COMPREHENSIVE RESEARCH ON RICE
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PROJECT TITLE: Cooperative Extension Rice Variety Adaptation and Cultural Practice Research

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OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

Objective I

To evaluate experimental cultivars in cooperation with public and private plant breeders for the purpose of new variety development, the following statewide uniform evaluation tests were conducted.

Very Early Maturity Group - Two uniform tests were conducted; at the Lauppe Ranch (Natomas District, Sutter County) and the Paulus Ranch (San Joaquin County). One similar test was conducted by the plant breeders on the Rice Experiment Station (Biggs, Butte County). Twenty-three advanced breeding lines (two proprietary) and six varietal standards were included in the off-station tests.

Early Maturity Group - Four uniform tests were conducted; at the Wylie Ranch (Glenn County), Geer and Son (District 108, Yolo County), the Mohammed Ranch (District 10, Yuba County) and Britz, Inc. (Fresno County). One similar test was conducted by the plant breeders on the Rice Experiment Station (Biggs, Butte County). Twenty experimental lines and eight commercially available varieties were included in each of the four off-station tests.

Late Maturity Group - Two tests were conducted; one at the Dennis Ranch (Colusa County) and a second at the Shannon Ranch (Sutter County). One test was conducted by the plant breeders on the Rice Experiment Station (Biggs, Butte County). Twenty advanced breeding lines and four commercially available varieties were tested at all locations.

Short and Medium Grain Special Tests - Two tests were conducted; one on the Erdman Ranch (Colusa County) and a second by the plant breeders on the Rice Experiment Station (Biggs, Butte County). These tests provide a preliminary screen for selecting superior lines for further testing in the statewide trials. Twenty-one experimental lines and four commercially available varieties were tested at both locations.

Objective II

To provide research on new and improved cultural practices, several experiments were conducted.

Water Management - A continuing study, funded in part by the UC IPM Program, was conducted in Sutter County. The purpose of this study was to determine the impact of a number of methods of water management during stand establishment on rice growth and the interaction with weeds, insects, diseases and mosquitoes. A brief summary of this project is included here because Rice Research Board funds supported the project with equipment and some labor.

Fertility Management - Nine studies comparing the response of several new varieties to nitrogen were conducted on growers' farms and at the Rice Experiment Station, Biggs. Three of the largest studies with six varieties and nine N rates will be reported in the RES annual report. Several smaller studies are reported herein.

Effect of Bti on Rice - A study was carried out in Sutter County to determine the effect on rice yield of Bti (Bacillus thurengesis) used as a mosquito larvacide.

Objective III

This project maintained an equipment pool to provide service to other principal investigators funded by the Rice Research Board.

SUMMARY OF 1987 RESEARCH OBJECTIVES:

Objective I - Rice Varieties

Statewide Uniform Evaluation of Advanced Breeding Lines

Nine uniform trials were conducted in the locations and maturity groups described previously in this report and at four additional locations by the rice plant breeders on the Rice Experiment Station. Several of the experimental lines had been tested in prior years. Seed for these tests was provided by the Rice Experiment Station, or in the case of proprietary cultivars, by their respective owners. The following analysis and tables are reported for over location averages for each group of tests (maturity, grain type). An Agronomy Progress Report, to be published later, will provide the results at each location.

Summary of the Very Early Tests (less than 90 days to 50% heading at Biggs)

Twenty-six cultivars were compared in three very early tests. Commercial standards at all locations included Calmochi-101, M-102, M-202, M-101 and M-201. Valencia 87 and two proprietary lines were added to the on-farm sites for a total of 29 entries.

Table 1 shows the averages comparing the agronomic performance of several characters for the 26 entries common to all locations. Calmochi 101 and M-102 were the leading entries in yield among commercially available varieties with M-202 and M-101 significantly lower. 85-y-136, a leading short grain candidate variety yielded similarly to M-202. In the two off-station tests, Valencia 87 ranked 24th of 29 entries, significantly below 85-y-136.

