundup/Fusilade 2000/Reflex[1/]	1.00/.188/0.38	PES/POT/POT	99	99	99	0	31.4
Roundup/Dual/Storm[2/]	1.00/2.00/0.75	PES/PES/POT	94	97	95	1	27.5
Ignite/Dual[1/]	0.75/2.00	PES	92	58	61	1	24.8
Ignite/Dual/Canopy[1/]	0.75/2.00/0.56	PES	94	96	95	21	24.5
Ignite/Dual/Scepter[1/]	0.75/2.00/.125	PES	92	95	94	3	24.7
Ignite/Dual/Sencor[1/]	0.75/2.00/0.56	PES	95	86	88	1	26.8
Ignite/Fusilade 2000/Reflex[1/]	0.75/.188/0.38	PES/POT/POT	98	98	98	1	29.2
Ignite/Dual/Storm[2/]	0.75/2.00/0.75	PES/PES/POT	97	99	98	1	26.1
Check			0	0	0	0	12.3
CV (%)			12.5	9.4	8.0	172.9	16.7
LSD (0.05)			14.9	11.4	9.8	11.7	6.0

1/ X-77 nonionic surfactant added at 0.25% (v/v).
2/ Agridex crop oil concentrate added at 1 pt/A.

Experiment: Sicklepod control study

Location: Rice Research Station

Soil Type: Crowley silt loam

Variety/Seeding Rate: Centennial, 50 lb/A

Planting Date: May 11

Row Spacing: 30 inches

Fertilizer: None

Plot Size: 3 rows x 25 ft (treat 2 rows)

Treated: May 11 (PES), May 29 (POT 1), June 6 (POT 2)

Weed Size: POT 1, 1 leaf; POT 2, 2-3 leaf

Crop Size: POT 1 (V1 - 4 in); POT 2 (V2-V3, 6 in)

Sprayer: Tractor compressed air - 20 GPA, 11003 nozzles, 25 psi

Rated: July 11

Rainfall: 1st week after planting, 3.80 in; 2nd week, 0.0; 3rd week, .50

Experimental Design: Randomized complete block, four replications

Table 3. Annual grasses (AG), sicklepod (SP) control, and soybean injury (I) using pre- and postemergence herbicides. Rice Research Station, Crowley, LA. 1989.

Treatment[1/]	Rate of application	Application time	Weed control phytotoxicity 7/11 AG	SP	I
	-(lb ai/A)-		(%)		
Lexone/Classic	0.38/.008	PES/POT 1[2/]	95	71	2
Scepter/Scepter	.125/.125	PES/POT 1	96	96	16
Lexone/Scepter	0.38/.125	PES/POT 1	98	97	4
Scepter/Classic	.125/.008	PES/POT 1	96	84	22
Lexone/Blazer	0.38/0.50	PES/POT 1	96	76	2
Lexone/Reflex	0.38/.375	PES/POT 1	98	84	0
Lexone/Cobra	0.38/0.20	PES/POT 1	96	62	1
CADRE	.016	POT 1	96	86	6
CADRE	.032	POT 1	99	95	14
CADRE	.064	POT 1	99	99	41
CADRE	.016	POT 2[3/]	95	90	8
CADRE	.032	POT 2	98	98	24
CADRE	.064	POT 2	99	99	48
Lexone (check)	0.38	PES	90	0	0
CV (%)			2.6	10.4	41.8
LSD (0.05)			3.6	12.0	8.0

1/ X-77 non ionic surfactant added at o.25% (V/V)
2/ POT 1 = post overtop treatment applied at the one leaf stage of sicklepod.
3/ POT 2 = post overtop treatment applied at the 2-3 leaf stage of sicklepod.

Experiment: General Weed Control Test

Location: Rice Research Station

Soil Type: Crowley silt loam

Variety/Seeding Rate: Centennial, 50 lb/A

Planting Date: May 10

Row Spacing: 30 in.

Fertilizer: none

Plot Size: 3 rows x 25 ft. (treated two rows)

Treated: Early post overtop (EP), May 26, Late post overtop (LP) June 6

Weed Size: Early post - 1 leaf, Late post 2-3 leaf

Crop Size: V1 - V2

Sprayer: Tractor compressed air - 20 GPA, 11003 nozzles, 25 psi

Rated: July 11

Rainfall: 1st week after planting, 0.5 in.; 2nd week, 5.55 in.; 3rd week, 0.0

Experimental Design: Randomized complete block, four replications

Table 4. Annual grasses (AG), cocklebur (CB), and pitted morningglory (PMG) control, and soybean injury (I) using pre- and postemergence herbicides. Rice Research Station, Crowley, LA. 1989.

Treatment	Rate of application	Application time	Weed control phytotoxicity 7/11 AG	CB	PMG	I
	-(lb ai/A)-		-----------(%)---------			
Dual/Canopy	2.00/0.38	PES/PES	97	98	96	11
Dual/Scepter	2.00/.125	PES/PES	94	93	94	1
Dual/Sencor	2.00/0.38	PES/PES	94	84	86	2
Dual/Blazer	2.00/0.38 1/	PES/LP	91	95	95	4
Dual/Cobra	2.00/0.20 1/	PES/LP	93	96	96	6
Dual/Scepter	2.00/.125 1/	PES/LP	96	97	94	1
Dual/Classic	2.00/.008 1/	PES/LP	94	98	97	3
Dual/Reflex	2.00/.375 1/	PES/LP	94	98	98	0
Fusilade 2000/Reflex	.063/.188 2/	EP/EP 3/ + LP/LP 4/	99	99	99	0
Fusilade 2000/Reflex	.125/.375 2/	LP	91	96	96	0
CV (%)			3.7	3.3	2.5	97.9
LSD (0.05)			4.9	4.4	3.3	4.0

1/ X-77 nonionic surfactant added at 0.25% (v/v).
2/ Agridex crop oil concentrate added at 1 pt/A.
3/ Early post (EP) = post overtop treatment applied 10 days after weed emergence.
4/ Late post (LP) = post overtop treatment applied 10 days after early post.

