COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT

January 1, 1979 - December 31, 1979

PROJECT TITLE: Cooperative Extension Rice Variety Adaptation and Cultural Practice Research

PROJECT LEADER AND PRINCIPAL UC INVESTIGATORS:

Project Leader: D. Marlin Brandon, Past Extension Agronomist (UCD), now Associate Professor, Louisiana State University Rice Experiment Station, Crowley, Louisiana.

Principal UC Investigators: L. A. Post, SRA (UCD) and Farm Advisors M. Canevari (San Joaquin), J. P. Guerard (Kern), S. C. Scardaci (Colusa), G. J. St. Andre (Fresno), C. M. Wick (Butte) and J. F. Williams (Sutter).

LEVEL OF 1979 FUNDING: $40,303.00

OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

Objective I

Determine adaptation of improved experimental rice lines and varieties to production areas of California and assist in development of improved, high yielding varieties of excellent quality for each production area of the state.

Statewide Rice Variety Tests

Very Early Maturity Group - Three uniform tests were conducted at the Rice Experiment Station (Butte), Demeter Corporation (Sacramento) and Paulus Ranch (San Joaquin). Twenty-eight varietal entries were included in each test.

Early Maturity Group - Four uniform tests were conducted at the Rice Experiment Station (Butte), Mohammed Ranch (Yuba), Geer Ranch (Yolo) and Costerison Farms (Kern). The Kern County test was lost due to blackbird feeding. Twenty-eight varietal entries were included in each test.

Late Maturity Group - Four uniform tests were conducted at the Rice Experiment Station (Butte), Wylie Farming (Glenn), Guisti Ranch (Sutter) and Redfern Ranch (Fresno). The Fresno County test was partially lost due to grower combine error. Twenty-four varietal entries were included in each test.

## Objective II

Characterize differential response of new rice varieties to source, rate and time of N application and to water depth in relation to seeding rate.

### Nitrogen Rate and Time of Application

Six experiments were conducted in cooperation with Dr. D. S. Mikkelsen and farm advisors to characterize N response patterns of M-101, M-301, L-201, M7, M9 and a new short-grain, short-stature line (tentatively named S-201) in different environments. An overall objective of these experiments was to recalibrate tissue analysis for new varieties and assist in the development of a quick test for tissue N. The experiments by maturity group were located at: very early group - Bolen (Sacramento) and Paulus (San Joaquin); early group - McKnight Ranch (Butte and Erdman Ranch (Colusa); and late group - Kelleher Ranch (Butte) and Illerich Ranch (Sutter).

### Effect of Water Depth in Relation to Seeding Rate on Performance of Tall and Short-Stature Rice Varieties

An experiment was conducted at the Rice Experiment Station, Biggs in cooperation with Dr. Howard Carnahan and Morton D. Morse. Samples from the 1978 experiment were used to determine the effect of water depth and seeding rate on yield components and their relationship to rice grain yield.

## Objective III

Determine the frequency of plant nutrient deficiencies in rice and the most efficient sources, rates and methods of plant nutrient application to rice in cooperation with Dr. D. S. Mikkelsen et al. Revise plant tissue and soil critical levels of plant nutrients in relation to new rice varieties.

### Effect of Phosphorus Source and Rate of Application on Growth and Yield of M9

An experiment was conducted in cooperation with C. M. Wick, Butte County Farm Advisor, on the Tennis Ranch to measure M9 growth and yield response to 35-17-0, 13-40-0 and 11-48-0 sources of P.

### Differential Response of New Rice Varieties to Zinc Deficiency in Alkaline Soils

An experiment was conducted in cooperation with S. C. Scardaci, Colusa County Farm Advisor, on the Herb Myers Ranch to determine the sensitivity of new rice varieties to zinc deficiency in alkaline soils.

## Objective IV

Determine the optimum rate and time of herbicide applications for control of sedges and broadleaf weeds in rice.

No experiments were initiated because of project leader's resignation.

## Objective V

Provide assistance to expedite rice research project leaders field research programs. Maintain a UCD Agronomy Extension-based rice project machinery pool for planting and harvesting field experiments.

Twenty-five rice field experiments were harvested with the two rice combines. Seventeen of these were directly related to this project and the remaining were Botany Weed Control, Agronomy and Range Science, and Plant Pathology experiments. Harvest assistance was given by Bill Brandon, Assistant to Dr. Donald E. Seaman, in the absence of an Extension Agronomist and UC Cooperative Extension funded Staff Research Associate. Experiments were located from Nelson (Butte County) to south of Bakersfield (Kern County).

## SUMMARY OF 1979 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

## Objective I

### Statewide Rice Variety Tests

A total of 11 uniform rice variety tests were conducted in 10 counties from Butte County to Kern County. The tests were designed to measure agronomic performance of experimental lines and new varieties in the major rice production areas of California when grown under typical cultural practices in each location. A total of 80 varietal entries were tested in three maturity groups. The very early and early groups each contained 28 entries while the late group contained 24 entries. Varietal entries tested were prepared and made available by the CCRRFI-USDA-UC rice genetics and breeding program. All Butte County tests were conducted on the Rice Experiment Station by the plant breeders.

Statewide (over all test locations) average performance of experimental lines and varieties are included in this report. Performance by location is not reported because of a need for brevity but references are made to individual tests when desirable. A detailed summary by location and for multi-years will be published at a later date.

## Summary of Very Early Rice Variety Tests (<90 days to 50% Heading at Biggs)

Two of these experiments were located in cool areas (Natomas and Escalon) and one in a warm area (Biggs). Agronomic performance of the 28 varietal entries tested are shown in Table 1. The new varieties L-201 and S-201 yielded as great or slightly greater than the commercial Earlirose check when all test locations are averaged and M9 and M-101 yielded slightly less than Earlirose. Productivity of these new short-stature varieties and L-201 was not as great as that of the tall Earlirose variety in the Escalon test probably because of a severe umbrella-plant infestation. The lower yields are not thought to be related to lower temperatures because the more cold sensitive L-201 and M9 produced very well in the cool Natomas test.

It is interesting that four of the eight highest yielding entries in this group were short-grain, short-stature lines. The experimental short-grain 78-y-119 and 78-y-219 performed very well in all test locations. S-201 (tentatively named) performed well at Natomas which is cool but yields were quite low in the Escalon test probably because of the weed infestation and cool temperatures. Apparently this new group of short-grain, short-stature lines is not only more resistant to lodging, but is also less sensitive to low temperatures than S6. The tentatively named S-201 should be released as a replacement for S6 if milling and other grain qualities are similar to S6.

The new variety M-101 yielded slightly less than L-201, S-201, Earlirose and M9 when averaged over all locations. A nitrogen rate and time of application experiment located close to the Escalon variety test showed that M-101 yielded slightly greater than Earlirose when fertilized with an optimum N rate in the absence of severe weed infestions. In the absence of low temperatures and severe lodging of Earlirose, one might expect the performance of this tall and short-stature variety to be similar.