Summary of the Early Tests (90-97 days to 50% heading at Biggs)

Twenty experimental lines and eight commercially available varieties including Calmochi-101, L-202, M-101, M-102, M-201, M-202, S-201 and Valencia 87 were tested at the four on-farm locations. Twenty-six total entries were tested.

The five location summary for agronomic performance is shown in Table 2 for the 26 entries common to all locations. Among commercial varieties M-102 and M-202 showed significantly higher yields. S-201, M-101 and L-202 yielded intermediate to the two highest yielding varieties but were significantly higher than M-201. M-201 ranked 25th of 26 in yield, most likely because of cold-induced sterility, a characteristic of the 1987 rice growing season. In the four off-station sites (Table 3) Calmochi-101 ranked significantly higher in yield than all other entries (including experimentals not shown in Table 3) probably because of its superior resistance to cold induced sterility. Valencia 87 ranked above M-201 in these tests, but below all other commercial varieties. 86-y-136, a very advanced short grain line, ranked 18th overall (Table 2) but 7th compared to commercial varieties in the off-station tests (Table 3).

Summary of the Intermediate and Late Rice Variety Tests (more than 97 days to 50% heading at Biggs)

Four commercially available standards, A-301, M-7, M-302 and M-401 and 20 experimental lines were compared in three intermediate/late tests at the locations previously described.

M-401 was the leading commercial variety ranking third among all entries (Table 4). M-302 and M-7 ranked 17th and 21st, respectively, but were not significantly different in yield. A-301 ranked last in yield similar to results found in previous years. The relatively poorer performance of this variety is due in part to poor seedling vigor and low resistance to cold-induced sterility. A-301, however, is an aromatic long grain variety targeted for specialty markets.

Many of the experimental lines tested in this group are intermediate in maturity rather than late, continuing a trend towards earliness. M-7, for example, is the latest variety in the test at 111 days to flowering.

Summary of the Short and Medium Grain Special Test

Twenty-one experimental cultivars and four commercially available varieties, Calmochi-101, M-101, M-102 and M-202 were compared at the two locations previously described. M-202 and M-102 ranked 3rd and 4th respectively but were not significantly different in yield from the top 16 entries including 13th ranked Calmochi-101 (Table 5). M-101 ranked 24th and was significantly lower in yield than all other commercial varieties. Several of the experimental cultivars with outstanding agronomic characters may be advanced to the 1988 statewide trials.

Objective II - Cultural Practices

Summary of Rice Water Management Studies

This work was funded by the UC IPM Program, but is briefly reported here for the information of the Rice Research Board. The project involved studies on the response of invertebrates (midges, rice water weevil, mosquitoes), stem diseases, weeds, herbicide performance, and plant growth to water management regimes. See the 1985 RM-2 report for details of the trial. Table 6 gives a three year yield summary for 1985-87. Additional data will be included in the report to the funding agency.

Three year means suggest a beneficial effect on yield of increasing water depth in the absence of herbicides. This effect is attributed to the positive impact of water depth on weeds; competition of most weeds was moderately to greatly reduced by deeper water. Over the three year trial duration, weed species competition narrowed. In shallow water and drained basins, all weeds flourished and species success was dependent on their competitive ability. Beginning with a mixed stand of common rice weeds in 1985, shallow plots ended in a solid stand of barnyardgrass in 1987; all other weeds were crowded out. In contrast, the only significant weed in deep water in 1987 was roughseed bulrush which tolerates deep water. Moderate water depth and the treatments involving either drainage or changes in water depth reacted intermediate to the extremes of shallow and deep water, in respect to yield and weed control.

Where conventional herbicides were used three year mean yields were not different among all water treatments. However, as in the untreated trial, averages mask individual year differences. In the absence of intense weed pressure, herbicides worked effectively over a wide range of water management strategies, but in individual years, treatment differences did occur.

