COMPREHENSIVE RESEARCH ON RICE
January 1, 1975 through December 31, 1975

PROGRAM AREA AND TITLE: RM-2. Cooperative Extension Improved Rice Production Systems Research.

PROJECT LEADER: D. Marlin Brandon, Extension Agronomist (UCD). Principal UC Investigators: L. A. Post, Staff Research Associate (UCD) and Farm Advisors: W. Michael Canevari (San Joaquin), Kenneth Mueller (Colusa), J. G. St. Andre (Fresno), Carl M. Wick (Butte), J. F. Williams (Sutter), and David R. Woodruff (Kern).

LEVEL OF 1975 GRANT: $28,287.00

OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

Objective I: Determine the adaptability of the most promising new rice lines made available by CCRRF-USDA-UC and private plant breeders to the various rice production areas of the State. Identify environmental factors that cause specific lines to perform well in some areas and poorly in others. In addition to the Statewide Varietal Testing Program, advanced generations will be tested at the UCD Rice Research Facility to determine their agronomic performance in a cool environment and suitability for entry into the statewide testing program.

Experiments Conducted

Standard Statewide Variety Testing Program

1. Very Early Maturity Group Tests - Three uniform tests were conducted in 1975. These were located in Butte, Sacramento and San Joaquin counties.

2. Early Maturity Group Tests - Six uniform tests were conducted in this maturity group in 1975. These were located in Butte, Yuba, Yolo, Sacramento, San Joaquin and Kern counties.

3. Late Maturity Group Tests - Five uniform tests were conducted in 1975. These tests were located in Butte, Glenn, Sutter, Fresno and Kern counties.

UCD Testing of Advanced Generation Lines

1. Very Early Maturity Group Test - A single test of 59 entries with two replications was conducted at UCD.

2. Early Maturity Group Test - A single test of 109 entries with two replications was conducted at UCD.

3. Late Maturity Group Test (Short and Medium Grain) - A single test of 82 entries with two replications was conducted at UCD.

4. Late Maturity Group Test (Long Grain) - A single test of 32 entries with two replications was conducted at UCD.

Objective II: Study response of nine rice varieties to plant nutrients and other agronomic variables to determine optimum levels of these variables in

different environments of the State. Characterize differential response of new varieties to these variables on a statewide basis and provide growers information that will encourage maximum performance of new rice varieties the year they are released.

Experiments Conducted

Uniform Tests to Measure Agronomic Response of New Rice Varieties to Nitrogen

1. Response of the Early Maturity Group Varieties to Nitrogen - One experiment was conducted in a typical upper Sacramento Valley environment and one in a cool environment on the fringe of the Sacramento-San Joaquin Delta. The experiments were located in Butte and San Joaquin counties and each consisted of five nitrogen rates and three varieties replicated four times. Dr. Duane Mikkelsen and local county farm advisors cooperated in these experiments.

2. Response of the Late Maturity Group Varieties to Nitrogen - One experiment was conducted in the warmer Glenn County area and another in the cooler Sutter Basin area. The Glenn experiment was conducted in a field where rice has been grown continuously several years, whereas the Sutter Basin experiment was in a more fertile soil that is rotated periodically to other crops. Each experiment consisted of five nitrogen rates and three varieties replicated four times. Dr. Duane Mikkelsen and local county farm advisors cooperated in these experiments.

Experiments to Determine the Effect of Seeding Rate on the Performance of New Rice Varieties

1. Effect of Seeding Rate on Yield of the Variety S6 - One experiment was conducted in Yuba County in cooperation with John F. Williams, Farm Advisor. This experiment was conducted adjacent to the uniform Early Maturity Group Rice Variety Test and it consisted of four seeding rates replicated four times.

2. Effect of Seeding Rate on Yield of the Line D-7 - One experiment was conducted in the Sutter Basin in cooperation with John F. Williams, Farm Advisor. This experiment was conducted adjacent to the Standard Late Maturity Group Rice Variety Test and it consisted of four seeding rates replicated four times.

Objective III: Determine the most efficient sources, rates and methods of plant nutrient applications in view of increased cost of fertilizers and cooperate with Dr. Duane Mikkelsen et al. in keeping soil and tissue analyses current relative to newly released rice varieties.

Experiments Conducted

1. An experiment was conducted in cooperation with Dr. Duane Mikkelsen to determine the most efficient time and method of nitrogen application in rice. The N^{15} tracer method was used in the experiment because this technology allows more accurate determination of the fate of fertilizer nitrogen in the plant. The experiment was conducted in southern Colusa County and consisted of 15 fertilizer nitrogen treatments replicated four times.

2. An experiment was conducted in cooperation with Dr. Duane Mikkelsen and others to determine the cause and method of correction of an apparent plant nutrient deficiency in the red, San Joaquin soil series on the east side of the Sacramento and San Joaquin Valleys. The experiment had two levels of nitrogen, phosphorus and potassium in it and these were replicated four times. It was located in eastern San Joaquin County.

3. One experiment was conducted in Glenn County to determine the most effective zinc sources and rate of zinc application in a zinc deficient soil. The experiment consisted of four zinc sources at four rates and was replicated four times.

4. The nitrogen by new rice varieties experiments listed under Objective II are also related to this objective.

Objective IV: Determine the more effective and efficient management of rice land relative to grower returns on investment and conservation of land and water resources. Identify plant growth variables in rice soils that limit production of rotational crops and efficiency of land use.

Experiments Conducted

1. Response of Wheat to Nitrogen and Banded Phosphorus when Grown after Rice - One experiment was conducted in southern Colusa County to identify variables that limit wheat production in soil rotated out of rice. The experiment consisted of 17 nitrogen x phosphorus treatments designed to identify the optimum nitrogen and phosphorus fertilizer rates and provide data on time of nitrogen application.

2. Basic Research on Cause of Phosphorus Deficiency in Crops Grown after Rice - Research is currently underway to study soil phosphorus transformations when rice soils are flooded that induce phosphorus deficiency in crops grown after rice. This research will be used in partial fulfillment of requirements for a Ph.D. in Soil Science.

Objective V: Provide specialized, professional assistance needed to expedite Cooperative Extension Rice Research and Education Programs and field research of other projects in the Comprehensive Rice Research Program. Maintain a UCD Agronomy Extension-based rice project machinery pool designed to seed and harvest rice field experiments.