## Summary of Early Rice Variety Tests (90-99 days to 50% Heading at Biggs

Twelve experimental lines yielded greater than M9 but only one yielded significantly greater (Table 2). Nine of the 12, including the tentatively named S-201, were short-grain, short-stature lines. Twenty-three entries yielded significantly greater than S6 when averaged over all tests. The new varieties S-201, M9, M-301, L-201 and M-101 were among those performing better than S6.

The new group of short-stature, short-grain entries showed exceptionally good yield potential relative to S6 and even M9. The 1979 performance data coupled with that of 1978 indicate that S-201 should be considered for release soon. S-201 shows very good seedling vigor, cold tolerance, lodging resistance and yield potential relative to any currently grown rice variety. Although the new varieties M-101, M-301 and L-201 yielded significantly less than M9 and S-201, their

Table 1. 1979 statewide performance summary of very early experimental rice lines and varieties.

| 1979 entry no. | Variety description | Grain type[1] | Grain yield @ 14% moisture, lbs/acre | Duncan's test | Grain moisture @ harvest, % | Seedling vigor[2] | Days to 50% heading | Plant height, cm | Lodging, %[3] |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 78-y-119 | S | 8490 | a | 20.3 | 4.3 | 88 | 87 | 2 |
| 6 | L-201 | L | 8210 | ab | 19.3 | 4.1 | 96 | 90 | 2 |
| 25 | 78-y-219 | S | 8200 | ab | 21.3 | 3.9 | 93 | 74 | 2 |
| 18 | 78-y-162 | S | 8130 | abc | 21.4 | 4.1 | 97 | 87 | 6 |
| 20 | 78-y-138 | M | 8120 | abc | 23.0 | 4.2 | 95 | 83 | 1 |
| 5 | S-201 | S | 8040 | abcd | 21.0 | 4.0 | 96 | 83 | 12 |
| 16 | 78-y-114 | M | 8010 | abcd | 22.8 | 4.3 | 91 | 83 | 1 |
| 1 | Earlirose | M | 7960 | abcd | 20.6 | 4.7 | 94 | 111 | 69 |
| 10 | 78-y-10 | M | 7870 | abcd | 21.0 | 4.4 | 89 | 89 | 1 |
| 8 | 78-y-8 | P | 7730 | abcde | 19.9 | 3.7 | 91 | 80 | 1 |
| 12 | 78-y-16 | M | 7650 | abcde | 19.3 | 4.2 | 91 | 89 | 5 |
| 27 | 78-y-153 | M | 7570 | bcde | 20.7 | 4.3 | 90 | 87 | 2 |
| 19 | 78-y-135 | M | 7560 | bcde | 23.3 | 4.0 | 93 | 86 | 3 |
| 3 | M9 (F) | M | 7520 | bcde | 23.4 | 4.4 | 91 | 85 | 5 |
| 21 | 78-2172 | S | 7490 | bcde | 19.0 | 3.7 | 86 | 84 | 4 |
| 23 | 78-y-116 | M | 7470 | bcde | 21.6 | 4.5 | 90 | 82 | 2 |
| 9 | 78-y-9 | M | 7430 | bcde | 17.9 | 3.4 | 93 | 79 | 1 |
| 2 | M-101 | M | 7430 | bcde | 19.4 | 4.3 | 87 | 84 | 9 |
| 11 | 78-y-13 | M | 7420 | bcde | 18.7 | 4.2 | 88 | 86 | 7 |
| 14 | 78-y-22 | M | 7380 | bcde | 20.8 | 3.9 | 92 | 82 | 2 |
| 4 | 78-D-18347 | S | 7350 | bcde | 19.1 | 4.1 | 89 | 80 | 15 |
| 22 | 78-y-94 | M | 7340 | bcde | 18.5 | 3.9 | 86 | 83 | 1 |
| 26 | 78-2242 | S | 7340 | bcde | 17.8 | 3.9 | 88 | 86 | 4 |
| 24 | 78-y-103 | M | 7330 | bcde | 20.3 | 4.2 | 89 | 87 | 4 |
| 7 | 78-y-249 | L | 7280 | cde | 17.8 | 3.8 | 88 | 86 | 1 |
| 13 | 78-y-20 | M | 7150 | de | 20.6 | 3.7 | 92 | 83 | 1 |
| 28 | 78-646 | M | 7140 | de | 20.8 | 4.1 | 92 | 82 | 1 |
| 17 | 78-y-123 | M | 6880 | e | 21.1 | 4.2 | 89 | 85 | 1 |
| C.V., % | | | 9.2 | | 7.5 | 12.2 | 2.6 | 5.3 | 152.8 |
| LSD (.05) | | | 561 | | 1.2 | 0.4 | 2 | 5 | 7 |

[1]S = short, M = medium, L = long.
[2]Subjective rating of 1-5, where 1 = poor, 5 = excellent emergence at 28 days after planting.
[3]Subjective rating of 1-99, where 1 = 1%, 99 = 99% lodged.

Table 2. 1979 statewide performance summary of early experimental rice lines and varieties.

| 1979 entry no. | Variety description | Grain type[1] | Grain yield @ 14% moisture, lbs/acre | Duncan's test | Grain moisture @ harvest, % | Seedling vigor[2] | Days to 50% heading | Plant height, cm | Lodging, %[3] |
|---|---|---|---|---|---|---|---|---|---|
| 40 | 78-y-43 | S | 9730 | a | 21.1 | 4.5 | 93 | 88 | 30 |
| 47 | 78-y-214 | S | 9640 | ab | 21.6 | 4.6 | 94 | 87 | 30 |
| 45 | 78-y-210 | S | 9620 | ab | 21.3 | 4.7 | 93 | 88 | 40 |
| 39 | 78-y-42 | S | 9490 | abc | 20.6 | 4.5 | 93 | 85 | 30 |
| 42 | 78-y-33 | S | 9480 | abc | 21.2 | 4.7 | 92 | 89 | 30 |
| 48 | 78-y-203 | S | 9470 | abc | 21.2 | 4.8 | 94 | 86 | 30 |
| 44 | 78-y-186 M-201 | M | 9450 | abc | 21.4 | 4.3 | 90 | 82 | 1 |
| 31 | S-201 | S | 9400 | abcd | 20.9 | 4.5 | 93 | 86 | 30 |
| 46 | 78-y-211 | S | 9390 | abcde | 21.4 | 4.8 | 94 | 86 | 30 |
| 51 | 78-y-115 | M | 9270 | abcdef | 22.6 | 4.9 | 90 | 87 | 30 |
| 38 | 78-y-40 | S | 9230 | abcdef | 21.3 | 4.4 | 92 | 85 | 30 |
| 43 | 78-y-36 | M | 9150 | bcdefg | 22.3 | 4.8 | 92 | 90 | 10 |
| 34 | M9 (F) | M | 9000 | cdefgh | 22.0 | 4.9 | 89 | 90 | 40 |
| 35 | M9 (HR) | M | 8930 | defghi | 22.0 | 5.0 | 89 | 92 | 40 |
| 54 | 78-y-309 | L | 8930 | defghi | 20.5 | 3.7 | 96 | 86 | 10 |
| 37 | R-4249-5C Cal-202 | S-W | 8900 | efghi | 22.6 | 4.1 | 94 | 87 | 20 |
| 52 | 78-1135 | M | 8850 | fghi | 22.6 | 4.7 | 95 | 94 | 30 |
| 41 | 78-y-35 | M | 8790 | fghi | 22.8 | 4.5 | 95 | 96 | 30 |
| 36 | M-301 | M | 8720 | ghij | 23.1 | 4.8 | 96 | 94 | 30 |
| 49 | 78-y-168 | M | 8650 | hij | 23.1 | 4.6 | 90 | 87 | 20 |
| 50 | 78-y-337 | M | 8500 | ij | 22.4 | 4.8 | 96 | 76 | 1 |
| 32 | L-201 | L | 8470 | ij | 19.1 | 3.1 | 95 | 97 | 20 |
| 33 | M-101 | M | 8250 | j | 18.9 | 4.7 | 84 | 90 | 40 |
| 29 | S6 | S | 7790 | k | 21.4 | 4.6 | 95 | 121 | 60 |
| 55 | 78-y-319 | L | 7660 | k | 18.6 | 3.1 | 95 | 100 | 10 |
| 53 | 78-y-284 | L | 7640 | k | 19.1 | 3.5 | 95 | 90 | 20 |
| 56 | 78-H-2901 | L | 7030 | l | 20.7 | 2.7 | 97 | 96 | 10 |
| 30 | Calmochi-201 | S-W | 6960 | l | 22.4 | 4.2 | 96 | 114 | 50 |
| C.V., % | | | 6.0 | | 6.4 | 9.0 | 2.0 | 4.9 | 63.3 |
| LSD (.05) | | | 430 | | 1.1 | 0.3 | 2.0 | 4.0 | 10.0 |