Table 1. 1987 Very early trial - 3 location summary

Entry	Grain[1] type	Grain yield @14% moisture (lbs/a)	Grain moisture at harvest (%)	Seedling[2] vigor (1-5)	Days to 50% heading	Plant height (in)	Lodging[3] 1-99
19 86-Y-126	S	10140	21.7	4.3	98	33.6	9
13 84-Y-149-E-C-15	M	10030	19.9	4.4	95	33.5	1
14 86-Y-109	S	9850	20.7	4.2	95	31.0	15
21 Calmochi-101	W	9840	16.6	4.4	93	32.6	8
13 86-Y-97	S	9750	17.8	4.5	99	31.2	5
4 M-102	M	9700	20.7	4.4	98	34.1	1
9 84-Y-9	M	9630	17.9	4.3	93	31.6	5
17 85-Y-130	S	9630	18.5	4.2	100	34.0	2
5 84-Y-149-E-C-33	M	9610	19.3	4.5	95	34.0	1
2 84-Y-149-EC6-HR	M	9610	19.2	4.4	94	33.6	1
7 86-Y-296	M	9600	21.2	4.1	99	33.5	12
6 86-Y-171	M	9550	17.9	4.5	94	32.5	21
18 86-Y-124	S	9530	21.0	4.1	99	32.5	13
8 86-Y-211	M	9490	15.3	4.4	93	32.7	6
11 86-Y-11	M	9490	16.9	4.3	97	33.5	3
15 86-Y-235	S	9450	20.7	4.3	100	31.6	3
16 85-Y-98	S	9440	20.0	4.2	96	32.3	19
12 85-Y-136	S	9220	17.3	4.5	99	31.1	6
10 M-202	M	8960	20.0	4.6	101	33.9	2
22 85-Y-321	L	8750	18.1	3.6	98	32.2	2
23 85-Y-718	L	8620	16.0	4.2	96	28.9	1
1 M-101	M	8570	18.4	4.7	94	33.8	35
24 85-Y-354	L	8440	16.7	4.2	100	27.4	2
26 M-201	M	8390	22.7	4.4	103	33.0	5
25 86-Y-368	L	8260	16.1	3.9	98	31.9	1
20 85-Y-296	L	8100	16.9	4.4	103	33.5	1
GRAND MEAN		9290	18.7	4.3	97	32.4	7
CV		7.4	6.1	6.7	1.8	4.8	1 38.3
LSD (.05)		560	0.9	0.2	1	1.3	8

[1]S = short; M = medium; L = long; W = waxy.
[2]Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.
[3]Subjective rating of 1-99 where 1 = none and 99 = 99% lodged.

Table 2. 1987 Early variety trial - five location summary

Entry	Grain[1] type	Grain yield @14% moisture (lbs/a)	Grain moisture at harvest (%)	Seedling[2] vigor (1-5)	Days to 50% heading	Plant height (in)	Lodging[3] 1-99
43 86-Y-329	M	10010	20.4	4.2	101	36.4	4
38 86-Y-267	S	9910	18.8	4.2	100	33.4	2
33 M-102	M	9800	18.7	4.4	96	35.3	2
39 85-Y-287	M	9690	18.5	4.1	98	35.0	2
41 85-Y-207	S	9650	19.4	4.3	100	33.7	3
52 86-Y-763	M	9460	19.9	4.2	101	35.8	14
29 M-202	M	9450	20.5	4.5	99	35.0	8
36 83-Y-254	S	9450	20.2	4.4	103	33.0	2
40 86-Y-269	S	9270	21.4	4.3	104	35.7	4
31 S-201	S	9260	21.2	4.3	104	34.5	10
51 86-Y-754	M	9260	20.5	4.1	98	34.8	3
32 M-101	M	9160	15.6	4.4	91	35.0	16
49 86-Y-474	L	9110	15.3	3.7	95	32.6	1
44 L-202	L	9060	16.6	4.1	99	30.1	1
45 85-Y-395	L	9020	14.2	3.9	94	32.5	1
50 85-35864	L	8930	15.1	3.9	96	38.4	12
37 86-Y-247	S	8930	20.7	4.1	101	35.0	14
34 85-Y-136	S	8680	14.9	4.3	97	32.0	9
53 86-Y-599	L	8600	15.5	4.0	99	32.0	1
54 86-Y-54	M	8530	22.0	4.1	101	33.5	1
48 86-Y-468	L	8280	15.6	3.9	98	31.5	1
35 86-Y-35	M	8260	20.2	4.5	98	34.3	36
42 84-Y-298	M	8110	22.2	4.2	101	33.5	1
46 86-Y-715	L	8030	16.0	4.0	97	33.5	1
30 M-201	M	7870	22.7	4.3	102	33.8	2
47 86-Y-435	L	7150	15.6	3.9	100	30.1	1
GRAND MEAN		8960	18.5	4.2	99	33.9	6
CV		7.5	7.2	4.3	1.9	4.7	92.3 1
LSD (.05)		420	0.8	0.1	1	1.0	7