SUMMARY OF 1975 WORK (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

Objective I

Standard Statewide Rice Variety Tests by Maturity Group

A total of 14 uniform rice variety experiments were conducted in eight counties from Butte to Kern. These tests were designed to measure agronomic performance of potentially new rice lines in various environments of California. The varietal entries in the tests were categorized into Very Early Maturity Group (requires <90 days to 50% heading), Early Maturity Group (requires 90 to 100 days to 50% heading), and Late Maturity Group (requires >100 days to 50% heading). The average performance of lines in these maturity

groups over all locations are reported here. A detailed summary by location is not attempted in this report for the sake of brevity. However, such a summary by location will be published and made available later.

1. Summary of Standard Very Early Rice Variety Group - Two of these tests were located in cool environments and one in the warmer climate of the Rice Experiment Station at Biggs. The average yields, seedling vigor, days to 50% heading, plant height and lodging of the three tests are shown in Table 1.

   There was a highly significant variety by location interaction in this maturity group. This indicates that varieties performed differently depending upon the location of the test. Therefore, one must be concerned with the performance of a given variety in a specific location and the statewide averages cannot be broadly applied to performance. For example, the line 73/12881 performed well based upon grain yield in the Biggs and Sacramento County locations but performed very poorly in the San Joaquin County location. Low night temperatures that induce blanking in the less cold tolerant varieties probably is responsible for the differential performance of several of the lines in the warm and cool locations.

   Earlirose continued to be a very high yielding variety in this maturity group and was the standard variety for comparison. However, there were four pearl and three medium-grain lines that performed comparably to or better than Earlirose and had the desirable characteristics of being earlier and shorter than Earlirose. The line 72/6904 has been tested for the past two years and has performed well in both the warm and cool climates. It was approximately three days earlier, 6 centimeters shorter, and more resitant to lodging than Earlirose. This line has shown good yield potential and is an example of lines in this group that have real potential. The variety Maxwell performed poorly in all test locations probably because of its tendency to lodge severely.

2. Summary of Standard Early Rice Variety Group - This group of varieties was tested in more locations than other groups and contains some lines that appear very desirable for California conditions. It contained the standard varieties Colusa and Earlirose and the newly released varieties M5 and S6. Two of these tests were conducted in cool climates, one in a moderately cool climate, two in the warmer upper Sacramento Valley climate and one in the hot climate of the lower San Joaquin Valley. The average grain yield, seedling vigor, days to 50% heading, plant height and lodging over all locations are presented in Table 2.

   There was a highly significant variety by location interaction in this group and the performance of a given line was dependent on the location in which the test was conducted. For example, the line 72/4963, a short-statured line derived from the indica gene source, performed well in the warmer climates of the Sacramento and San Joaquin Valleys but yielded very low in the cooler areas. The cause of the poor performance in the cooler locations was most likely due to cold induced blanking. Conversely, the line 72/12093 performed well in all locations, except in the Yuba County test, which indicates it may be well adapted to all rice growing areas relative to climate of the State. The poor performance of this line in the Yuba test may have been due to its sensitivity to what appeared to be a soil related problem.

Table 1.

VERY EARLY STANDARD RICE VARIETY TESTS - 1975

STATEWIDE MEANS

Entry No.	Variety Description	Grain Type	Yield @ 14% H_2O lbs/A	Duncan's Test	Seedling Vigor 1-5	Days to 50% Heading	Plant Height cms	Lodging 0-10
21	72/6904	P	8420	a	3.7	101	100	1
9	72/4511	P	7910	ab	4.1	101	101	2
5	72/12093	M	7900	ab	4.1	102	75	1
29	73/12881	M	7760	abc	3.9	103	73	1
2	Earlirose	M	7680	abcd	4.4	104	106	4
11	72/4740	P	7550	abcde	4.4	93	105	1
6	71-D/125 Sel.	P	7510	abcdef	4.4	105	72	1
18	72/6135	M	7490	abcdef	4.0	97	109	7
14	72/5234	P	7430	bcdef	4.1	94	100	4
23	72/4745	P	7390	bcdef	4.5	100	99	1
25	72/6954	P	7290	bcdefg	4.4	104	107	2
20	72/6196	M	7270	bcdefg	4.3	94	99	4
4	71-D/18	M	7260	bcdefg	3.9	101	105	5
28	73/12870	M	7260	bcdefg	4.3	99	72	1
22	72/6977	P	7250	bcdefg	4.0	96	101	1
30	73/12899	M	7230	bcdefg	4.3	101	72	1
3	72/6181	P	7220	bcdefg	4.1	96	95	1
24	72/6145	P	7060	bcdefgh	4.3	101	104	2
26	72/7300	P	6790	cdefgh	3.5	103	107	1
15	72/5256	P	6750	cdefgh	4.7	98	109	2
17	72/6102	M	6720	defgh	4.6	89	104	3
10	72/4551	P	6700	defgh	4.3	89	97	1
7	72/4292	M	6630	efgh	4.6	90	102	1
27	72/15446	M	6490	fgh	3.4	105	95	1
19	72/6149	M	6310	ghi	4.1	92	99	1
13	72/5201	P	6290	ghi	4.4	96	103	2
12	72/4741	P	6280	ghi	4.1	94	105	1
16	72/5669	M	6210	hi	4.6	97	101	1
8	72/4381	P	6060	hi	4.4	102	109	1
1	Maxwell	P	5370	i	4.3	97	111	7
$LSD_{.05}$ for Adjacent Means			840		0.6	2	6	2
C.V. (varieties) %			14.8		13.8	2.0	6.2	77.9

Location $LSD_{.05}$ for yield = 720 lbs/A

Variety X Location $LSD_{.05}$ for yield = 1450 lbs/A

Table 2.