[1]S - short, M = medium, L = long, S-W = short grain waxy.
[2]Subjective rating of 1-5, where 1 = poor and 5 = excellent emergence at 28 days after planting.
[3]Subjective rating of 1-99, where 1 = 1%, 99 = 99% lodged.

yield levels were good compared to S6. L-201 was sensitive to higher rates of molinate in 1979 and its yield potential was greatly reduced in some locations. Severe molinate toxicity in L-201 was observed in the Yuba County early variety test and it apparently resulted in the much poorer performance of L-201 in this location. Well designed experiments are needed to better understand conditions that cause molinate injury to L-201.

Summary of Late Rice Variety Tests (>105 days to 50% Heading)

The late maturing short-stature varieties M7, Calrose 76 and M-301 (Pending) yielded significantly greater than the tall M5 check as shown in Table 3. The experimental short-grain entry of intermediate height, 78-y-339, performed significantly greater than any other entry in this group. Its greater yields may be attributable to excellent lodging resistance in relation to that of M7, Calrose 76 and M-301 (pending). M-301 appeared more lodging susceptible than M7 and Calrose 76 in these experiments and in nitrogen rate and time of application experiments located close to these variety tests.

## Objective II

Differential Response of California Rice Varieties to Nitrogen Rate and Time of Application

Two experiments of each maturity group were conducted in different environments to measure the effect of N rate and time of application on the yield of tall and short-stature varieties. The maturity groups and varieties used were: very early group - Earlirose, M-101, S-201 and L-201; early group - S6, M9, M5 and M-301. Nitrogen rates used were 0 to 180 lbs/acre (0-202 kg/ha) preplant in 30 lbs/acre (34 kg/ha) increments. The 90 lbs N/acre rate and 150 lbs N/acre rate were split so that two-thirds of each N rate was applied preplant and one-third was applied at the mid-tillering, panicle initiation or flag leaf stage of growth. Selected experiments of each maturity group are included for brevity but other experiments are referred to where appropriate. These experiments were conducted in cooperation with Dr. D. S. Mikkelsen et al. Please refer to Project No. RB-1 for a summary of the tissue recalibration aspects of this project.

Very Early and Early Maturity Group

The differential response of Earlirose, M-101, S-201 and L-201 to preplant N in San Joaquin County is shown in Figure 1. The yield advantage of the short-stature M-101 over Earlirose was not as great in 1979 as it was in 1978 probably because of reduced lodging. Both medium-grain varieties responded very well to N. Earlirose grain yields reached their maximum at 135 kg N/ha (120 lbs N/acre) while those of M-101 peaked at 168 kg N/ha (150 lbs N/acre). The short-grain S-201 performed very well at both cool locations although it was planted June 1 in Natomas. As might be expected, all varieties in the June 1

Table 3. 1979 statewide performance summary of late experimental rice lines and varieties.

| 1979 entry no. | Variety description | Grain type[1] | Grain yield @ 14% moisture, lbs/acre | Duncan's test | Grain moisture @ harvest, % | Seedling vigor[2] | Days to 50% heading | Plant height, cm | Lodging, %[3] |
|---|---|---|---|---|---|---|---|---|---|
| 73 | 78-y-339 | S | 9530 | a | 17.1 | 4.6 | 106 | 106 | 1 |
| 68 | 78-y-64 M-401 | M | 8850 | b | 20.1 | 4.7 | 107 | 104 | 40 |
| 79 | 78-y-413 | M | 8770 | b | 20.6 | 4.7 | 105 | 102 | 40 |
| 81 | 78-y-422 | M | 8680 | bc | 20.3 | 4.5 | 110 | 103 | 30 |
| 75 | 78-y-346 | M | 8590 | bcd | 19.5 | 4.5 | 105 | 100 | 30 |
| 80 | 78-y-392 | M | 8580 | bcd | 19.9 | 4.9 | 110 | 106 | 30 |
| 62 | M7 | M | 8520 | bcde | 20.4 | 4.6 | 110 | 99 | 40 |
| 69 | 77-y-277 | M | 8490 | bcde | 21.0 | 4.8 | 108 | 101 | 30 |
| 65 | 78-y-73 | M | 8490 | bcde | 20.0 | 4.6 | 109 | 103 | 30 |
| 72 | 78-1925 | M | 8390 | bcde | 19.3 | 3.9 | 105 | 97 | 30 |
| 77 | 78-y-357 | M | 8380 | bcde | 19.5 | 4.6 | 102 | 104 | 40 |
| 67 | 78-y-66 | M | 8360 | bcde | 20.7 | 4.6 | 109 | 96 | 40 |
| 66 | 78-y-78 | M | 8270 | bcde | 18.9 | 4.5 | 104 | 101 | 40 |
| 71 | 78-y-79 | M | 8210 | bcde | 18.9 | 4.4 | 102 | 104 | 40 |
| 63 | Calrose 76 | M | 8180 | bcde | 19.4 | 4.6 | 111 | 101 | 40 |
| 78 | 78-1311 | M | 7990 | cde | 17.9 | 4.4 | 104 | 102 | 40 |
| 82 | 78-y-447 | M | 7990 | cde | 16.7 | 3.7 | 111 | 105 | 1 |
| 76 | 78-y-356 | L | 7980 | cde | 18.7 | 4.8 | 103 | 103 | 30 |
| 83 | 78-1797 | M | 7960 | de | 18.8 | 4.7 | 103 | 105 | 40 |
| 74 | 78-y-343 | M | 7930 | de | 17.3 | 4.8 | 103 | 104 | 40 |
| 64 | M-301 | M | 7850 | e | 19.4 | 4.8 | 102 | 103 | 50 |
| 70 | 78-y-76 | M | 7840 | e | 18.4 | 4.2 | 102 | 98 | 30 |
| 61 | M5 | M | 7050 | f | 19.7 | 4.7 | 103 | 124 | 90 |
| 84 | 78-y-454 | L | 6780 | f | 15.5 | 3.6 | 105 | 102 | 1 |
| C.V., % | | | 6.8 | | 4.9 | 11.6 | 1.2 | 3.6 | 23.1 |
| LSD (.05) | | | 450 | | 0.8 | 0.4 | 1 | 4 | 7 |