[1]S = short; M = medium; L = long; W = waxy.
[2]Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.
[3]Subjective rating of 1-99 where 1 = none and 99 = 99% lodged.

Table 3. 1987 Early variety trial - four location summary

Entry	Grain[1] type	Grain yield @14% moisture (lbs/a)	Grain moisture at harvest (%)	Seedling[2] vigor (1-5)	Days to 50% heading	Plant height (in)	Lodging[3] 1-99
55 CM-101	W	10330	14.2	4.2	93	32.9	2
33 M-102	M	9750	19.2	4.2	98	35.5	3
29 M-202	M	9380	21.6	4.3	100	35.3	9
32 M-101	M	9360	16.0	4.3	92	35.2	15
31 S-201	S	9170	21.5	4.2	104	34.9	12
44 L-202	L	8890	17.0	3.8	100	30.4	2
34 85-Y-136	S	8770	15.7	4.1	99	32.3	11
56 Valencia 87	S	8680	16.5	4.1	95	33.3	1
30 M-201	M	7670	23.4	4.1	102	34.1	2
GRAND MEAN		9110	18.3	4.1	98	33.8	6.3
CV		7.3	7.1	5.1	1.7	4.8	186.4
LSD (.05)		450	0.9	0.1	1	1.1	8

[1]S = short; M = medium; L = long; W = waxy.
[2]Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.
[3]Subjective rating of 1-99 where 1 = none and 99 = 99% lodged.

Table 4. 1987 Late variety trial - three location summary

Entry	Grain[1] type	Grain yield @14% moisture (lbs/a)	Grain moisture at harvest (%)	Seedling[2] vigor (1-5)	Days to 50% heading	Plant[3] height (in)	Lodging[4] 1-99
79 86-Y-564	M	9090	18.7	4.3	106	35.7	1
5 86-Y-525	M	9040	19.9	4.3	109	37.3	1
63 M-401	M	8880	20.2	4.3	108	36.9	1
80 86-Y-570	M	8560	18.4	4.2	106	37.8	1
68 86-Y-516	S	8530	18.8	4.4	105	34.7	1
78 86-Y-560	M	8440	17.1	4.6	103	36.3	1
70 86-Y-519	S	8430	18.7	4.4	109	37.6	1
82 86-Y-82	S	8390	18.5	4.5	105	35.2	1
69 85-Y-502	S	8370	19.1	4.2	106	35.8	1
81 86-Y-83	S	8310	19.1	4.3	106	35.2	1
66 86-Y-505	S	8310	18.2	4.4	105	33.6	1
65 85-Y-508	S	8290	19.0	4.1	104	35.1	2
77 86-Y-558	M	8270	17.9	4.4	106	36.1	1
72 86-Y-766	S	8170	18.0	4.2	104	32.9	1
67 86-Y-509	S	8100	19.0	4.3	105	34.5	1
73 86-Y-768	S	8030	18.4	4.5	106	35.8	1
62 M-302	M	7960	18.3	4.4	105	36.8	1
64 86-Y-489	S	7920	18.6	4.2	105	36.4	1
71 85-Y-497	S	7770	18.2	4.2	104	34.3	1
76 86-Y-532	M	7690	16.9	4.5	104	35.9	1
61 M-7	M	7670	19.2	4.1	111	36.6	1
74 85-Y-463	M	7580	16.5	4.5	104	36.1	1
83 86-H-3689	L	7010	15.8	3.8	106	31.6	1
84 A-301	L	5810	16.9	3.5	108	30.2	1
GRAND MEAN		8110	18.3	4.3	106	35.4	1
CV		7.	6.9	6.5	1.5	3.5	55.5
LSD (.05)		500	1.0	0.2	1	1.2	NS