EARLY STANDARD RICE VARIETY TESTS - 1975

STATEWIDE MEANS

Entry No.	Variety Description	Grain Type	Yield @ 14% H_2O lbs/A	Duncan's Test	Seedling Vigor 1-5	Days to 50% Heading	Plant Height cms	Lodging 0-10
39	72/12093	M	7990	a	3.9	98	83	1
35	71/6404	P	7560	b	4.1	103	101	1
41	72/5094	P	7540	b	3.9	100	110	5
49	72/14787	P	7460	bc	4.3	104	98	0
44	72/6798	M	7400	bcd	3.9	100	98	3
43	71/6629	M	7370	bcd	4.5	101	111	4
54	72/15542	M	7280	bcde	2.9	101	88	0
31	Earlirose	M	7280	bcde	4.5	101	111	5
32	S6	P	7190	bcde	3.7	103	112	2
51	72/14938	P	7150	bcde	4.2	105	101	1
33	M5	M	7140	bcde	3.8	104	113	3
40	72/4453	P	7140	bcde	4.3	101	109	5
38	71/10877	P	7020	cdef	3.6	105	77	0
34	NFD E.R.^{75}	M	6910	defg	3.2	101	109	3
48	72/14780	M	6900	defg	4.1	103	98	1
36	71/2804	P	6850	efgh	3.4	107	74	0
45	72/7373	P	6780	efghi	4.1	103	107	4
53	72/15498	M	6590	fghi	3.7	104	79	0
56	72/32990	M	6530	fghij	3.6	105	76	0
42	72/5989	M	6520	fghij	4.3	100	114	2
52	72/15471	M	6460	ghijk	3.9	106	75	0
60	73/18220	M-Glu.	6420	ghijk	3.0	103	112	6
47	72/12130	M	6380	hijk	3.8	105	74	0
60A	Colusa	P	6320	ijk	3.6	105	108	5
37	71/4963	P	6090	jkl	3.4	109	78	0
50	72/14932	P	6010	kl	4.3	105	103	0
55	72/15700	M	5830	l	3.7	104	81	0
59	72/15493	P	5740	l	3.1	106	--	0
46	72/7892	P	5630	l	3.8	107	109	1
57	C.I. 9875	M	5000	m	3.9	108	97	1
58	72/14777	M	4800	m	4.2	107	77	0
$LSD_{.05}$ for Adjacent Means			430		0.3	3	4	1
C.V. (varieties) %			10.3		14.6	4.0	6.2	88.0

Location $LSD_{.05}$ for yield = 580 lbs/A

Variety X Location $LSD_{.05}$ for yield = 960 lbs/A

There are several lines in the group that have performed well in two years of testing. Certainly the short-statured line 72/12093 which matured about three days earlier than Earlirose this year is a desirable plant type which has exhibited high yield potential based upon the statewide tests. This line approached 10,000 pounds per acre yield in the Yolo and Butte County tests which was grown in a highly fertile soil environment. It performed well in the cooler locations as well as the warmer ones, and therefore, appears to tolerate low night-time temperatures during stand establishment and the reproductive plant growth stages. The newly released varieties M5 and S6 performed well in most locations and yielded significantly greater than Colusa on a statewide basis. These varieties appeared to show greater tolerance to low temperatures than Colusa based upon observation. The reason for their poor performance in some locations was apparently due to nutritional variables within the experimental area. The desirability of line 71/4963 as a California variety appears questionable due to its lack of cold tolerance. It has performed well in warmer areas but poorly in the cooler areas. The results of the nitrogen by variety experiments in this report indicate that the yield potential of 71/4963 is greatly reduced in the cool San Joaquin County location. The proprietary line N.F.D.75 performed similarly to Earlirose as indicated by the statewide data. However, it was a little more resistant to lodging and is reported to have better grain quality than Earlirose. In the Kern County location, N.F.D.75 yielded significantly greater than Earlirose but was about eight days later in maturity. Yield samples taken from the grower's field in which Calrose was grown, indicated that Calrose yielded about the same as Earlirose and N.F.D.75 in this May 27 planting. Surprisingly, Earlirose was only a few days earlier than the Calrose planting in this field, probably because of the greater photoperiod sensitivity of Calrose which shortened the days required to mature it.

3. Summary of Standard Late Rice Variety Group - This variety group, which contains rice varieties that require 150 to 170 days for maturity, was tested only in the warmer climates of the Sacramento and San Joaquin Valleys, except the Sutter County location was a moderately cool area. Generally these varieties are not well adapted to the cooler Sacramento-San Joaquin Delta area and its fringes where low night temperatures are common. This maturity group contained the standard varieties CS-M3, Calrose and CS-S4 and there were several lines that performed significantly better than the standards. The average grain yield, seedling vigor, days to 50% heading, plant height and lodging over all locations are presented in Table 3.

   There are three lines in this group that have performed well in two years of testing in all test locations. The lines 72/11858, 72/12089 and 71/D-7 have exhibited greater yield potential than standard varieties over the two years of testing. These lines are similar in height (approximately 86 cms in 1975), similar to CS-M3 in maturity and show as good or better seedling vigor than standard varieties. The line 71/1289 has been tested three years and has yielded well in warmer areas, but the 1975 yields were extremely poor in the cooler Sutter County tests, probably because of cold induced blanking. Yield reversals such as this in particular locations were the source of variation that caused a highly significant variety by location interaction in this group. However, the stability of

Table 3.

LATE STANDARD RICE VARIETY TESTS - 1975

STATEWIDE MEANS

Entry No.	Variety Description	Grain Type	Yield @ 14% H_2O lbs/A	Duncan's Test	Seedling Vigor 1-5	Days to 50% Heading	Plant Height cms	Lodging 0-10
82	73/15147	M	9190	a	4.4	111	80	0
84	73/15881	M	8930	ab	4.1	111	74	0
79	73/4160	M-P	8810	abc	4.9	110	83	0
77	73/17677	M	8580	bcd	4.4	111	81	0
74	72/13882	M	8550	bcde	4.2	110	86	0
69	72/11858	M	8490	bcdef	4.6	108	88	1
85	73/16632	M	8440	cdefg	4.3	108	88	1
83	73/15760	P-M	8220	defgh	4.6	111	80	0
70	72/12089	M	8210	defgh	4.1	105	84	0
80	73/12928	M	8090	efghi	4.0	112	78	0
68	71/D-7	M	8060	fghi	3.8	109	86	2
71	72/10791	M	7990	ghi	4.0	111	75	0
65	72/3764	L	7950	hij	3.5	107	107	1
76	73/15926	P	7930	hij	3.7	108	79	3
72	72/13064	M	7870	hijk	4.1	112	72	0
81	73/13594	M	7680	ijkl	4.2	110	78	1
64	Tsuri Mai	M	7510	jkl	4.0	105	117	5
61	CS-M3	M	7480	jkl	3.8	108	122	5
66	71/1289	M	7440	kl	4.2	113	76	0
73	C.I. 9906	P	7270	lm	3.3	107	87	0
67	71/1769	M	7260	lm	3.9	116	74	0
63	Terso	M	6970	mn	4.0	103	119	8
62	CS-S4	S	6900	mn	3.1	110	109	4
78	73/17750	M	6600	n	4.1	111	90	0
85-A	R1659	M	* 9430		3.7	113	97	4
61A	Calrose	M	* 7200		4.0	106	97	6
75	Ampex	P	* 7200		4.6	112	115	3
$LSD_{.05}$ for Adjacent Means			410		0.3	1.0	3.0	0.8
C.V. (varieties) %			8.4		13.2	1.5	5.4	90.8

*Not included in statewide analysis. Two locations only.