FORAGE CROPS TISSUE CULTURE RESEARCH

BERMUDAGRASS IMPROVEMENT THROUGH TISSUE CULTURE

S.S. Croughan

Production of Regenerated Plants

S.S. Croughan and K.M. Hebert

Research in this area focused on determining a media sequence to improve the plant regeneration efficiency from Coastal inflorescences. Coastal is the most widely grown hybrid forage bermudagrass in the southeastern United States. Regeneration frequency is variety specific and the regeneration rates for Coastal are quite low.

Shoot material was collected from the Hill Farm Research Station in Homer, LA on June 20, July 26, and September 7, 1989. Stems were trimmed to approximately 90 mm lengths and stored in a refrigerator until sterilization. Approximately 400 immature inflorescences were processed using the standard methods. In addition, over 400 immature inflorescences were evaluated for their response to the following media sequence. Immature inflorescences between 5 and 25 mm in length were plated onto Murashige and Skoog basal medium containing 6% sucrose and either 5 or 20 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D). The inflorescences were transferred after either 3, 7, 10, or 14 days onto Murashige and Skoog basal medium containing either 3 or 6% sucrose, with 0 or 1 mg/l 2,4-D and 0 or 0.5 g/l activated charcoal. Every 2 to 4 weeks the inflorescences and developing calli were transferred to fresh media. Data is still being collected from this experiment, but it appears that the regeneration frequency was not increased with any of the media sequences evaluated. Time on 2,4-D was not a critical factor and activated charcoal appeared to promote the formation of roots, but did not increase shoot development.

Screening for Resistance to *Bipolaris cynodontis* and *Spodoptera frugiperda*

P.D. Colyer, S.S. Quisenberry, K.M. Hebert, and S.S. Croughan

Regenerated bermudagrass plants continued to be evaluated for resistance to fall armyworm and leaf spot disease. Over 660 regenerated lines have been screened for fall armyworm resistance. Several lines have gone into advanced testing for confirmation of fall armyworm resistance.

New isolates of the fungus *Bipolaris cynodontis* (previously named *Helminthosporium cynodontis*) are being evaluated for toxin production and methods for optimal toxin production evaluated to improve the screening process. Among 140 isolates screened for toxin production, 21 were identified as good toxin producers. These were retested and the top 12 isolates identified. Table 1 shows the disease symptom ratings of four bermudagrass varieties tested against the toxin produced from these 12 isolates.

Table 1. Disease symptom ratings of four bermudagrass varieties tested with toxin from the top 12 isolates identified for toxin production.

Isolate	Bermudagrass variety: Coastal	Grazer	Brazos	Hardie	Average
	Disease symptom rating[1]				
160	3.5	2.0	3.0	4.0	3.1
166	3.0	2.0	3.0	3.5	2.9
183	3.5	2.0	3.0	3.5	3.0
185	3.0	2.0	3.0	3.0	2.8
191	2.5	2.5	3.0	3.5	2.9
205	3.0	2.5	3.0	4.0	3.1
206	3.0	1.5	3.0	3.0	2.6
278	2.5	1.5	3.0	3.0	2.5
388	2.5	2.0	3.0	3.0	2.6
412	1.0	1.0	2.5	3.0	1.9
413	2.0	2.0	2.0	3.0	2.3
427	2.0	2.0	3.0	3.0	2.5
Average	2.6	1.9	2.9	3.3	

[1] Rating scale: 0 = no symptoms, 5 = severe symptoms.

Field Evaluation of Regenerated Bermudagrass Plants

M.M. Eichhorn, Jr., S.S. Croughan, B.D. Nelson, and K.M. Hebert

Field evaluations of regenerated lines of bermudagrass are continuing. An additional seven regenerated lines and two checks (Coastal and Oklan) were established at the Hill Farm Research Station in Homer, LA on April 10, 1989. Additional information on these lines and others planted in previous years may be obtained by contacting Dr. M.M. Eichhorn, Jr. at the Hill Farm Research Station.

At the Rice Research Station in Crowley, LA, data were collected for the third year from plots established in 1987. While several of the regenerated lines performed as well as the parent variety from which they were developed, none of the regenerated lines had consistently better yield or quality.

Among 154 lines of regenerated bermudagrass established in the field in 1988, only 95 were maintained for further evaluation in 1989. The 95 lines were selected through visual rating for stand establishment and overall growth habit. Plots were harvested and samples taken for quality analysis. At least one more year of data will be collected before conclusions are drawn.

ALFALFA IMPROVEMENT THROUGH TISSUE CULTURE

S.S. Croughan

Evaluation of regenerated alfalfa plants: Screening for resistance to *Phoma medicaginis* and field tests

S.S. Croughan, K.A. Fishbeck, P.D. Colyer, J.L. Rabb, and K.M. Hebert

Screening for resistance to *Phoma medicaginis* was continued. Seed-derived plants were evaluated four times to determine the repeatability of the method and seasonal influences. While there was some variability between runs, the overall trend was the same for the four varieties. The majority of plants had disease ratings of 1 or 2 (0 = no symptoms, and 5 = severe symptoms) for Apollo, Vangard, and WL 318, while the population of Florida 77 plants had a fairly even distribution across all rating levels. Several regenerated plants had low disease ratings, however with the low ratings on the check plants, it was difficult to confirm significant improvements in the regenerated plants. New methods are currently being evaluated to optimize this screening technique.

Line A61, a regenerated line from the variety WL 318, and line A318, from the variety Apollo, were chosen for field evaluations at the Red River Research Station. Plants were vegetatively propagated and the cuttings transplanted to the field March 15, 1989. Plots approximately 5 feet x 20 feet were established with plants 6 inches apart. The plots were harvested three times over the growing season.

The two regenerated lines had the highest yields on the first cutting, but did not yield as well on the second and third harvests (Table 1). Total yield, however, for line A61 (referred to as selection 1 in 1988 annual reports) was the highest of all varieties in the test. For additional information on other alfalfa varieties, contact Mr. J.L. Rabb at the Red River Research Station, Bossier City, LA.