[1]S = short; M = medium; L = long; W = waxy.
[2]Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.
[3]Heights for 2 locations, Biggs and Colusa, only.
[4]Subjective rating of 1-99 where 1 = none and 99 = 99% lodged.

Table 5. 1987 Special short and medium grain variety trials - 2 locations

Entry	Grain[1] type	Grain yield @14% moisture (lbs/a)	Grain moisture at harvest (%)	Seedling[2] vigor (1-5)	Days to 50% heading	Plant height (in)	Lodging[3] 1-99
760 86-Y-135	S	10100	12.6	4.6	84	33.9	3
766 86-Y-202	M	10060	17.3	4.6	91	34.0	1
753 M-202	M	10030	15.1	4.8	91	34.6	4
751 M-102	M	10010	16.3	4.7	89	34.2	1
772 86-Y-285	M	9970	16.6	4.6	91	32.7	3
754 85-Y-136	S	9920	13.4	4.6	90	31.2	2
756 84-Y-149	M	9820	15.3	4.6	88	34.2	1
768 86-Y-208	M	9820	12.2	4.6	90	34.0	1
758 86-Y-105	S	9780	14.6	4.6	88	34.3	21
769 86-Y-227	S	9760	17.3	4.6	96	32.1	1
755 84-Y-9	M	9680	14.0	4.6	85	32.8	2
765 86-Y-179	M	9670	16.6	4.6	91	32.1	5
757 CM-101	W	9630	13.1	4.5	85	32.6	1
761 86-Y-761	M	9610	18.1	4.6	93	31.9	1
764 86-Y-166	M	9570	15.2	4.6	88	32.1	3
774 86-Y-314	M	9560	16.0	4.5	94	35.3	1
759 86-Y-121	S	9510	13.3	4.3	87	32.3	8
775 86-Y-315	M	9490	17.4	4.6	96	33.9	1
773 86-Y-293	M	9490	16.8	4.5	93	34.4	8
763 86-Y-157	M	9280	14.0	4.6	92	33.5	9
767 86-Y-204	M	9090	13.8	4.6	95	33.4	2
770 86-Y-254	S	9090	18.0	4.6	98	34.2	1
771 86-Y-258	S	8970	18.0	4.6	98	32.7	1
751 M-101	M	8940	14.0	4.7	86	35.1	14
762 86-Y-762	M	8670	14.9	4.7	92	33.8	47
GRAND MEAN		9580	15.4	4.6	91	33.4	6
CV		4.9	6.7	2.4	1.4	3.5	165.2
LSD (.05)		460	1.0	0.1	1	1.2	9

[1] S = short; M = medium; L = long; W = waxy.
[2] Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.
[3] Subjective rating of 1-99 where 1 = none and 99 = 99% lodged.

Table 6. The effect of water depth and weed control on rice yields

	Grain yield (lb/A)							
	Herbicides Not Used				Herbicides Used			
Water Treatment	1985	1986	1987	Mean	1985	1986	1987	Mean
Shallow	2446	3793	0	2079	7431	9006	10001	8813
Moderate	5091	5944	3460	4831	9055	8105	9860	9007
Deep	7211	5878	6008	6366	9306	6915	10285	8835
Leathers	5238	4895	4759	4964	9208	7521	10510	9080
Delayed drain	3997	5277	2599	3958	8082	7753	10030	8622
Old method	4658	6314	4676	5216	9009	7212	9382	8534
Mean	4773	5350	3550	4569	8682	7752	10011	8815
CV (%)	17.6	23.6	46.8	36.4	8.2	7.1	8.5	7.58
LSD (water by yr)	1428	2293	3550	1556	1289	997	NS	NS
LSD (water over yrs)	NS				910			
LSD interaction:								
Same year	NS				1114			
Among years	NS				1574			

A second experiment was conducted within the IPM Water management trial and compared eight rice varieties at three seeding rates over three continuous water depths, 2, 5, and 8", =/- 1 inch. Experimental design was a split plot with three replications; variety and seeding rate combinations as the subplots were arranged in a randomized complete block design within water depth treatments as the main plots. Yield results are given in Table 7. Additional measurements were made but are not reported here.