[1]S = short, M = medium, L = long.
[2]Subjective rating of 1-5, where 1 = poor, 5 = excellent emergence at 28 days after planting.
[3]Subjective rating of 1-99, where 1 = 1%, 99 = 99% lodged.

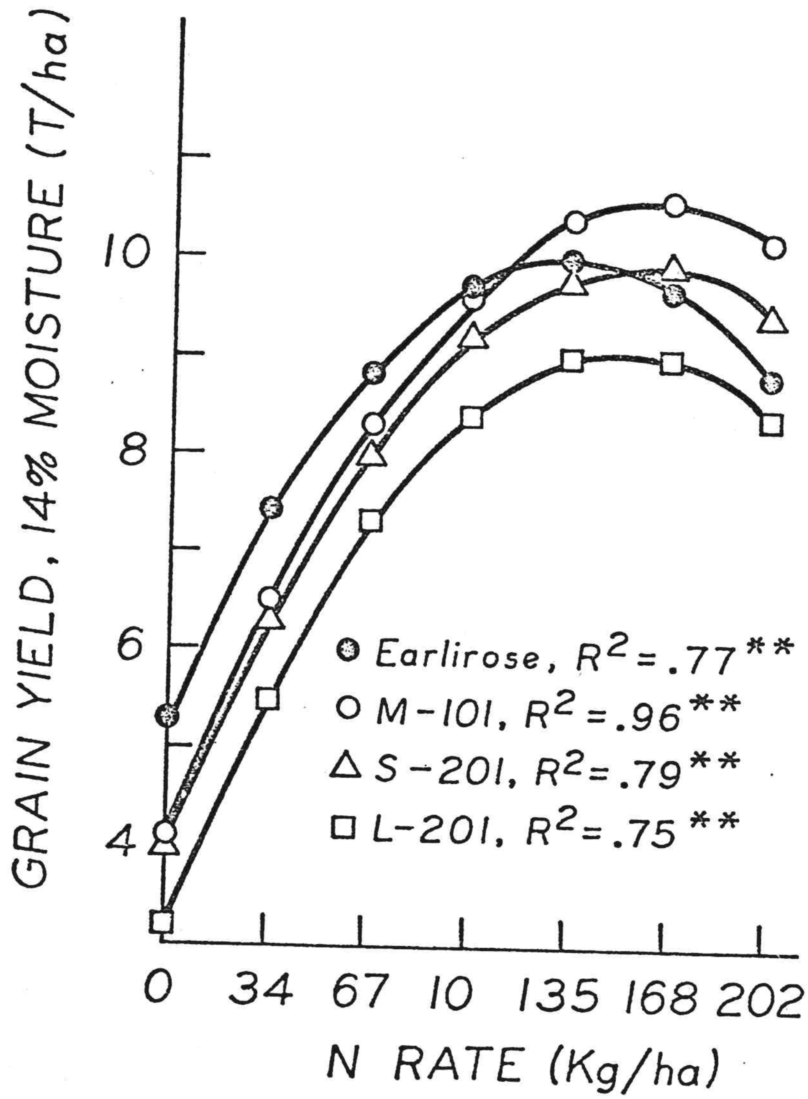


Figure 1. Response of very early and early rice varieties to N in San Joaquin County - Paulus, Escalon.

planting required less N for maximum yield than in the earlier San Joaquin planting. The new long-grain L-201 did not perform as well as Earlirose, M-101 and S-201 probably because of cold sensitivity. It did produce acceptable yields, however, and growers in the cool areas may want to plant it on limited acreage.

The effect of N rate and time of application on the performance of very early and early maturing rice varieties at a cool San Joaquin location is shown in Figure 2. The optimum time of application depended on the total N rate applied. The 90 lbs N/acre rate was near optimum for Earlirose in this location and consequently split applications of 60 lbs N/acre preplant plus 30 lbs N/acre applied at the mid-tillering to panicle initiation growth stages gave the greatest Earlirose yields. Conversely, the 90 lbs N/acre rate applied preplant gave the greatest yields of M-101, S-201 and L-201 rather than split applications. The 90 lbs N/acre rate was suboptimum for the short-stature and long-grain varieties and their greater yield response to preplant N in relation to the split treatments indicates that preplant N is more efficiently utilized than split applications. Split applications of the 150 lbs N/acre rate gave greater yields of all varieties than a single preplant application because this rate was excessive and N inefficiency favored higher yields. It is concluded that a single preplant application of N is superior to split applications if the optimum N rate is known but split applications may provide greater yields if excessive N is applied. It is apparent that a major portion of the total N should be applied before planting to maximize yields. Early N deficiencies cannot be completely negated by late N applications.

Early Maturity Group

The differential response of S6, M9, S-201 and L-201 to preplant N in Colusa County are shown in Figure 3. The yield advantage of the short-stature M9 over the tall S6 was not as great in 1979 as in previous years although it did show much greater yield stability at excessive N rates. The N response pattern of the new short-grain, short-stature S-201 was similar to that of M9 and evidence indicates that it may require about 30 lbs/acre more N than S6 for maximum yield. The long-grain L-201 was intermediate between the short-stature varieties and S6 in its response to N. All the varieties reached near maximum grain yield with only 90 lbs N/acre (101 kg/ha) in the Sacramento clay soil and lodging was common in all varieties when fertilized with excessive N.