Table 1. Alfalfa yields of two tissue culture lines and two varieties recommended for Louisiana from a test conducted at the Red River Research Station, Bossier City, LA. 1989.

Variety	Harvest dates 7/10	8/15	9/26	Total
	t/A			
A61	2.73	0.66	0.88	4.27
A318	1.93	0.94	0.53	3.40
Apollo	1.38	1.13	1.03	3.54
Florida 77	1.48	1.23	1.10	3.81

SCREENING FOR RESISTANCE TO ALFALFA WEEVIL AND THREE-CORNERED ALFALFA HOPPER

D. Moellenbeck, S.S. Quisenberry, and S.S. Croughan

A number of regenerated plants and check plants (from seeds) were screened for resistance to alfalfa weevil and three-cornered alfalfa hopper. Two cuttings were established from each regenerated plant and used for both screenings. Screenings were performed twice for each insect.

After 2 weeks regrowth, each plant was infested with two alfalfa weevil larvae. The plants were scored for amount of defoliation following 2 to 3 weeks growth. Five regenerated lines appear significantly more tolerant to the weevil (Table 2).

To screen for resistance to the three-cornered alfalfa hopper, plants with 2 weeks regrowth were infested with three nymphs apiece. Plants were scored for the amount of girdling after 2 to 3 weeks growth. Six regenerated lines had less girdling than the checks (Table 2).

One regenerated line (A317) showed improved resistance to both insects. The 10 regenerated lines identified as having potential improvements in insect resistance are undergoing further evaluations to confirm these observations.

Table 2. Results of preliminary insect resistance screening of regenerated lines.

Line	Alfalfa weevil (defoliation)	Line	3-cornered hopper (girdling)
Check	29.0	Check	3.00
A312	14.0	A286	1.50
A317	13.0	A317	1.50
A636	11.5	A315	1.00
A635	10.5	A601	1.00
A311	10.0	A637	0.50
A263	5.5		

SOYBEAN IMPROVEMENT THROUGH TISSUE CULTURE

S.S. Croughan and B. Marquis

A soybean biotechnology program was initiated at the Rice Research Station to develop new and useful germplasm for incorporation into the soybean breeding program. The project objective is to apply the techniques of biotechnology to the genetic improvement of soybeans. Target areas for improvement include disease, insect and herbicide resistance, yield, and seed quality.

Most techniques have been established on species related to soybeans and soybean varieties recommended for the northern and midwestern United States. Several approaches were tested in the Rice Research laboratory to determine the optimal one for southern varieties.

One approach involved the evaluation of cotyledonary nodes as the initial explant material. Mature seeds were surface sterilized, germinated on nutrient medium with the growth regulator 6-benzylaminopurine, and after approximately 14 days the cotyledonary node excised. Several hundred nodes from the varieties Centennial, Hartz 7126, Hartz 8112, and Asgrow 7986 were plated onto nutrient media. Different nutrient media were tested for their capacities to stimulate plantlet formation around the cotyledonary node. Plantlets formed from all four varieties tested, however, survival was low and only plants from Centennial and Asgrow 7986 have survived. These plants will be grown in the greenhouse to maturity, seeds collected, and the progeny evaluated for genetic improvements.

Two other explants tested were excised embryos from mature seeds and cotyledons from germinated seeds. The varieties Centennial, Hartz 6686, Hartz 7126, Hartz 8112, and Asgrow 7986 were tested on several types of media. The concentrations of sucrose, vitamins, and the hormone 1-naphthaleneacetic acid were varied. Both explant sources responded to the culture conditions and cell growth occurred, however, no plants were regenerated from the cells.

The most successful explant source tested was the cotyledon from an immature seed. Pods were collected from plants when the seeds were approximately 3 to 5 mm long (R5 stage). The seeds were removed from the pod, surface sterilized, and the seed coat removed. The immature embryo was removed and the cotyledons plated onto nutrient medium. After 3 to 4 weeks small embryos formed on the surface of the cotyledon. These embryos were transferred to a nutrient medium, designed to promote embryo development, for 8 weeks. Once the embryos reached physiological maturity, they were transferred to a third nutrient medium where they germinated into plants. Plants were transferred to pots for further development. Nineteen varieties and breeding lines were evaluated for their response to this technique. Several nutrient media were tested, and explants were collected from either field-grown or greenhouse-grown plants.

Using the cotyledons from immature seeds appears to produce the best results. Sixteen of the 19 lines tested produced embryos (see Table 1). Explants from greenhouse-grown plants produced more embryos per cotyledon than from field-grown plants. The growth environment of the plant from which pods are collected appears important in determining the efficiency of embryo formation. In a greenhouse, the environment can be more closely controlled to optimize embryo production.

At present, survival of the embryos to normal plants is low. Most embryos, when transferred to the third nutrient media to germinate, formed elongated hypocotyls. Root growth was normal, but leaves were typically small. Poor survival occurred when these plantlets were transferred to pots. Current research is focusing on this stage of development to improve plantlet survival.

An experiment was performed using the variety Centennial to determine the effects of cold treatment, sucrose level, nitrogen ratio, hormone concentration, and agar type on the number of embryos produced per cotyledon. Explant material was taken from field-grown plants and 80 cotyledons per media treatment were tested. Results are presented in Table 2. The higher ratios of nitrate to ammonium tended to produce more embryos per cotyledon. There was an interaction between hormone level and nitrogen ratio. While not consistent, at the higher nitrogen ratios, the higher hormone level was better for embryo production, while at the lower nitrogen ratios, the lower hormone level produced more embryos. The optimal sucrose level appears to be 3%, and Phytagel agar tended to be a better agar source than Bacto agar. Cotyledons plated directly from the field produced more embryos per cotyledon in most cases than those which were stored in the refrigerator for a short time. Pods picked in the morning and stored overnight in the refrigerator usually produced more embryos per cotyledon than those picked in the afternoon and stored overnight in the refrigerator.