Water treatment means (across subplots) were not different but there was a trend to lower yield as water became deeper. This result is attributed to certain varieties performing poorer in deeper water and at lower seeding rates. In all water treatments there was a difference due to varieties with M-202 performing best at all depths and A-301 poorest. Increased seeding rate did not affect yield of any variety in shallow water; in medium water there was a trend for several varieties to yield higher at higher seeding rates, but only A-301 was significantly affected. In deep water M-201, L-202, CM-101, and A-301 all had higher yield with additional seed. In contrast, S-201, M-202, and M-401 performed similarly at all seeding rates.

Rice varieties clearly differ in their tolerance to water depth; additional seed can partly compensate for the effects of deep water for intolerant varieties.

Table 7. The effect of water depth on rice variety yields

	Grain yield (lb/A)								
	Shallow			Medium			Deep		
Variety	75	150	225	75	150	225	75	150	225
S-201	10576	10304	10003	9508	9980	10162	9703	9722	9650
M-201	10100	10328	10685	10019	9836	10128	8773	9860	9986
M-202	11255	11356	11279	10594	11148	11305	9959	10456	9776
M-101	10466	10196	10389	9626	10248	10254	9247	9875	9804
M-401	10048	7941	9601	10100	9556	9943	9781	9722	9709
L-202	8984	10033	10016	8510	9353	9518	7489	8537	9500
CM-101	10965	10789	10574	9790	10819	10473	9188	10283	10382
A-301	6320	5457	5510	6450	5536	6888	5403	6567	7404
Means	9839	9551	9757	9325	9560	9835	8693	9378	9526
Water depth means			9716			9573			9199
CV (%)									
LSD (.05):									
Water depth						NS			
Variety/seeding rate means (not shown)						650			
Interaction:									
Within water depth						1115			
For different water depths						1106			

Yield Summary of Nitrogen Rate 1987 Trials

Sutter County

Increasing acreage of M-401 and concern about appropriate N fertilization for maximum yield was justification for this experiment. In this trial M-401, for which we have no specific N response data, is compared to M7 as the reference variety. Six preplant N rates at forty lb N/acre increments were the main-plots with variety as the sub-plots. A yield summary appears in Table 8.

The nitrogen means maximized at 160 lbs N/acre after a nearly linear increase with each increment of N. M-401 averaged higher yield than M7 across all N rates. M7 maximized yield near 200 lbs N/acre; M-401 maximized yield at 160 lbs N/acre, or at about 20% less N than required for M7.

Leaf samples were taken three times during the season; analysis is not complete at this time. Data will be correlated to yield as part of the diagnostic criteria for M-401. Similar trials were conducted elsewhere and data from this trial will be compiled with them.

Table 8. M7 vs M-401 at six levels of nitrogen

Preplant N Rate (lb/A)	Grain yield (lb/A)		
	M7	M-401	Mean
0	5010	5646	5328
40	5628	6476	6052
80	6157	7885	7021
120	7022	9068	8045
160	8116	9552	8834
200	8616	9451	9033
Mean	6758	8013	7383
CV (%)		4.72	
LSD (.05)			
N rates		649	
Varieties		211	
Interaction:			
From same mainplot		518	
For different main		957	

Butte County

In this trial, M-401 was tested at eight preplant N rates, spaced in thirty lb N/acre increments, and applied as ammonium sulfate. A summary of the harvest data appears in Table 9.