The effect of N rate and time of application on performance of early maturing varieties is shown in Figure 4. Time of N application at the 90 lbs N/acre rate had little effect on grain yield probably because it was a near optimum N rate for all varieties in the Sacramento clay soil. The preplant application of the total 90 lbs N/acre tended to give greater yields than split applications at this rate but the yields were not significantly greater than those of split N applications. The 150 lbs N/acre rate depressed grain yields of all varieties

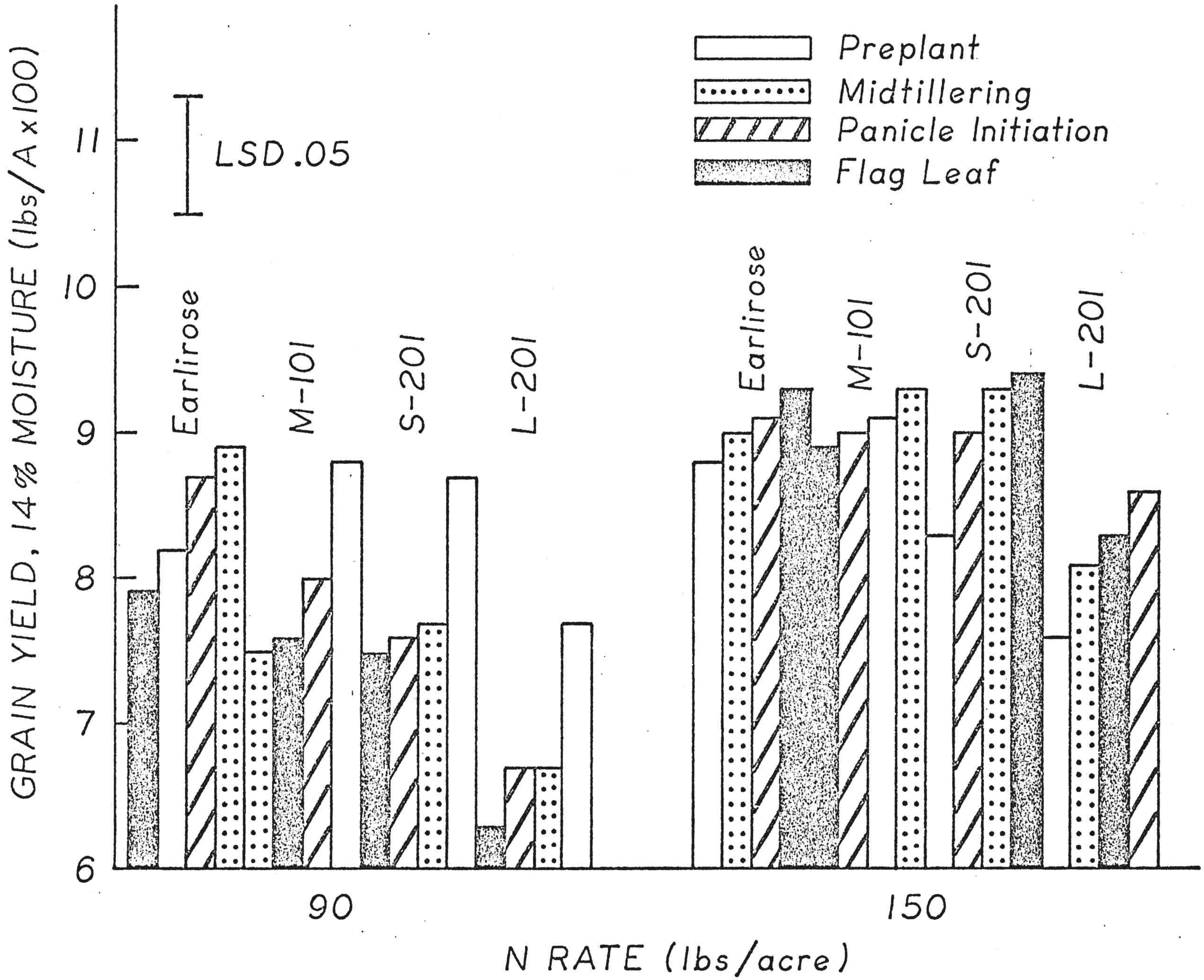


Figure 2. Effect of N rate and time of application on grain yields of very early and early rice varieties in San Joaquin County - Paulus, Escalon.

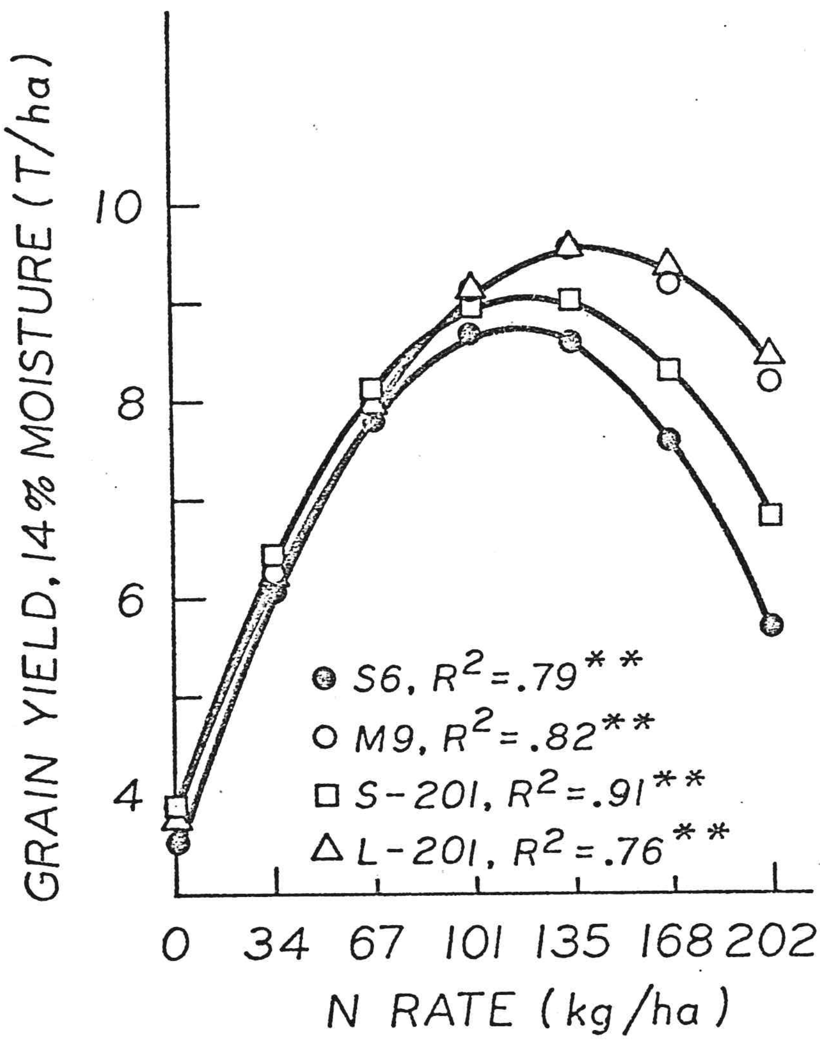


Figure 3. Response of early rice varieties to N in Colusa County - Erdman, District 108.