Table 1: Results from culture of immature cotyledon from greenhouse- or field-grown plants. Rice Research Station, Crowley, LA 1989.

	Total no. cotyledons plated		Total no. embryos formed		Average no. embryos per cotyledon	
	GH[1/]	FG[2/]	GH	FG	GH	FG
Maturity Group IV						
Ring Around 452	1400	----	4518	---	3.23	----
Crawford	1922	----	12129	---	6.31	----
Williams	1692	----	14812	---	8.75	----
Pioneer 9442	996	----	3111	---	3.12	----
Maturity Group V						
Bay	----	668	-----	178	----	0.27
Bedford	----	800	-----	644	----	0.81
Forrest	368	----	2831	---	7.69	----
Maturity Group VI						
Hartz 6686	----	188	-----	57	----	0.30
Hartz 6200	----	32	-----	0	----	0.00
Asgrow 6785	----	74	-----	0	----	0.00
Coker 686	226	----	342	---	1.51	----
Centennial	2266	1400	2464	956	1.09	0.68
LA 77-9729	----	38	-----	0	----	0.00
Maturity Group VII						
Delta Pine 417	----	202	-----	54	----	0.27
Hartz 7126	856	380	1252	13	1.46	0.03
Asgrow 7986	2180	264	1085	1	0.50	0.00
Coker 6847	28	----	25	---	0.89	----
LA 79-11123	----	404	-----	24	----	0.06
Maturity Group VIII						
Hartz 8112	1438	----	1299	---	0.90	----

1/ GH = greenhouse-grown
2/ FG = field-grown

Table 2: Factors effecting embryo production - average number of embryos produced per cotyledon. Rice Research Station, Crowley, LA 1989.

Treatments:		Environment[1/]			
		A	B	C	D
Sucrose vs Agar[2/]					
1%	Bacto	0.00	0.63	0.04	0.00
3%	Bacto	1.26	0.67	0.79	0.13
5%	Bacto	0.12	0.00	0.59	0.14
10%	Bacto	0.38	0.50	0.13	0.25
1%	Phytagel	0.03	0.00	0.00	0.00
3%	Phytagel	1.43	0.60	0.86	1.13
5%	Phytagel	0.77	0.38	1.52	0.57
10%	Phytagel	0.00	0.50	0.00	0.29
Nitrogen[3/] vs Hormone[4/]					
12.20	20	0.63	0.18	0.40	0.63
12.20	40	2.23	1.33	1.38	0.00
9.49	20	1.88	1.75	0.88	0.13
9.49	40	1.48	1.63	2.09	1.75
3.99	20	0.26	0.55	0.29	0.13
3.99	40	1.07	0.07	0.35	0.00
2.03	20	1.61	0.42	0.92	0.00
2.03	40	1.13	0.55	1.16	0.25
1.91	20	1.34	1.50	1.54	0.00
1.91	40	0.81	0.44	0.33	0.00

1/ a = pods picked in morning and cotyledons plated immediately.
b = pods picked in morning and cotyledons plated after 1½ hours in refrigerator.
c = pods picked in morning and cotyledons plated after overnight in refrigerator.
d = pods picked in afternoon and cotyledons plated after overnight in refrigerator.

2/ Bacto-agar (Difco #0140) and Phytagel (Sigma #P8169).

3/ Ratio of nitrate to ammonium in nutrient media.

4/ Concentration of 2,4-dichlorophenoxyacetic acid in mg per liter.

BEEF CATTLE NUTRITION RESEARCH

INFLUENCE OF FISH MEAL WITH AND WITHOUT SOLUBLES AND CRAB MEAL IN DIETS FOR FINISHING STEERS

T.W. White, F.G. Hembry, and L.S. Sticker

INTRODUCTION

Dietary protein entering the rumen is degraded and utilized by the microorganisms or escapes into the abomasum and lower gastrointestinal tract where it is degraded to amino acids that are absorbed. Some proteins are degraded less than others in the rumen and, therefore, may be of greater nutritional value. Fish meal is a high protein product of south Louisiana that has received only limited attention as a ruminant protein source in the United States but should have ruminal by-pass qualities since heat is used in the oil extraction process. Crab meal is another local by-product of the seafood industry that may supply nutrients for beef cattle.

MATERIALS AND METHODS

Seventy-five Hereford x Angus crossbred steers averaging 646 lb were blocked by weight into 15 groups in each of 2 years. One steer from each weight group was randomly assigned to each of five treatments. The treatments were: soybean meal control diet compared with diets containing 3 or 6% fish meal with and without solubles. The diets also contained 20% ground grass hay, 10% molasses, 1% dicalcium phosphate, .5% trace mineralized salt, .75% urea, 330 I.U. vitamin A per pound of feed, and 63 to 64% ground corn.

A second experiment was conducted with 48 Hereford x Angus crossbred steers averaging 626 lb that were blocked by weight into 12 groups. One steer from each weight group was randomly assigned to each of the four treatments. The four treatments were: soybean meal control diet compared with diets containing 5.5% crab meal plus 4.1% soybean meal, 5.5% crab meal plus 3.0% fish meal or 11% crab meal. The soybean meal diet and ingredients in the experimental diets were similar to these in the first experiment.

All steers were implanted with 36 mg Zeranol when the experiments were initiated. The steers were denied feed and water for 18 hours prior to weighing initially and at 28-day intervals. Steers were slaughtered and carcass characteristics evaluated by USDA graders and longissimus muscle area and fat thickness were measured on the cut surface at the 12th rib 48 hours after slaughter.

RESULTS AND DISCUSSION

The performance of steers fed fish meal with and without solubles is presented in Table 1. Feed intake was similar for all diets indicating that fish meal even with fish solubles does not adversely affect palatability. Average daily gains and carcass weights were not different (P>.05) among treatments although there was a trend for steers fed fish meal to gain faster and have heavier carcasses than steers fed the soybean meal diet.

Table 1. Performance of steers fed fish meal with and without fish solubles. Rice Research Station, Crowley, LA. 1988 and 1989.