M-401 reached a yield plateau at 120 lb N/acre; above this rate, no significant yield increases were attained. Grain moisture and plant height steadily increased with increasing nitrogen. Lodging became significant at 180 lbs N/acre, and no doubt contributed to yield loss at 210 lbs N/acre.

This trial was sampled three time for leaf tissue nitrogen during the growing season; analysis is not complete at this time and will be reported at a later date.

Table 9. M-401 at eight levels of nitrogen, Butte County, 1987

Preplant N rate (lb/A)	Grain yield (lb/A)	Grain moisture (%)	Height (in)	Lodging (%)
0	5066	15.6	32	1
30	6363	15.2	33	1
60	8718	16.4	37	1
90	9275	16.5	38	1
120	10308	17.3	39	1
150	10503	17.5	41	1
180	10559	18.7	41	27
210	9748	19.4	43	53
LSD (.05)	879	.8	2	17
CV (%)	5.7	2.7	3.4	92.4

Colusa County

Nine rates of preplant N, from 0 to 200 lbs N/acre, applied in 25 lbs N/acre increments, were used to test the nitrogen response of M-401. A summary of the harvest data appears in Table 10.

The yield response in this trial was different from the M-401 trials in Sutter and Butte Counties. In this trial, yields were lower at all nitrogen rates than in the other trials. Maximum yields were not reached until 175 lbs N/acre was applied. Grain moisture did not significantly change, and there was no lodging at any N rate.

Table 10. M-401 at nine levels of nitrogen, Colusa County, 1987

Preplant N rate (lb/A)	Grain yield (lb/A)	Grain moisture (%)	Height (in)	Lodging (%)
0	2377	16.8	27	1
25	2634	15.7	27	1
50	3573	14.1	29	1
75	4450	14.8	29	1
100	5336	12.8	33	1
125	7320	14.4	34	1
150	7812	15.1	36	1
175	8659	16.2	37	1
200	8521	15.7	37	1
LSD (.05)	633	NS	2	NS
CV (%)	7.7	14.1	4.6	--

Fresno County

The nitrogen response of L-202 at nine nitrogen rates was tested in this trial. The rates ranged from 0 to 200 lbs N/acre, applied in 25 lb N/acre, as ammonium sulfate.

Yields reach a maximum at 75 lb N/acre. Above this rete of applied N, there were no significant yield increases. Grain moisture showed a small increase with increasing N rates; there was no lodging at any nitrogen rate.

Leaf tissue samples were taken at two sampling dates for leaf nitrogen; this data is not available at this time and will be reported elsewhere.

Table 11. L-202 at nine levels of nitrogen, Fresno County, 1987

Preplant N rate (lb/A)	Grain yield (lb/A)	Grain moisture (%)	Lodging (%)
0	4322	16.7	1
25	5219	15.5	1
50	6498	15.0	1
75	7232	15.4	1
100	7632	15.9	1
125	7623	15.7	1
150	7630	17.1	1
175	7835	17.4	1
200	7447	17.4	1
LSD (.05)	620	1.0	NS
CV (%)	6.2	4.0	--

Colusa County

M-202 and M-201 were compared in this trial at nine different nitrogen rates. The rates ranged from 0 to 200 lb N/acre, applied in 25 lb N/acre increments as ammonium sulfate. A yield summary, for this trial, appears in Table 12.

The yield response of the two varieties to increasing nitrogen rates was not significantly different. However, M-202 reached a significant yield maximum at 150 lb N/acre, whereas M-201 did not reach a significant maximum until 175 lb N/acre. The lodging response (not shown) of the two varieties was similar, with no significant lodging until the 200 lb N/acre rate was applied.