Location $LSD_{.05}$ = 420 lbs/A

Variety X Location $LSD_{.05}$ = 930 lbs/A

yields in all locations of entries 72/11858, 72/12089 and 71/D-7 this year indicate these lines may be widely adapted in California.

1975 was the second year the short-statured 71/D-7 has been in the Standard Statewide Tests. It performed well in all locations showing good seedling vigor and reduced lodging when compared to CS-M3. When grown under favorable nitrogen nutritional levels it produced significantly greater grain yields this year than CS-M3, probably because of its greater resistance to lodging. In the nitrogen by variety experiments reported in this report, this line showed very high yield potential in the higher nitrogen rate treatments. 71/D-7 appears to respond to environment very similar to CS-M3 and Calrose and has the trait of being rather tolerant of low temperatures. The height of this line can be increased to about 95 centimeters by application of high nitrogen rates, but this is approximately 25 centimeters (10 inches) shorter than CS-M3 under similar conditions. Three 3-acre plantings of 71/D-7 were made by aircraft in three different locations and one 3-acre planting was seeded dry this year. 71/D-7 did not lodge in these plantings, but Calrose, CS-M3 and Terso, which were grown in the growers' fields did lodge. Commercial harvesters were used to combine these strip-plantings and growers generally reported no problem in its harvestability. However, the grower of the Butte County location reported 71/D-7 did not flow well into the bankout augar because of awns on the grain but no combine adjustments were made to separate the awns from the grain in harvest. This new short-statured line, which is similar to Calrose in all known characteristics, except height, appears to be a good candidate for release in California.

Another short-statured line, R1659, performed well in two test locations. This line is similar to 71/D-7 in that the gene which regulates plant height in the two lines comes from the same germplasm. R1659 has smooth hulls and leaves (glabrous) whereas those of 71/D-7 are rough (pubescent). Additional testing of R1659 will be required before its adaptability to different environments of California can be determined.

The long grain line 72/3764 has performed well in most test locations the past two years. It is earlier than CS-M3 and is more resistant to lodging than standard varieties. Although this line appears to be well adapted to environments that presently produce late maturing varieties, it has not performed as well in the Glenn County location as it has in others. The cause of its poorer performance in this location appears to be associated with the severe stem rot disease infection that has developed in it the past two years. Apparently it is not as tolerant to stem rot as the standard CS-M3 and other high yielding lines.

Tests of Preliminary Rice Lines at UCD

These tests were conducted for CCRRF rice breeders and the USDA rice geneticist. The purpose of these tests is to determine performance of new lines in the cool Davis location and their desirability for statewide testing. Please refer to the Rice Experiment Station Annual Report to the Rice Research Board for results of these tests.

Objective II

Summary of Uniform Tests to Measure Agronomic Response of New Rice Varieties to Nitrogen

Four tests to determine the responsiveness of three early maturity group lines and three late maturity group varietal lines were conducted in cooperation with Dr. Duane Mikkelsen and rice farm advisors. Only a brief summary is presented in this report for the sake of brevity. A more detailed report will be prepared and made available later. Please also refer to Dr. Duane Mikkelsen's 1975 report as it will contain yield component measurements of these experiments.

1. Response of Three Early Maturity Group Rice Varieties to Nitrogen - Two experiments were conducted to determine the responsiveness of three early rice varieties to nitrogen fertilizer in two locations. The tests contained the new rice varieties M5, S6 and the short-statured line 71/4963. Rates of nitrogen applied were 60, 90, 120, 150 and 180 pounds per acre. This range included sub-optimum, optimum and excessive rates of nitrogen. The yield results of these tests are summarized in Figures 1 and 2.

   The three early maturing varieties responded similarly to increasing increments of nitrogen in both locations. The rate of yield increase decreased greatly as nitrogen was increased from 150 to 180 pounds per acre for S6, M5 and 4963. The response curves of the three varieties in the Butte location were quadratic whereas those in the San Joaquin location were linear. The three varieties reached their maximum yield potential at the 150 pounds per acre nitrogen rate in the Butte County location and yields were depressed by application of the higher 180 pounds rate. However, the data indicates that yield response to nitrogen had not reached its maximum at the 150 to 180 pounds rate in the San Joaquin location even though the mean yields were lower in this location.

   The relative slope of the M5 and S6 regression lines indicates these two varieties responded to nitrogen in a very similar way in the cooler San Joaquin and warmer Butte County locations. Not only were they responsive to nitrogen but they performed well in both locations. Conversely, the short-statured line 4963 was not responsive to nitrogen and performed poorly in the cool location. However, 4963 was very responsive to nitrogen and yielded significantly greater than M5 and S6 in the warmer Butte County test. This data indicates that 4963 is narrowly adapted in California because of its sensitivity to low night-time temperatures and low temperatures greatly reduce its responsiveness to fertilizer nitrogen. This is not surprising since 4963 carries indica genes and the indica type rices are very sensitive to low temperatures. These experiments exemplify the need for testing new rice lines in different locations and subjecting them to nutritional variables. Such information can prevent great monetary loss to rice growers should new rice lines be grown without this knowledge.

2. Response of Three Late Maturity Group Rice Varieties to Nitrogen - Two experiments were conducted to determine the responsiveness of three late maturing rice varieties to nitrogen fertilizer in two locations. These tests contained the standard variety CS-M3 and the short-statured line 71/D-7 and the long grain 3764. Rates of nitrogen applied were 60, 90,

FIGURE 1. RESPONSE OF THREE EARLY MATURITY GROUP RICE VARIETIES TO NITROGEN. LOCATION: MCKNIGHT RANCH, BUTTE COUNTY. 1975.