Item	Soybean meal	Percent fish meal: Without solubles 3	Without solubles 6	With solubles 3	With solubles 6
No. steers	30	30	30	30	30
Initial weight, lb	646	646	646	646	646
Days on feed	98	98	98	98	98
Dry feed intake, lb	25.4	24.8	25.6	25.1	25.8
Daily gain, lb	3.01	3.10	3.11	3.17	3.17
Feed:gain	8.4	8.0	8.2	7.9	8.1
Carcass weight, lb	546	550	555	559	558
Marbling score[a]	8.7	9.1	9.2	9.1	8.6
Quality grade[b]	10.6	10.6	10.8	10.8	10.5
Fat thickness, mm	9.5^{de}	10.4^{cd}	10.9^{c}	10.0^{cde}	8.8^{e}
Kidney, heart, and pelvic fat, %	1.8	1.9	1.9	1.9	1.8
Longissimus muscle area, sq in	10.9	11.0	11.0	10.8	11.3

[a] Slight minus = 7; slight = 8; slight plus = 9.

[b] Select plus = 11; choice minus = 12.

[cde] Means on the same line that do not have a common superscript letter differ (P<.05).

Fish meal with solubles tended to provide for faster gains and heavier carcasses than fish meal without solubles. Feeding fish meal tended to improve feed efficiency. This may be the result of more efficient protein utilization or to the additional energy provided by the fat in the fish meal. Carcass characteristics were similar for steers fed all diets.

Fish meal did not have a consistent influence on ruminal fluid constituents (Table 2).

Crab meal is the dried by-product of the seafood industry that remains after removal of the edible portion of the crab for human consumption. Crab meal analyzed approximately 34% crude protein, 3% fat, 13% ADF, 20% NDF, 27% calcium, and 1% phosphorus. The structural portion or shell composed of chitin is very similar to cellulose, hence the level of ADF which is a measure of plant fiber. Insitu studies with crab meal suggest that chitin is relatively resistant to microbial degradation in the rumen.

The influence of feeding crab meal as a protein source to finishing beef steers is shown in Table 3. Performance and carcass characteristics were very similar for all diets suggesting that crab meal can be successfully fed to beef cattle. The pH of ruminal fluid was higher (P<.05) when crab meal was included in the diet than when soybean meal was the major protein source (Table 4). This is probably due to the high calcium content of the crab meal. Other ruminal fluid characteristics were very similar regardless of diet.

Table 2. Influence of fish meal with and without fish solubles on ruminal pH, molar proportions (mol/100 mol) and total concentrations (mM) of volatile fatty acids. Rice Research Station, Crowley, LA. 1988 and 1989.

Item	Soybean meal	Percent fish meal Without solubles 3	6	With solubles 3	6
pH	6.3	6.3	6.3	6.4	6.5
Acetate	62.7[ab]	60.8[c]	61.3[bc]	64.3[a]	62.8[ab]
Propionate	17.2[b]	19.1[a]	18.0[b]	17.2[b]	19.3[a]
Isobutyrate	.2	.1	.2	.2	.0
Butyrate	17.7[ab]	17.7[ab]	18.1[a]	16.2[bc]	15.1[c]
Isovalerate	.6[b]	.6[b]	.7[ab]	.7[ab]	.9[a]
Valerate	1.5	1.7	1.7	1.4	1.5
Acetate:propionate ratio	3.8[ab]	3.4[c]	3.5[bc]	3.9[a]	3.3[c]
Total VFA	110	118	113	118	105

[abc] Means on the same line that do not have a common superscript letter differ ($P<.05$).

Table 3. Influence of crab meal alone and in combination with soybean meal or fish meal on finishing performance of steers. Rice Research Station, Crowley, LA. 1989.

Item	Soybean meal	5.5% crab meal - 4.1% soybean meal	5.5% crab meal - 3% fish meal	11% crab meal
No. steers	12	12	12	12
Initial weight, lb	626	626	626	626
Days on feed	140	140	140	140
Dry feed intake, lb	24.8	24.1	23.7	23.4
Daily gain, lb	2.55	2.63	2.42	2.48
Feed:gain	9.7	9.2	9.8	9.4
Carcass weight, lb	595	594	581	578
Marbling score[a]	10.2	10.0	10.2	9.9
Quality grade[b]	11.2	11.1	11.6	11.3
Fat thickness, mm	12.2	12.6	12.2	11.3
Kidney, heart, and pelvic fat, %	2.0	2.0	2.2	2.0
Longissimus muscle area, sq in	11.0	10.3	10.2	10.2

[a] Slight minus = 7; slight = 8; slight plus = 9.

[b] Select plus = 11; choice minus = 12.

Table 4. Influence of crab meal on ruminal pH molar proportions (Mol/100 mol) and total concentrations (mM) of volatile fatty acids. Rice Research Station, Crowley, LA. 1989.

Item	Soybean meal	5.5% crab meal - 4.1% soybean meal	5.5% crab meal - 3% fish meal	11% crab meal
pH	6.2^{c}	6.5^{b}	6.7^{a}	6.6^{ab}
Acetate	61.8	63.7	64.5	62.2
Propionate	19.2	19.2	17.6	20.6
Isobutyrate	.6	1.4	.8	.7
Butyrate	16.2	13.2	14.3	14.2
Isovalerate	$.8^{b}$	1.1^{ab}	1.4^{a}	$.9^{b}$
Valerate	1.5	1.3	1.4	1.4
Acetate:propionate ratio	3.3	3.6	3.9	3.2
Total VFA	131	126	128	119

^{abc} Means on the same line that do not have a common superscript letter differ ($P<.05$).

SUMMARY

These experiments suggest that fish meal and crab meal may be used as protein sources for finishing beef steers. Fish meal and crab meal are palatable and may contribute at least 6 and 11% of the total feed ingredients, respectively. In addition to supplying protein, fish meal contributes considerable energy as fat and crab meal provides some calcium.