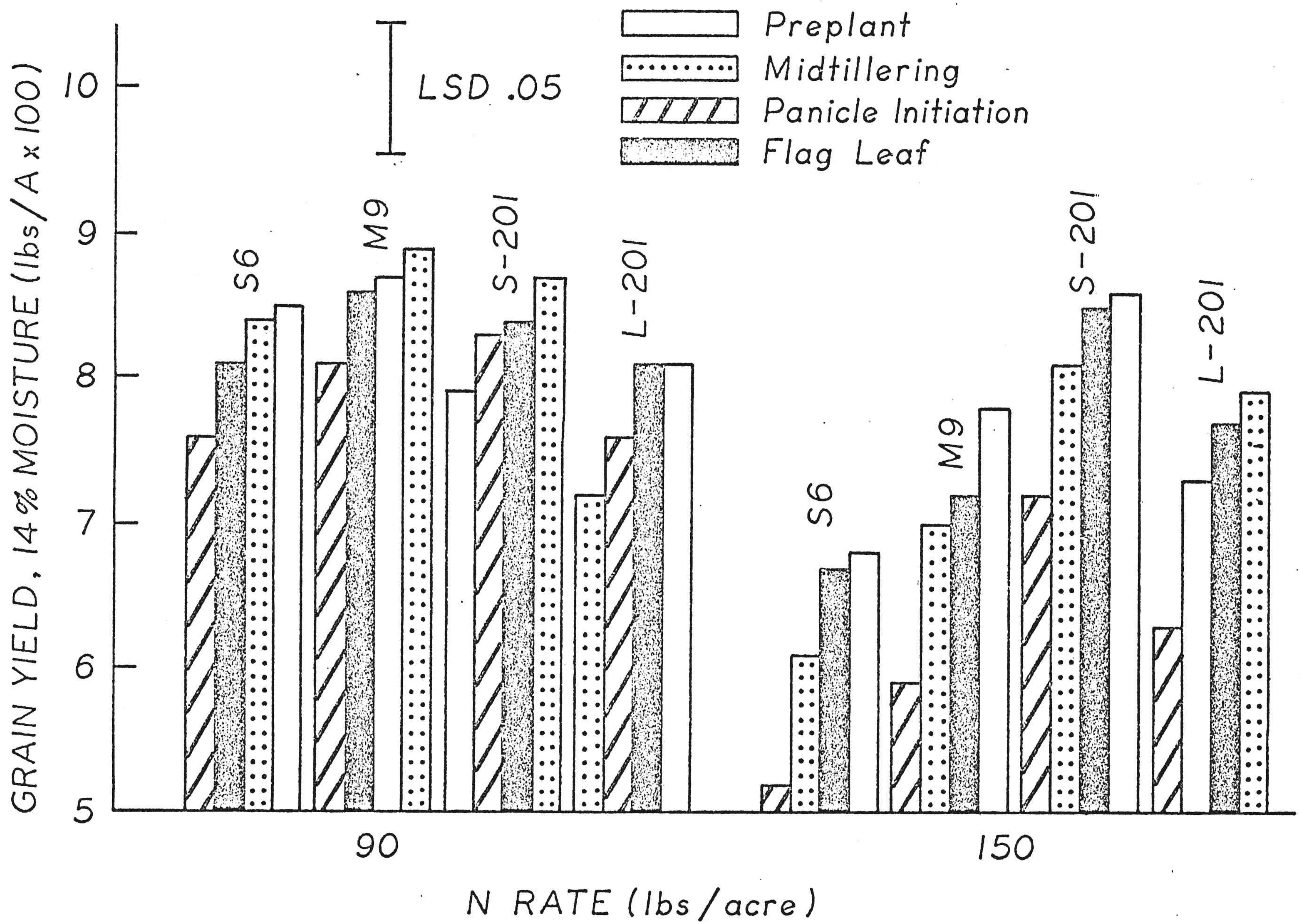


Figure 4. Effect of N rate and time of application on grain yields of early rice varieties in Colusa County - Erdman, District 108.

in relation to the 90 lbs N/acre rate regardless of time of application because it was excessive. These results indicate that all N should be applied preplant in these varieties if near optimum rates are applied.

Late Maturity Group

The differential response of Calrose, M5, M7 and M-301 to preplant N is shown in Figure 5. M7 was more N responsive in this experiment than other varieties. The 150 lbs N/acre (168 kg N/acre) rate maximized grain yields of M7 but only 90 lbs N/acre (101 kg N/acre) were required to maximize those of Calrose and M5. The new short-stature M-301 was more responsive to N than M5 and Calrose, but yields peaked at a lower N rate than that of M7. M-301 has better lodging resistance than M5 and Calrose but has weaker straw than M7. It appears the rate of N required for yield maximization of M-301 is similar to that required for M9 and other short-stature varieties.

The effect of N rate and time of application on the performance of late maturing varieties is shown in Figure 6. The split applications of N tended to increase grain yields of the tall Calrose and M5 and the short-stature M-301 at the 90 lbs N/acre rate. The preplant application gave significantly greater yields than split applications, however, in the short-stature M7. Ninety pounds of N per acre was greatly suboptimum for M7 and the split applications caused more severe yield reduction because of their inefficiency. The application of 150 lbs N/acre preplant also gave the greatest yields of M7 when compared to split applications but the application of 100 lbs N/acre preplant plus 50 lbs N/acre at the mid-tillering and panicle initiation stages gave almost comparable yields. The preplant application of 150 lbs N/acre depressed the yield of Calrose and M5 when compared to split applications because the preplant rate plus the split applications were excessive. M-301 responded similarly to M7 at the 150 lbs N/acre rate relative to time of N application but its maximum yields were significantly less than those of M7.

Differential Effect of Shallow and Deep Water on the Performance of Tall and Short-Stature Early Rice Varieties

The effect of a continuously deep water depth in relation to a continuously shallow water depth on the performance of new short-stature and early rice varieties is shown in Table 4. Grain yields of all the short-stature varieties except M-101 were decreased by deep water in relation to shallow water in 1979. Deep water had a major depressive effect on the yields of L-201, S-201 and M9 but deep water tended to increase the yield of M-101. The deep water treatment hastened the maturity of S6, S-201, M9 and L-201 based upon days to 50% heading. Grain yields of the tall S6 and M5 were not influenced by the two water depths.