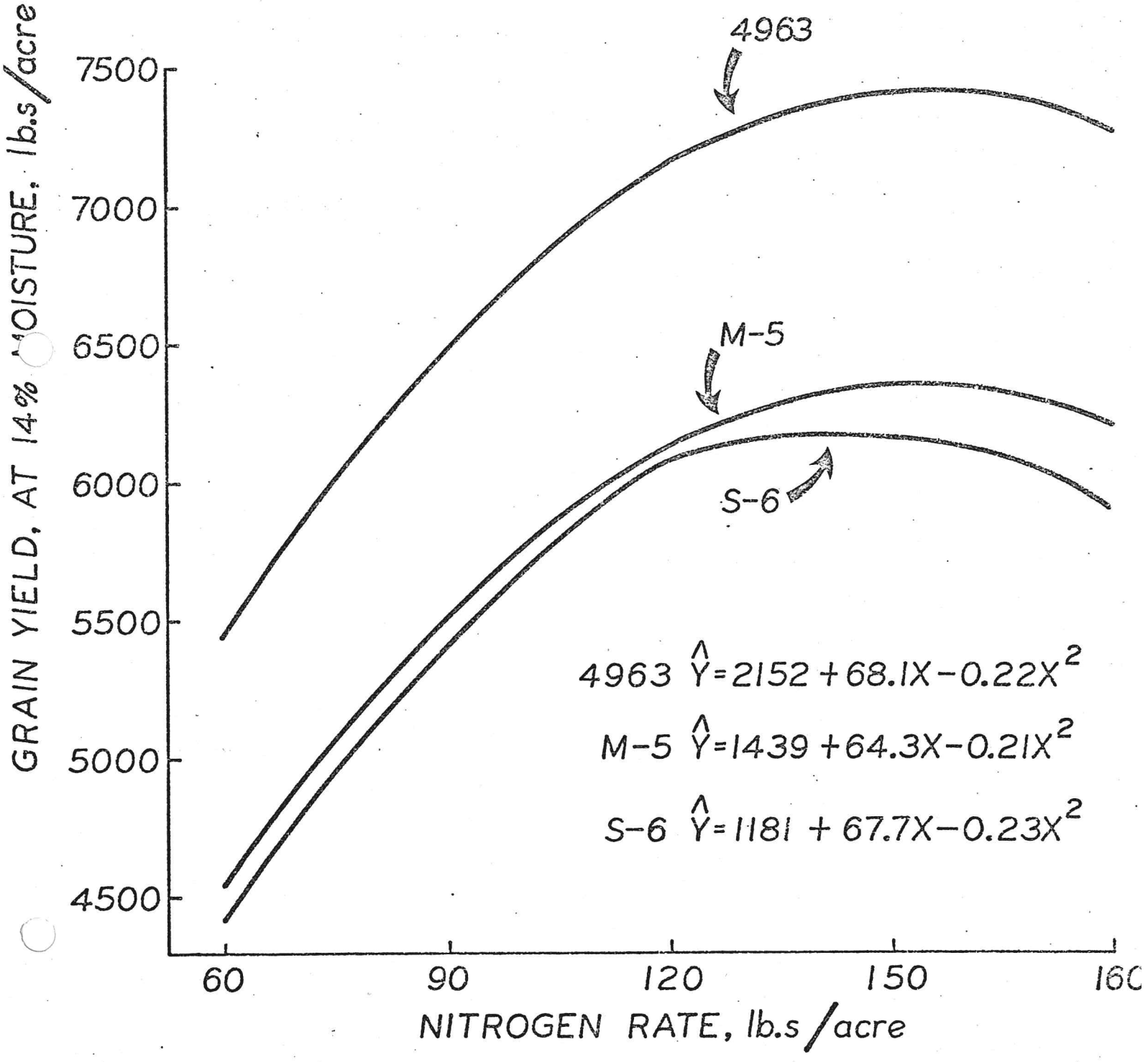
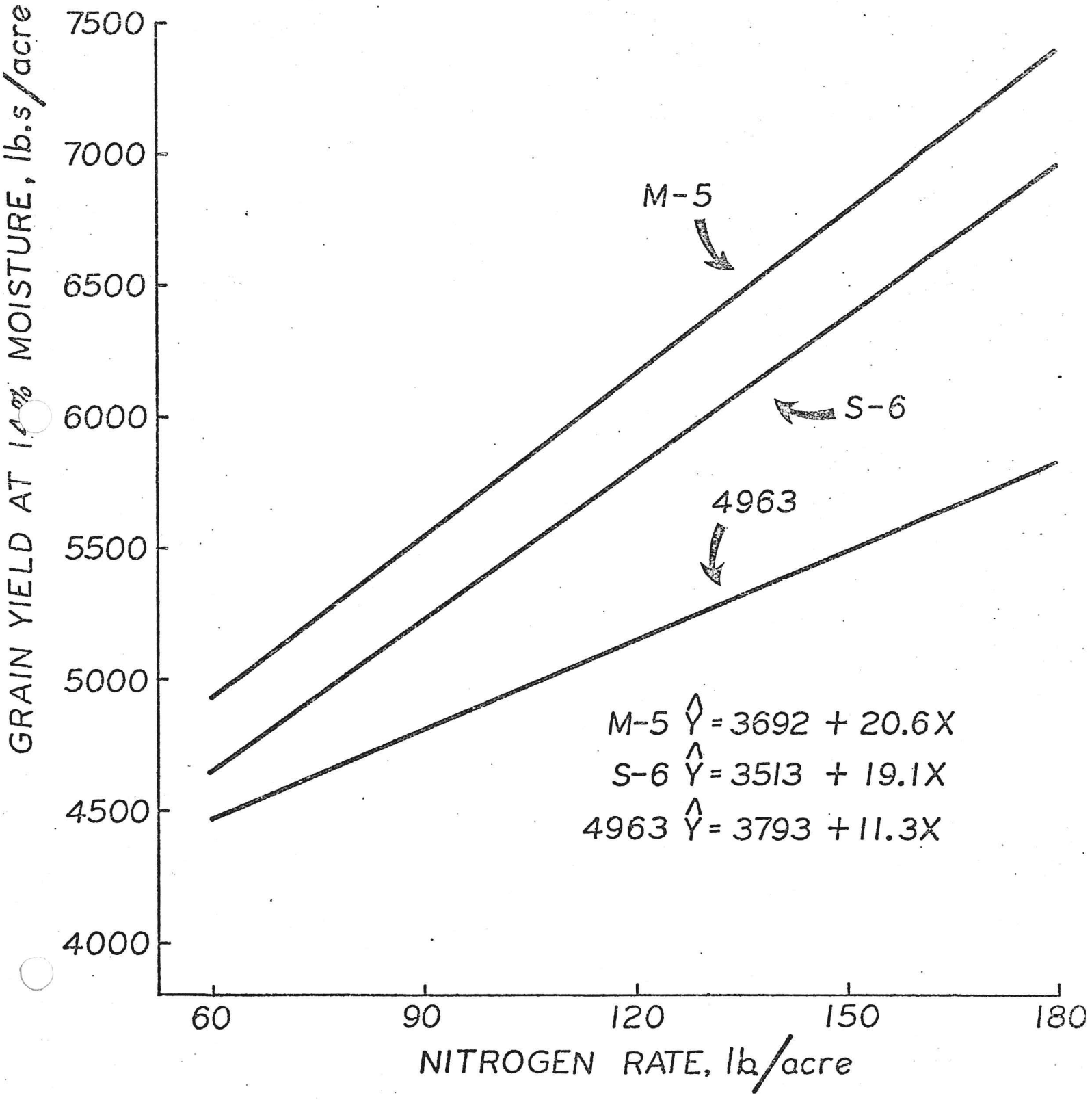