INTERNATIONAL RICE TRAINING PROGRAM

Maurice F. Miller

The Rice Research Station has cooperated for a number of years with the Foreign Training Division of the International Agricultural Development Service by providing an information training program for international leaders, government officials, farmers, students, and others interested in the production, processing, and marketing of rice.

Data regarding the classification of visitors according to countries are presented in Table 1. A total of 151 participants, representing 20 countries, were guests at the Rice Research Station in 1989. This was an increase of 95 participants compared to 1988. Belgium provided the largest number of visitors (89).

Table 1. Number of participants according to country. Rice Research Station, Crowley, LA. 1989.

Country	Number of participants
Argentina	1
Belgium	89
Brazil	8
China (PROC)	2
Congo	1
Costa Rica	6
Egypt	3
Equador	4
Gambia	5
Honduras	2
India	2
Japan	6
Malaysia	5
Netherlands	5
Nigeria	5
Panama	1
Sri Lanka	1
Thailand	3
Union of South Africa	1
West Indies (Trinidad)	1
TOTAL	151

Table 2 presents information regarding the number of participants according to sponsoring organizations. The largest number was self sponsored.

Subject matter of interest to the participants varied from general rice production practices to specific interests, such as plant breeding, water management, processing, marketing, control of rice diseases, insects, and weeds. There was also interest in biotechnology, rice genetics, milling, and grading.

Table 2. Number of visitors according to sponsoring organizations. Rice Research Station, Crowley, LA. 1989.

Sponsoring organization	Number sponsored
Arrocera Los Sauces	6
F.A.O.	1
Governments (Foreign)	5
Peace Fellowship Program	1
Private Companies	5
Self	101
Rice Council	14
Rotary Club International	5
Universities (Foreign)	1
USAID	8
USIA	2
USIS	2
TOTAL	151

ECONOMICS OF ENTERPRISE SELECTION AND WHOLE FARM DECISION MAKING IN THE LOUISIANA RICE GROWING AREAS *

Arthur M. Heagler and Brian E. McManus **

Enterprise budget projections for 1990 were developed for rice, soybeans, milo, corn, wheat, wheat-soybean double crop, and rice-crawfish double cropping systems. A summary of the enterprise budgeting analysis for Southwest Louisiana is presented in Table 1. Budgeting results for rice production in Northeast Louisiana are shown in Table 2. Owner-operator and tenant-operator situations were budgeted for each enterprise with the exception of the rice-crawfish double cropping system. Other than rice, all enterprises were valued at a projected market price. Rice income was calculated by adding the product of the loan price of $6.50 per hundredweight and the actual yield to the deficiency payment. The deficiency payment was calculated by multiplying the area average proven yield times the difference between the target price and the loan value, $4.21 per hundredweight. Under these assumptions, sufficient revenue was available to cover direct expenditures for all but the soybean tenant-operator situations and the second rice cutting. Direct expenditures were defined to be seed, fuel, fertilizer, labor, chemicals, maintenance on equipment, and interest on operating capital. Total specified expenses include direct expenditures, the annualized cost of replacing capital assets, and interest on non-operating capital. Those enterprises that did not generate sufficient income to cover total specified expenses were the soybean enterprises, the milo tenant situation, the rice second cutting enterprise, and the rice-crawfish double crop.

Detailed enterprise budgets and supporting data were published in A.E.A. Research Report Number 80, January, 1990.

Service enterprise budgets were prepared for several alternative rice irrigation systems in Louisiana. For Southwest Louisiana, cost estimates were developed for diesel, electric, and natural gas power systems. Deep well and surface water sources for each of the above power systems were evaluated. Per acre inch direct irrigation costs for a deep well water source were estimated to be approximately $1.84, $2.60, and $1.54 for diesel, electric, and natural gas systems, respectively. Total per acre inch irrigation costs for a deep well water source were estimated to be approximately $3.08, $3.63, and $2.76 for diesel, electric, and natural gas systems, respectively. Per acre inch direct irrigation costs for a surface irrigation water source were estimated to be approximately $0.81, $1.00, and $0.67 for diesel, electric, and natural gas systems, respectively. Total per acre inch irrigation costs for a surface water source were estimated to be approximately $1.51, $1.57, and $1.35 for diesel, electric, and natural gas systems, respectively.

---

* Research supported in part by funds provided by Louisiana rice producers through the Louisiana Rice Research Board.

** Associate Professor and Research Associate, respectively, Department of Agricultural Economics and Agribusiness, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, Louisiana.

For Northeast Louisiana, cost estimates were developed for diesel and electric power systems for both deep well and surface water sources. Per acre inch direct irrigation costs for a deep well water source were estimated to be approximately $0.60 and $0.82 for diesel and electric systems, respectively. Total per acre inch irrigation costs for a deep well water source were estimated to be approximately $1.37 and $1.47 for diesel and electric systems, respectively. Per acre inch direct irrigation costs for a surface water source were estimated to be approximately $0.50 for both diesel and electric systems. Total per acre inch irrigation costs for a surface water source were estimated to be approximately $1.14 and $1.01 for diesel and electric systems, respectively.

Detailed results of the irrigation cost analysis are reported in A.E.A. Research Report Number 80, January 1990.

At the request of several rice producer groups, Louisiana rice cost of production estimates were compared with estimates calculated by the Economic Research Service (ERS) of the United States Department of Agriculture. A summary of this comparison was presented to a combined meeting of the Louisiana Rice Research Board, the Louisiana Rice Promotion Board, and the Rice Advisory Committee of the Louisiana Farm Bureau at the Rice Research Station on July 14, 1989. This report was also presented at a meeting with U.S. Congressman Jerry Huckaby along with producers and agricultural economists of the Louisiana Agricultural Experiment Station.

A meeting was held in Washington D.C. with ERS and agricultural economists from land grant institutions representing the five major rice producing states, Arkansas, California, Louisiana, Mississippi, and Texas. These economists all held rice production and marketing responsibilities for their respective states. Cost of production estimates were presented from all parties and differences in estimates and in the underlying methodology and assumptions were discussed. A summary paper of the meeting was prepared, including a discussion of the major differences in cost estimation between ERS and the land grant universities. This paper was approved by the economists and administrations of all five land grant institutions and released in February 1990.