The short-stature rice varieties yielded greater than the tall

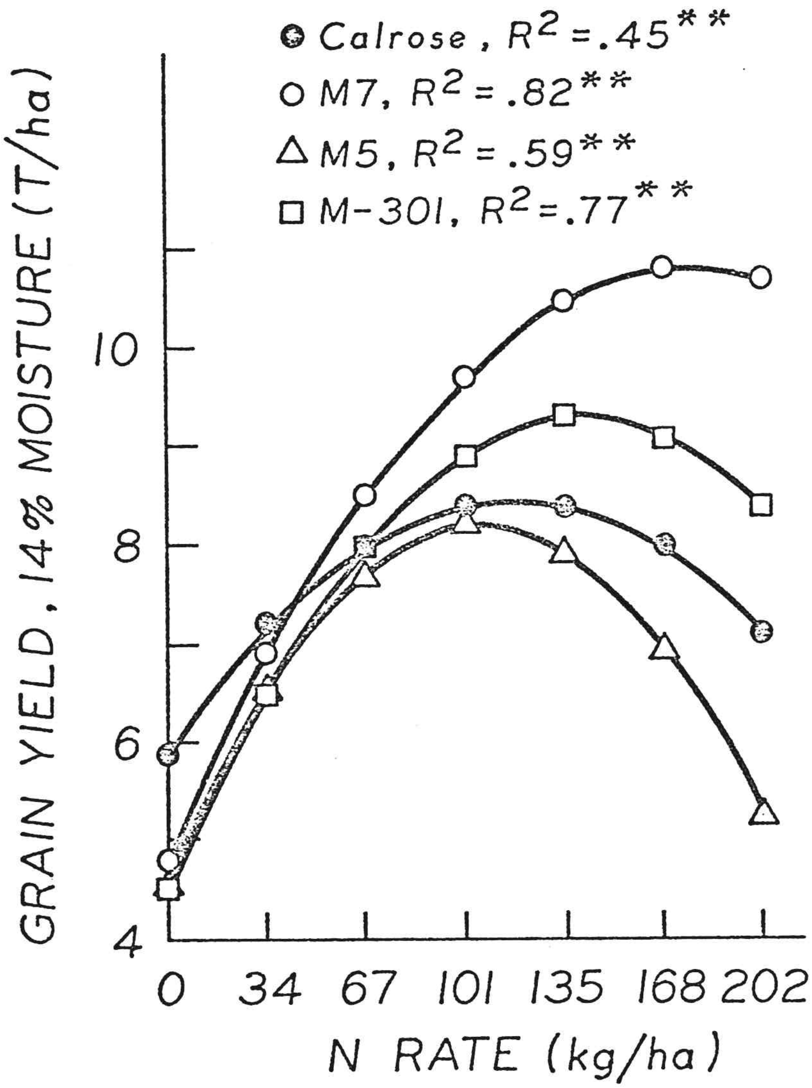


Figure 5. Response of late rice varieties to N in Butte County - Kelleher, Richvale.

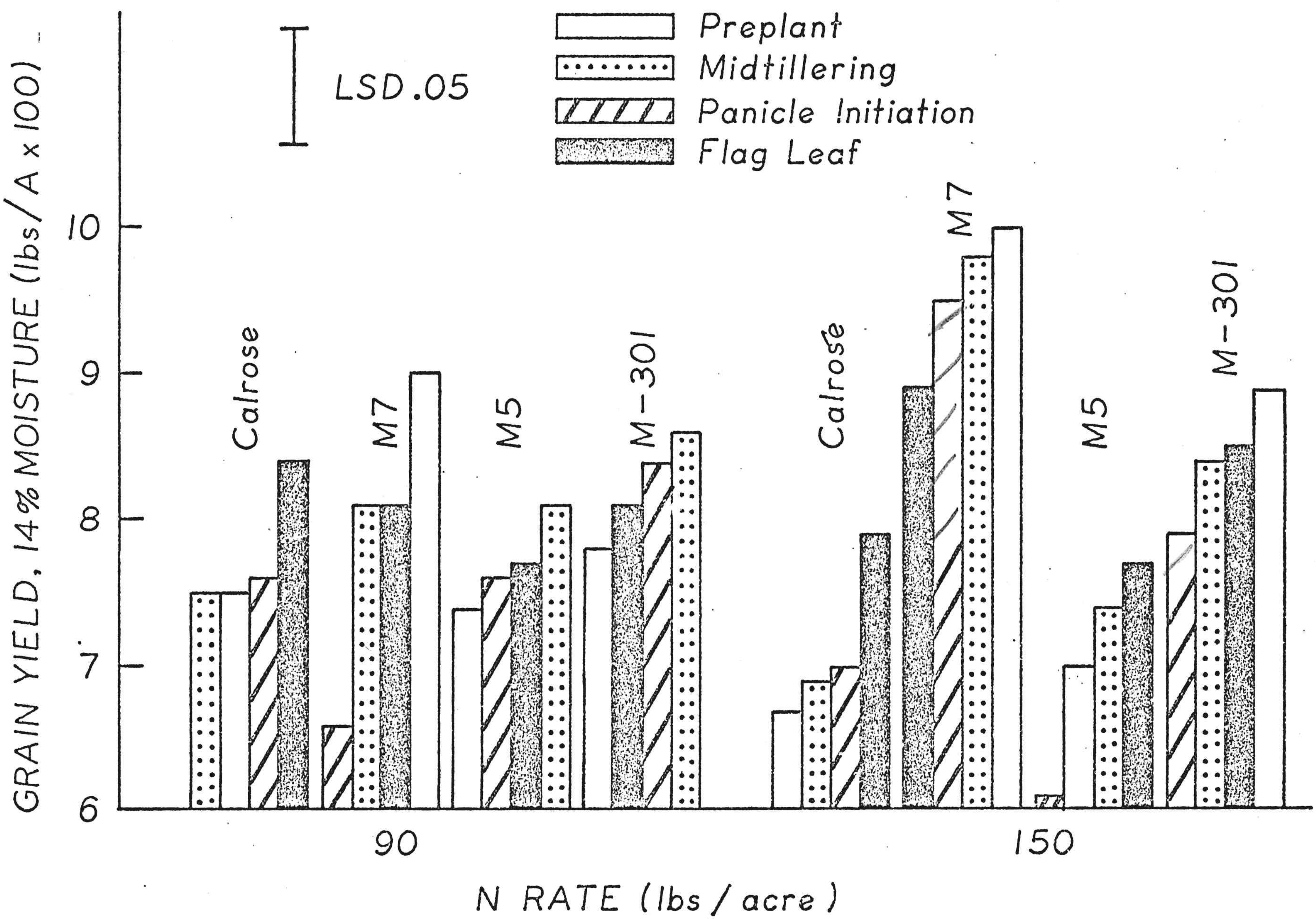


Figure 6. Effect of N rate and time of application on grain yields of late rice varieties - Kelleher, Richvale.

Table 4. Differential effect of water depth on yield performance of tall and short-stature early rice varieties.

| Variety | Water Depth 2-6 inches | 6-10 inches | Variety mean* |
|---|---|---|---|
| | lbs/acre @ 14% moisture | | |
| L-201 | 8700 | 8000 | 8380 a |
| S-201 | 8910 | 7230 | 8070 ab |
| M-301 | 8280 | 7780 | 8030 ab |
| 78-y-309 | 7820 | 8140 | 7980 ab |
| M9 | 8170 | 6990 | 7580 bc |
| S6 | 7060 | 7180 | 7120 cd |
| M-101 | 6770 | 7030 | 6900 de |
| M5 | 6190 | 6380 | 6290 e |
| Depth mean | 7740 | 7350 | |

LSD .05 for water depth = 460 lbs/acre
LSD .05 for variety = 480 lbs/acre
LSD .05 for water depth X variety = 680 lbs/acre

*Means followed by the same letter are not significantly different at the 5% level.

varieties especially in the shallow water treatment. S-201 produced approximately 1200 pounds/acre more grain than S6 when averaged over both water depths. M-301 yielded approximately 1700 pounds/acre more than the tall M5 and did not appear to be greatly affected by the 6-10 inch water depth. The poorer performance of M-101 may have been related to its earlier maturity (approximately 7-12 days) relative to the other varieties and subsequent lodging before harvest. Deep water tended to decrease lodging of all these varieties, but lodging of M-101 was similar to that of tall varieties. The yield performance of all varieties was not improved by increasing their seeding rate above 175 lbs/acre regardless of water depth. A seeding rate of 225 lbs/acre tended to decrease grain yields of all these varieties.