FIGURE 2. RESPONSE OF THREE EARLY MATURITY GROUP RICE VARIETIES TO NITROGEN. LOCATION: BRUMLEY RANCH, SAN JOAQUIN COUNTY. 1975.



120, 150 and 180 pounds per acre. This range included sub-optimum, optimum and excessive rates of nitrogen. The yield results of these tests are summarized in Figures 3 and 4.

Yield response of CS-M3, D-7 and 3764 was linear in the Glenn location. The soil in this location was relatively infertile and this particular field had been in rice the past ten years. Consequently, plant response to nitrogen was great and the taller varieties did not lodge badly even at the 180 pounds per acre nitrogen rate. Although the rate of yield increase per increment of added nitrogen appeared to decrease at the 150 pounds rate, the optimum yield response was not obtained in this experiment. The regression equations indicate that these three varieties responded similarly to nitrogen, but D-7 exhibited higher yield potential than the other two lines. Additional data is needed to establish optimum nitrogen application rates for these lines in this location.

The Sutter Basin experiment was conducted under quite different conditions than the Glenn County one. This experiment was conducted in a more fertile soil that is frequently rotated out of rice into upland crops. The yield levels of the varieties were extremely high at the lower 60 pounds per acre nitrogen rate and yield response to higher nitrogen increments was very small. The lines D-7 and CS-M3 exhibited a linear response to nitrogen, even though response was small. However, 3764 exhibited a quadratic response in that yield decreased beyond the 150 pounds per acre nitrogen rate. Application of more than 90 pounds per acre nitrogen in this location was questionable in view of a minimal increase in rice yield from higher rates of nitrogen.

Summary of Studies to Determine the Effect of Seeding Rate on Yield on New Rice Varieties

1. The Effect of Seeding Rate on Yield of S6 - An experiment was conducted by John F. Williams, Sutter County Farm Advisor, adjacent to a Standard Early Rice Variety Test to determine the optimum seeding rate for the new rice variety S6. The data indicates there was no significant difference in yield between the 150 and 200 pounds per acre seeding rates. While there was no significant difference in the data between the 100 pounds per acre rate and the 150 pounds per acre rate, it appears that the lower 100 pounds per acre rate provided an insufficient plant population for maximum yield. The data supports other observations that 50 pounds per acre of seed is insufficient for maximum yield. Further studies need to be conducted to determine the effect of seeding rate on the yield of the short-statured lines.

2. The Effect of Seeding Rate on Yield of 71/D-7 - An experiment was conducted by John F. Williams, Sutter County Farm Advisor, adjacent to a Standard Late Rice Variety Test to determine the optimum seeding rate for the line 71/D-7. This line is a short-statured one derived from irradiated Calrose and shows promise as a new variety. The results of this experiment indicated there was no significant difference in yield between the 50, 100, 150 and 200 pounds per acre seeding rates. This was unusual in that greatly depressed yields are usually observed with less than a 100 pounds per acre seeding rate due to insufficient plant density. This experiment was conducted in a very fertile soil and apparently the plants tillered suffi-

FIGURE 3. RESPONSE OF THREE LATE MATURITY GROUP RICE VARIETIES TO NITROGEN. LOCATION: WYLIE FARMING, GLENN COUNTY. 1975.