Table 1. A Summary of Projected Costs and Returns per Acre for Rice, Soybeans, Corn, Milo, Wheat, Wheat-Soybean Double Crop, Rice-Crawfish Double Crop Production, Southwest Louisiana, 1990. a/

Crop Description	Yield Per Acre	Unit	Total Income	Direct Expenses	Returns	Fixed Expenses	Total Expenses	Returns
			Dollars per Acre					
Rice Enterprises:								
Water Plant, Owner b/	46.10	cwt.	479.25	344.07	135.18	93.62	437.69	41.56
Water Plant, Tenant c/	27.66	cwt.	287.55	219.39	68.16	50.25	269.64	17.91
Drill Plant, Owner b/	48.55	cwt.	495.17	326.98	168.19	97.62	424.60	70.57
Drill Plant, Tenant c/	29.13	cwt.	297.10	205.95	91.15	54.24	260.19	36.91
Second Cutting b/	9.64	cwt.	62.66	71.42	-8.76	31.56	102.98	-40.32
Soybean Enterprises:								
6-Row, Owner b/	24.50	bu.	134.75	116.60	18.15	36.93	153.53	-18.78
6-Row, Tenant c/	19.60	bu.	107.80	115.16	-7.36	36.92	152.08	-44.28
Drill Plant, Owner b/	27.00	bu.	148.50	124.69	23.81	35.82	160.51	-12.01
Drill Plant, Tenant c/	21.60	bu.	118.80	123.07	-4.27	35.82	158.89	-40.09
Corn Enterprises:								
6-Row, Owner b/	100.00	bu.	225.00	163.20	61.80	40.55	203.75	21.25
6-Row, Tenant c/	80.00	bu.	180.00	159.60	20.40	40.55	200.15	-20.15
Milo Enterprises:								
Drill Plant, Owner b/	44.43	cwt.	144.40	106.84	37.56	29.72	136.56	7.84
Drill Plant, Tenant c/	35.54	cwt.	115.52	106.84	8.68	29.72	136.56	-21.04

(Continued)

Table 1. (Continued)

Crop Description	Yield Per Acre	Unit	Total Income	Direct Expenses	Returns	Fixed Expenses	Total Expenses	Returns
			Dollars per Acre					
Wheat Enterprises:								
Drill Plant, Owner b/	45.00	bu.	157.50	83.53	73.97	27.33	110.86	46.64
Drill Plant, Tenant c/	36.00	bu.	126.00	83.53	42.47	27.33	110.86	15.14
Wheat-Soybean Double Crop								
Wheat-Soybean, Owner b/	45+25	bu.	295.00	139.61	155.39	48.21	187.82	107.18
Wheat-Soybean, Tenant c/	45+25	bu.	236.00	139.61	96.39	48.21	187.82	48.18
Rice-Crawfish Double Crop: d/								
Rice-Crawfish, Owner b/	4200+800	lbs.	663.00	543.06	119.94	196.69	739.75	-76.75

a/ Income for rice was calculated by adding the product of the loan price of \$6.50 per hundredweight and the actual yield to the deficiency payment. The deficiency payment was calculated by multiplying the proven yield times the difference between the target price and the loan value or \$4.21 per hundredweight. Crop prices used were \$5.50 per bushel for soybeans, \$2.25 per bushel for corn, \$3.25 per hundredweight for milo, and \$3.50 per bushel for weight.

b/ Land costs were not included for the owner-operator.

c/ Rental arrangements for rice were 1/5 crop share for land and 1/5 crop share for water with both the landlord and waterlord each paying 1/5 of fertilizer, chemicals, and drying and storage costs and the waterlord paying all of the irrigation fuel and fixed costs. Rental arrangements for soybeans, corn, milo, and wheat were 1/5 crop share for land with the landlord paying 1/5 of any drying and storage costs.

d/ Rice was valued at the loan rate of \$6.50 per hundredweight. Average monthly prices for live crawfish were \$0.60, \$0.50, and \$0.40 for January, February, and March, respectively.

Table 2. A Summary of Projected Costs and Returns per Acre for Rice Production, Mississippi Delta and Ouachita Areas, Louisiana, 1990. a/

Crop Description	Yield Per Acre	Unit	Total Income	Direct Expenses	Returns	Fixed Expenses	Total Expenses	Returns
			Dollars per Acre					
Water Plant, Owner b/	48.60	cwt.	477.10	263.63	213.47	80.94	344.57	132.53
Water Plant, Tenant c/	29.16	cwt.	286.26	211.43	74.83	50.18	261.61	24.65
Drill Plant, Owner b/	48.60	cwt.	477.10	258.98	218.12	86.36	345.34	131.76
Drill Plant, Tenant c/	29.16	cwt.	286.26	204.68	81.58	55.59	260.27	25.99

a/ Income for rice was calculated by adding the product of the loan price of $6.50 per hundredweight and the actual yield to the deficiency payment. The deficiency payment was calculated by multiplying the proven yield times the difference between the target price and the loan value or $4.21 per hundredweight.

b/ Land costs were not included for the owner-operator.

c/ Rental arrangements for rice in Northeast Louisiana were 1/5 crop share for land and 1/5 crop share for water with the waterlord paying all irrigation fuel and fixed costs and both the landlord and waterlord each paying 1/5 of the drying and storage costs.

STATION PERSONNEL

Joseph A. Musick - Resident Director
Professor

Mary Baronet[1/]
Typist Clerk II

Carol L. Bastian
Secretary

Teresa H. Malbrough
Custodian I

Darlene M. Regan
Word Processor Op. Spec.