Table 12. M-201 vs M-202 at nine levels of nitrogen, Colusa, 1987

Preplant N rate (lb/A)	M-201	M-202	Mean
0	2226	2019	2123
25	3414	3260	3337
50	4453	4063	4258
75	5765	5902	5834
100	7052	6702	6778
125	8665	7987	8326
150	8914	8915	8915
175	9557	9102	9329
200	8423	8697	8560
LSD (.05)			
N rates			479
Varieties			226
Interactions			NS
CV (%)			
N rate			7.3
Variety			7.3

Effect of Bti (*Bacillus thuringensis*) on M-201 Rice, Sutter County, 1987

This trial was done in cooperation with the Yuba-Sutter Mosquito Abatement District (Mike Kimball). The objective was to gather evidence on the effects of Bti mosquito larvacide on flowering rice, as measured by yield. This material is sprayed on over 100,000 acres of rice in the district; some concern was voiced regarding possible negative effects on rice. No data was available specific to rice. This trial was done by hand in small plots, using ULV application but at maximum labled rate. A randomized complete block design with five replications was used. Material was sprayed with a Micron Herbi calibrated to deliver the required dosage. Treatments were applied three times, when the crop (M-201) was in various stages of heading; one treatment had multiple applications. An additional treatment involved walking through on each spray date to equalize and evaluate the effect of the applicator moving through the plots.

None of the treatments had a significant effect on plant height, moisture content of harvested grain or grain yield (Table 13). Variation was very small in all parameters measured, lending validity to the results. We conclude the treatments had no effect and supports the belief that the material is not harmful to the rice. Follow-up work with airplane applications needs to be done to verify these indications.

Table 13. The effect of Bti application timing on rice height, moisture at harvest and yield

Treatment time	Plant height (cm)	Moisture content (%)	Grain yield (lb/A)
20% headed	78	21.2	10519
50% headed	77	21.4	10477
100% headed	76	21.3	10757
20+50+100%	77	21.0	10587
Walk through	77	21.1	10550
Untreated	77	21.1	10613
CV (%)	4.3	2.3	2.3
LSD (.05)	NS	NS	NS

Objective III - Assistance to Other Projects

The rice equipment pool, including a precision fertilizer applicator, harvester, microloggers, backpack CO_2- driven sprayers and other equipment, were used with labor from this project to assist in approximately forty field experiments in 1987.
The precision fertilizer was used to establish 11 fertilizer trials in 6 counties. The rate of application was either 0 to 200 lbs. N/A in 25 lb

increments, or 0 to 210 lbs N/A in 30 lb. increments.

The plot harvester was used to harvest 9 of the 11 fertilizer trials, 9 variety trials, 10 weed control trials, 3 fungicide trials, a large seeding rate x variety x water management trial, and a water management trial (IPM).

Eight microloggers were used to collect on-site daily air and water temperatures at four locations. This data is analyzed and made available to interested researchers associated with rice production.

The backpack sprayers were used to make precision applications of herbicides and growth regulators in nine different experiments. These sprayers were also used to provide weed control on levees during the growing season.

In addition to assisting in the above, labor from this project is used to plant, collect samples and monitor growth in numerous trials. This project also provides support in designing and analyzing rice field experiments.

Publications or Reports

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CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

Nine rice variety tests were conducted on farm sites throughout the growing areas of the Sacramento and San Joaquin Valleys. Four similar tests were conducted on the Rice Experiment Station, Biggs, California. The 1987 growing season was characterized by low temperatures during the period of pollen formation, approximately two weeks before heading. Thus, 1987 was an excellent year for the plant breeders to determine the tolerance to cold induced sterility of the experimental lines. The two leading commercial varieties in the very early and early tests were Calmochi-101 and M-102, both having superior resistance to blanking than all other commercial varieties.

A large three year study on the effect of water management on weed control was completed in 1987. This study, conducted in Sutter County, was funded in part by the UC IPM group. The results showed that deep water had a positive effect on suppressing barnyardgrass where no herbicides were used. These plots also showed that significant weed species shifts can occur. After three years of shallow water, barnyardgrass was the predominant weed whereas in deep water, roughseed bulrush was the significant weed. Where weeds were controlled with herbicides, average three year yields did not differ, however, in individual years, too-shallow or too-deep water reduced yields.

A number of experiments, conducted by other projects, received assistance with planting, fertilizing, herbicide application, harvesting and data analysis from investigators on this project.