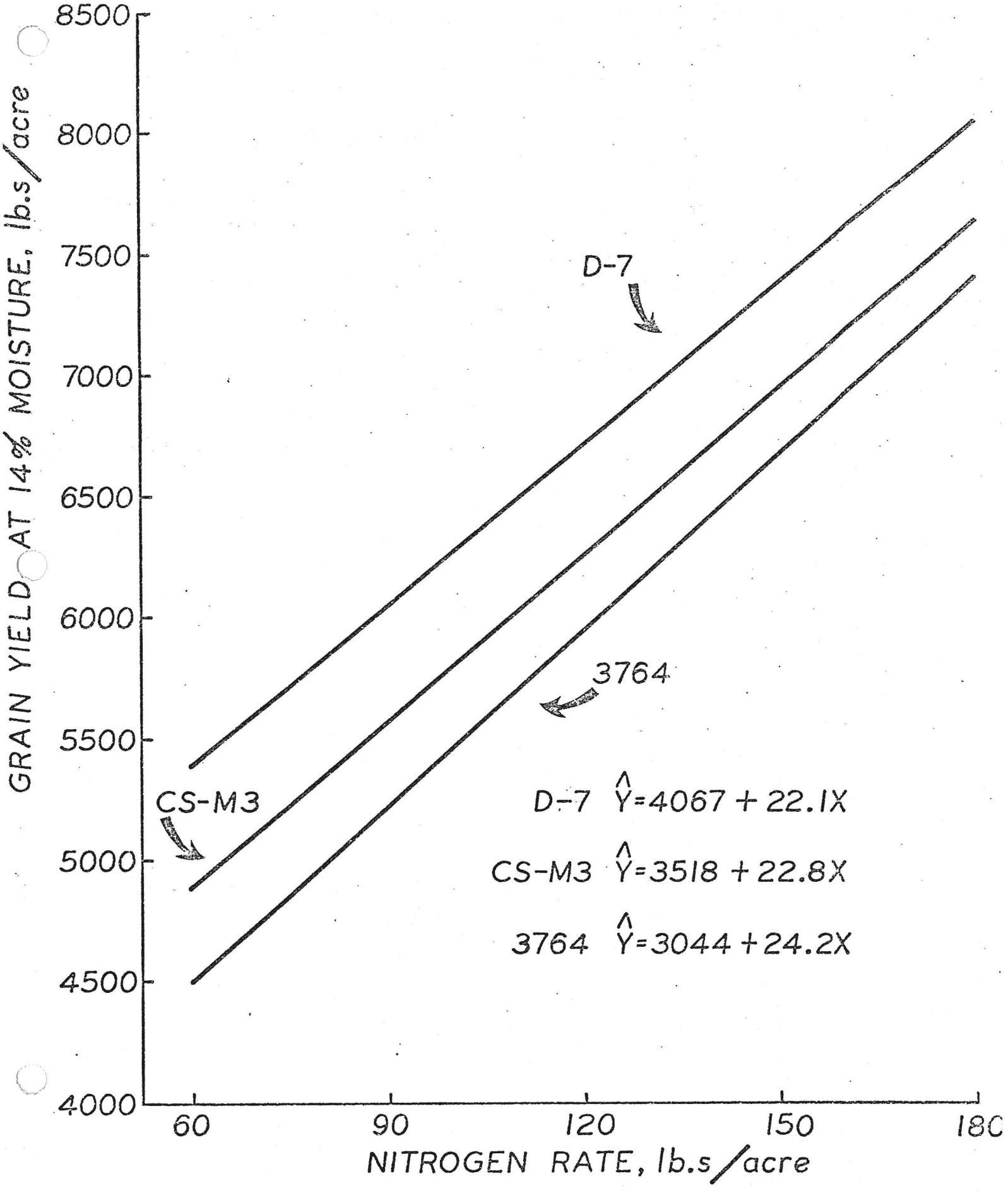
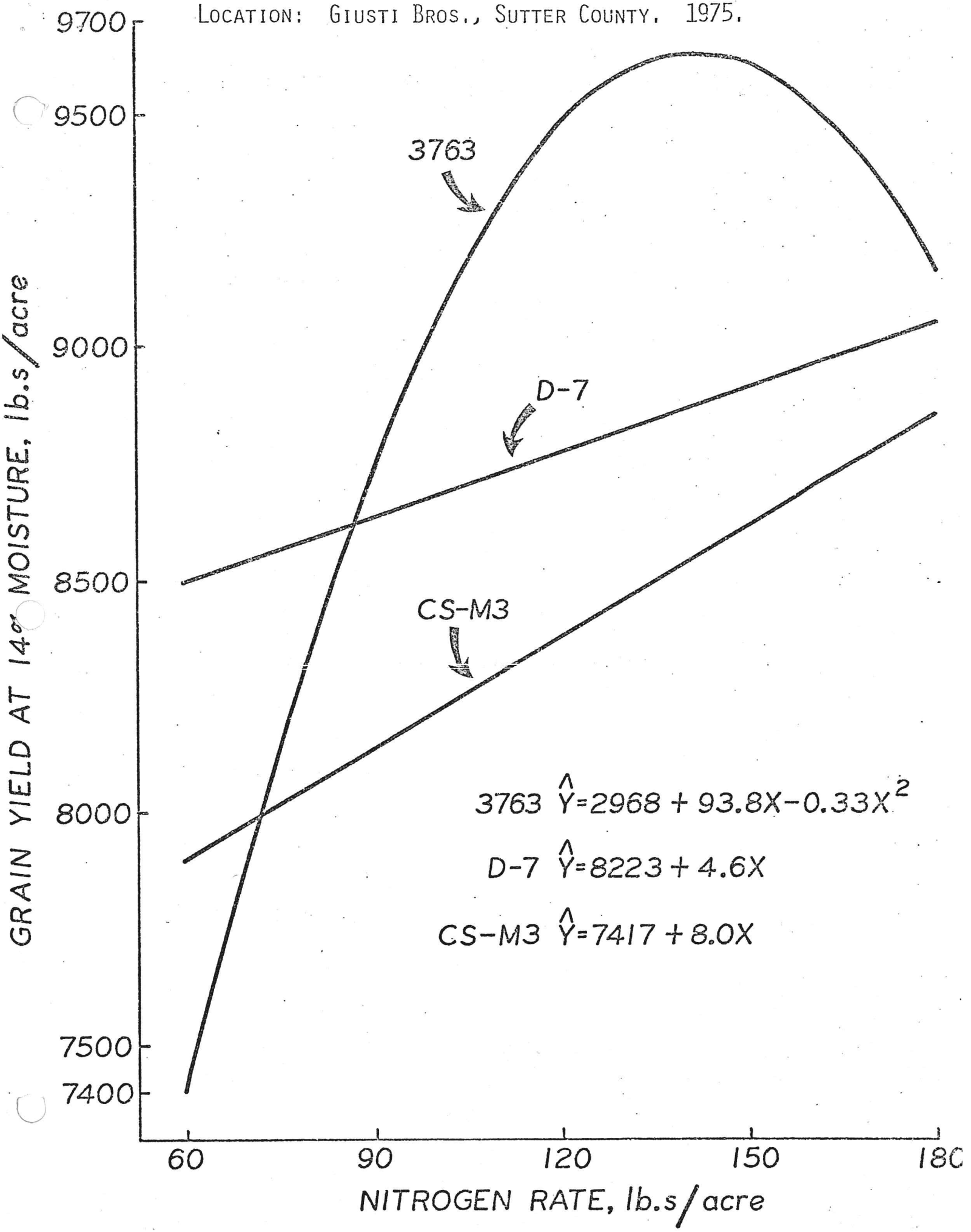


FIGURE 4. RESPONSE OF THREE LATE MATURITY GROUP RICE VARIETIES TO NITROGEN
LOCATION: GIUSTI BROS., SUTTER COUNTY. 1975.



ciently in the lower seeding rates to compensate for the reduced stand. Consequently, yield levels at all seeding rates were high and a significant difference between the seeding rate treatments was not observed.

Objective III

Summary of Experiments to Determine More Efficient Rates and Methods of Nitrogen Application in Rice

1. An experiment was conducted to determine the most efficient rate and method of nitrogen application in rice. The N^{15} method was used to provide positive data on the fate of nitrogen in the plant. By essaying the N^{15} in the plant tissue and grain it is possible to determine the amount of fertilizer nitrogen that actually gets into the rice plant. The data generally showed the most efficient utilization of fertilizer nitrogen by the plant occurred when all the nitrogen was applied preplant. The second most efficient method studied was 2/3 of the total nitrogen applied preplant and 1/3 topdressed at panicle initiation or the early boot plant growth stages. Please refer to project report RB-1, Rice Nutrition and Fertilization. of Dr. Duane Mikkelsen's for details of this experiment.