Patrick K. Bollich - Rice Fertilization
Assistant Professor

William J. Leonards, Jr.
Research Associate

Ora J. Primeaux
Research Farm Specialist II

Sharon M. Rawls[2/]
Research Associate

Douglas M. Walker
Research Associate

Suzan S. Croughan - - - - - - - - - - - - - - - - Forage Crops Tissue Culture
Associate Professor

Kathy A. Fishbeck[3/]
Visiting Associate Professor

Karen M. Hebert[4/]
Research Associate

1/ Appointed 04/03/89
2/ Resigned 05/31/89
3/ Resigned 05/31/89
4/ Resigned 01/12/90

Timothy P. Croughan - Rice Tissue Culture
Associate Professor

Qi Ren Chu[5/]
Post-Doctoral Researcher

Mona M. Pizzolatto
Research Associate

Ronald P. Regan
Research Associate

Dannell B. Trumps
Lab Tech Asst-Agribusiness

Xin Hua Wang
Research Associate

Richard T. Dunand - Rice Physiology
Associate Professor

Raymond R. Dilly, Jr.
Research Associate

Gregory A. Meche
Research Associate

Wayne C. Faulk - Farm Manager
Instructor

Brian D. Broussard
Research Farm Specialist II

Jeffery L. Jackson
Research Farm Specialist II

Timothy C. Miller
Research Farm Specialist II

Randal K. Morgan
Research Farm Specialist II

Ronald J. Pellerin
Research Farm Specialist II

Ovrilien J. Primeaux
Research Farm Manager I

Oday Sonnier
Research Farm Specialist II

Andrus Stutes
Research Farm Specialist II

Kenneth J. Trahan
Research Farm Specialist II

5/ Resigned 11/30/89

Donald E. Groth - Plant Pathology
Associate Professor

Marty J. Frey
Research Associate

Joseph Nugent
Lab Tech Asst-Agribusiness

Robert J. Habetz - Soybean Research
Research Associate

Steven D. Linscombe - Rice Breeding
Assistant Professor

Andre P. Fabacher
Research Associate

Christopher G. Gravot[6/]
Research Farm Assistant I

Robert J. Guidry
Lab Tech Asst-Agribusiness

Farman Jodari
Instructor

M. Fred Miller - Rice Processing
Assistant Professor

Elaine M. Nowick[7/] - Rice Genetics
Assistant Professor

Herman L. Hoffpauir
Research Farm Specialist II

John F. Robinson[8/] - Rice Insects
Research Entomologist (USDA)

Patricia A. Bollich[9/]
Research Farm Assistant I

George B. Trahan
Agricultural Research Technician (USDA)

6/ Appointed 01/21/89
7/ Resigned 06/15/89
8/ Resigned 08/15/89
9/ Appointed 02/25/89

Donnie R. Stutes - Shop

Research Farm Maintenance Manager

James J. Borne

Research Farm Maintenance Spec. I - Equipment

Melvin Lawrence

Research Farm Maintenance Repairer

Sidney J. Dugar[10/]

Laborer - Farming

Lawrence M. White, III - Foundation Seed Rice

Research Associate

T. Wayne White[11/] - Animal Science

Professor

Gerardo R. Romero

Research Associate

E. Allen Wilson[12/] - Bird Control in Rice

Research Associate

10/ Retired 07/31/89

11/ Transferred to the Animal Science Dept. in Baton Rouge 11/01/88

12/ Resigned 05/05/89

Jesse M. Jaynes -- Biochemistry
Biochemistry Department
Louisiana State University Agricultural Center

Seth J. Johnson -- Insect Control
Entomology Department
Louisiana State University Agricultural Center

Kenneth L. Koonce -------------------------------- Experimental Statistics
Experimental Statistics Department
Louisiana State University Agricultural Center

George D. Lindberg --- Rice Diseases
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

Billy D. Nelson --- Forage Quality
Southeast Research Station

Sharron S. Quisenberry ---------------------------- Forage Insect Control
Entomology Department
Louisiana State University Agricultural Center

James L. Rabb --- Alfalfa Research
Red River Research Station

Milton C. Rush -- Rice Diseases
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

Dearl E. Sanders --- Weed Control
Louisiana Cooperative Extension Service

Raymond W. Schneider --------------------------------------- Rice Diseases
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

Joseph E. Sedberry, Jr. ---------------------------------- Soil Chemistry
Agronomy Department (Minor Elements)
Louisiana State University Agricultural Center

Johnnie P. Snow -- Soybean Disease
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

The Rice Station is especially indebted to Mr. H. F. Morris, Jr., Feed and Fertilizer Laboratory, for the chemical analysis of research samples. Dr. Kenneth L. Koonce, Department of Experimental Statistics, and his staff aided in the research program through their help in the planning and statistical analysis of research data.

Cooperating personnel responsible for research projects at the Rice Station include the following campus staff.

Lucas Aviles -- Rice Research
University of Puerto Rico
Lajas, PR

John B. Baker -- Weed Control
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

Gerard T. Berggren, Jr. ---------------------------------- Soybean Diseases
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

David J. Boethel -------------------------------------- Soybean Entomology
Entomology Department
Louisiana State University Agricultural Center

Gary Britenbeck -------------------------------------- Soybean Inoculation
Agronomy Department
Louisiana State University Agricultural Center

Marc A. Cohn -- Red Rice Control
Plant Pathology & Crop
Physiology Department
Louisiana State University Agricultural Center

Patrick D. Colyer --------------------- Bermudagrass and Alfalfa Diseases
Red River Research Station

Marcus M. Eichhorn, Jr. ------------------------------------- Forage Crops
Hill Farm Research Station

Steve A. Harrison --- Wheat Research
Agronomy Department
Louisiana State University Agricultural Center

Bob G. Harville ---------------------- Soybean and Grain Sorghum Research
Agronomy Department
Louisiana State University Agricultural Center

Arthur M. Heagler --- Economics
Agricultural Economics Department
Louisiana State University Agricultural Center

F. Glen Hembry -- Beef Cattle
Animal Science Department
Louisiana State University Agricultural Center

Clayton A. Hollier -- Plant Pathology
Louisiana Cooperative Extension Service
Louisiana State University Agricultural Center