## Objective III

### The Effect of Phosphorous Source and Rate of Application on the Performance of M9

An experiment was conducted to determine the effect of three P sources on growth and yield performance of M9. Preliminary soil analysis indicated a marginal soil P level and a rate factor was included to determine the optimum P fertilization rate for M9. The sources used were 11-48-0, 13-40-0 and 35-17-0 at rates of 0, 40, 80 and 120 lbs $P_2O_5$/acre.

A slight growth response to P was observed in the early growth stages of M9 but there was no significant P effect at harvest. Yield results indicate the new urea-ammonium polyphosphate 35-17-0 is an acceptable source of both N and P for rice. The lack of a yield response to fertilizer P although the soil P level was marginal indicates that M9 may require no more fertilizer P than other rice varieties. Certainly the average grain yield of 10,800 lbs/acre observed in the zero P treatment of this experiment indicates P was not yield limiting.

### Differential Performance of New Rice Varieties In An Alkaline Soil

The performance of the new rice varieties M-101, S-201, M9 and L-201 in an alkaline soil and their response to zinc are shown in Table 5. The short-stature M-101 and S-201 showed much greater seedling vigor and yielded significantly greater than M9 and L-201 in this heavily cut soil. Although there was no significant grain yield response to zinc, there was an early growth response. Moreover, L-201 showed what appeared to be zinc deficiency symptoms (rusty brown spots-bronzing) in the lower zinc rate treatments. A greenhouse experiment conducted during the winter of 1979 indicated a zinc response was likely in this soil and that M9 and L-201 were more severely affected than M-101 and S-201. The data shows a slight response trend of L-201 to zinc but it was not statistically significant.

The results of this experiment coupled with those of a greenhouse experiment indicate that M9 and L-201 may be more sensitive than M-101

Table 5. Differential response of new short-stature rice varieties to zinc in an alkaline soil-Meyers, Colusa County.

| Variety | Zinc rate, lbs/acre 0 | 4 | 8 | 16 | Variety mean* |
|---|---|---|---|---|---|
| | Grain yield @ 14% moisture, lbs/acre | | | | |
| M-101 | 6580 | 6640 | 6470 | 7080 | 6690 a |
| S-201 | 6430 | 6430 | 6290 | 6630 | 6450 a |
| M9 | 5740 | 5550 | 5500 | 5630 | 5600 b |
| L-201 | 4920 | 6040 | 5660 | 5660 | 5570 b |
| Zn rate mean | 5920 | 6170 | 5980 | 6250 | |

LSD .05 for varieties = 440 lbs/acre

*Means followed by the same letter are not significantly different at the 5% level.

and S-201 to calcareous soils with low zinc levels. Evidence indicates that zinc deficiency is related to this sensitivity but additional research is necessary to determine the exact cause of the differential sensitivity observed between the varieties.

PUBLICATIONS OR REPORTS:

The following publications resulted from this project. Information developed from this project also was used for popular articles in magazines and newspapers and for radio and television reports. Information originating from this project was used as the basis of presentations to approximately 1500 rice growers and industry personnel in the winter rice meetings and annual field days.


1. Brandon, D. M., L. A. Post, J. F. Williams, G. J. St. Andre, C. M. Wick and T. L. Prichard. 1979. Summary of 1978 and multi-year statewide rice variety tests. Agronomy Progress Report No. 101, Agronomy and Range Science Department/Extension, UCD. Mimeo. 21 pp.

2. Brandon, D. M. and D. S. Mikkelsen. 1979. Phosphorus transformations in alternately flooded California soils. I. Cause of phosphorus deficiency in rice rotation crops and correctional methods. Soil. Sci. Soc. of Amer. J. September-October issue.

3. Mikkelsen, D. S., D. M. Brandon, J. F. Williams and C. M. Wick. 1979. Management of California rice varieties. In: Rice Field Day Bulletin, Biggs, California.


GENERAL SUMMARY OF 1979 RESEARCH RESULTS:

Eleven uniform rice variety tests were conducted in 10 counties in 1979. Eighty varietal entries were tested in cooperation with CCRRFI rice breeders, the USDA rice geneticist and farm advisors in major rice areas.

Four of the eight highest yielding entries in the very early maturity group were short-grain and short-stature lines. The outstanding performance of these lines in relation to medium-grain lines has not been observed in the past. The new varieties S-201, L-201 and M-101 yielded very well at the cool areas in which these tests were conducted but they did not yield significantly greater than Earlirose. The yield advantage of short-stature lines over tall ones was not observed in 1979 as it has been in the past.

Nine of the 12 highest yielding entries in the early maturity group were short-grain and short-stature lines. Twenty-three entries including S-201 yielded significantly greater than S6 when averaged over all tests. The new S-201 should be released as a replacement for S6 as soon as feasible.

The late maturing short-stature varieties M7, Calrose 76 and M-301 yielded significantly greater than the tall M5 check in this group. M-301 appeared to have less lodging resistance than M7 and Calrose 76.

The effect of N rate and time of application on performance of new rice varieties was studied in six experiments located in different environments. The short-stature varieties M-101, S-201, M9, M-301 and M7 were slightly more N responsive than tall varieties in 1979, but the yield advantage of short-stature types over the tall ones was not as great as observed in the past. The optimum time of N application depended on total rate of N applied. A single preplant application of the total N rate was superior to split applications when the N rate was suboptimum. The split N applications were superior to a single preplant application of the total rate, however, when the rate was excessive. These results are consistent with those of 1978. The data indicate that a single preplant application of N is most efficient and will provide maximum yields when the application rate is near optimum regardless of variety. Split applications, however, provide maximum yields when excessive N is applied because of the inefficiency associated with N application in water. It appears that a preplant N rate great enough to prevent early N deficiency in rice is necessary for maximum grain yield.

Continuously deep water (6-10 inches) depressed the grain yields of most new rice varieties at the Rice Experiment Station, Biggs. The deep water treatment decreased the yields of M9, S-201, M-301 and L-201 but did not affect the yield of M-101. Deep water hastened the maturity of S6, S-201, M9 and L-201 but did not influence maturity of M-301, M5 and M-101. This data indicates that relatively shallow water (2-6 inches) is required for maximum productivity of the new short-stature varieties.

The short-stature M-101 and S-201 showed much greater seedling vigor and yielded significantly greater than M9 and L-201 in a calcareous soil that had a marginal zinc level. The new long-grain L-201 appeared more sensitive to the problem and developed "bronzing" symptoms which appeared to be associated with zinc nutrition.