2. One experiment was conducted on the shallow, red San Joaquin soil series that is characterized by a relatively shallow hardpan. Several thousand acres of rice are planted each year on this soil but production levels are relatively low. This experiment was established to determine why yields of rice were low the previous two years in this location. Variable rates of nitrogen, phosphorus and potassium were used as the treatments to study their influence on the problem.

   The data indicated that nitrogen at higher rates most significantly affected the yield of rice. Rice yield levels at 100 pounds per acre nitrogen were normal and this rate resulted in a yield increase of approximately 2000 pounds of rice per acre. Phosphorus and potassium deficiencies did not appear to limit rice yield in this experiment. Applications of these two plant nutrients did not increase rice yields beyond those of nitrogen only.

Objective IV

1. Response of Anza Wheat to Nitrogen and Phosphorus When Grown After Rice - This experiment was established in a Sacramento clay soil in the fall after rice had been harvested. The field had been in rice for three years. The objective of the study was to study nitrogen and phosphorus nutrition of wheat and determine optimum rates of these two plant nutrients in this cropping system. The Sacramento clay soil is a relatively fertile rice soil and crops planted after rice have not shown great response to banded phosphorus as the red soil types have. However, yield increases of 300 to 500 pounds per acre have been shown in some locations to banded phosphorus. The experiment consisted of nitrogen rates of 0, 50, 100, 150 and 200 pounds per acre nitrogen and 0, 60 and 120 pounds per acre P_2O_5. The data collected from this experiment is very extensive and has not been analyzed completely at this date. A full report that deals with factors that limit yields of crops planted after rice will be made in the near future after data is complete.

The yield data of this experiment indicates that wheat planted after rice requires extremely high levels of nitrogen for maximum yields. The maximum yield observed in this experiment as a result of nitrogen application was approximately 6800 pounds per acre and this was 600 pounds per acre more grain than produced at the 150 pounds per acre nitrogen rate. An experiment is currently being conducted to determine the optimum rate of nitrogen application in this situation. The reason that such a high rate of nitrogen is required for optimum plant growth and yield is unknown. Since the nitrogen was applied in a split application in this experiment (2/3 preplant + 1/3 at late tillering), large losses of nitrogen through denitrification probably did not occur. Furthermore, two preplant treatments compared with split applications at a common nitrogen rate indicated there was no difference in the methods of nitrogen application. There was no significant effect of banded phosphorus on wheat yields in this experiment. However, there was a plant growth response exhibited in greater tillering and earlier maturity. Earlier maturity may have been detrimental to yield in this experiment because of the greater chance of frost injury. The complete statistical analysis of all variables measured in this experiment should answer some of the questions the data uncovers.

Backup Support Provided by Cooperative Extension

The rice combines stationed at UCD were used to harvest 4,316 rice plots from Butte to Kern County. They harvested all the variety tests, the nitrogen x variety tests and assisted in the harvest of Weed Control, Plant Pathology and Agronomy field experiments. A two-man crew was assigned to each combine through the harvest season from September 20 to November 3, 1975. The harvesters were transported a total of 5,400 miles during the harvest season.

PUBLICATIONS AND REPORTS

1. Brandon, D. M. et al. 1975. Cooperative Extension California Rice Research Report. Annual Issue, Rice Journal 78(7):36-39.

2. Brandon, D. M. et al. 1975. Rice Production School, A Current Summary of Varieties, Plant Nutrition and Crop Protection Practices. Cooperative Extension, University of California. 27 p.

3. Brandon, D. M. 1975. Phosphorus, Zinc and Potassium Fertilization of Rice. Rice Production School, Cooperative Extension, University of California. p. 17-20.

4. Mikkelsen, D. S. and D. M. Brandon. 1975. Zinc Deficiency in California Rice. California Agriculture 29(9):8-9.

5. Brandon, D. M. 1975. Recognizing and Correcting Rice Plant Nutrient Deficiencies. Rice Farming 9(5):18-20.

6. Brandon, D. M. et al. 1974. Cooperative Extension Improved Rice Production Systems Research Annual Report. University of California. 9 p.

GENERAL SUMMARY OF ACCOMPLISHMENTS IN 1975

Fourteen Standard Rice Variety Tests were conducted in nine California counties in 1975. There were three lines in the very early maturity group that yielded an average of 3 to 10% greater than the standard variety Earlirose, three lines in the early maturity group that yielded 4 to 10% greater than the standard Earlirose variety, and 15 new lines in the late maturity group that yielded 5 to 23% greater than the standard CS-M3 variety. The early line 72/12093 is short-statured, earlier than Earlirose and has shown high yield potential in all test locations in two years of testing. The late lines 71/D-7, 72/11858 and 72/12089 are short-statured, similar to CS-M3 in maturity and have shown high yield potential in all test locations in two years of testing. The line 71/D-7, derived from irradiated Calrose seed responds to environment similarly to CS-M3, except it is about 10 to 14 inches shorter and does not lodge as readily as CS-M3. This line appears to be the prime candidate for release presently. It is necessary to look at individual test data by location to determine variety performance in a given location because some varieties are narrowly adapted while others are broadly adapted.

Four experiments to determine responsiveness of three early and three late maturity lines to fertilizer nitrogen were conducted in four different environments. The results of these tests show clearly that environment greatly affects the degree of plant response of all tested lines to fertilizer nitrogen. While the early maturing lines S6, M5 and 4963 responded similarly in the warmer and cooler locations, the degree of response of 4963 to added nitrogen in the cooler location was greatly depressed. The reason for the poorer response in the cool environment was due to sensitivity of 4963 to low temperature. Conversely, 4963 exhibited greater response to nitrogen in the warmer environment than did M5 or S6. Since M5 and S6 showed good plant response to nitrogen in both the warm and cool locations, they appear to be more widely adapted than the short-statured 4963 line. The late maturing lines 71/D-7 and CS-M3 responded to fertilizer nitrogen similarly at both locations tested. The long grain line 72/3764 responded similarly to D-7 and CS-M3 in an infertile, continuous rice soil in Glenn County, but differed from these lines in a very fertile soil in the Sutter Basin by reaching a maximum yield response at 150 pounds per acre nitrogen. An additional 30 pounds per acre nitrogen depressed yields of 72/3764 in this environment. The overall data indicated that 71/D-7 had greater yield potential than the other late lines probably because of its shortness and greater resistance to lodging.