PROJECT NO. RM-1

COMPREHENSIVE RESEARCH ON RICE
ANNUAL REPORT

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PROJECT TITLE: Improvement of Agronomic Practices for Rice Production

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OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH THEM:

Objective I. To determine how herbicides and other agricultural chemicals may be used advantageously in the development of improved systems of rice management.

1. In cooperation with J. F. Williams, two experiments were conducted at the Honcut Creek Ranch in Yuba County to determine the control of cattail and riverbulrush by post-emergence applications of glyphosate, silvex and 2,4-D formulations before seedbed preparation -- Yuba County.

2. The previously untested herbicides acifluorfen, MC-7783, MC-10978, NC-20484, RH-4413, RH-5730, RH-8254, RH-8817 and RH-9841 were evaluated among 7 different experiments to determine their potential usefulness in rice management -- Biggs.

3. The promising experimental rice herbicides bifenox, Drepamon, ethofumesate, MBR-18337, perfluidone, thiobencarb and triclopyr were re-evaluated among 6 additional experiments to obtain further information regarding: (a) their most effective times and rates of application, (b) the kinds of weeds controlled, (c) the most effective and safest formulation of those with more than one available, and (d) the potential use of some in combination or in sequence with other herbicides -- Biggs.

4. Three experiments were conducted to determine the susceptibility of the new long-grain rice variety L-201 to injury by granular Bolero, Drepamon and Ordram, respectively -- Biggs.

5. Three separate experiments were conducted: (a) to compare four different slow-release granular molinate formulations with respect to efficacy and rice safety at different times and rates of application; (b) to compare the relative efficacies of liquid and granular formulations of Bolero, Drepamon and Ordram applied at 4 lb ai/A before and after flooding and (c) to obtain additional performance data and residue samples for Federal and State registration of Drepamon use in rice -- Biggs.

Objective II. To develop improved systems of rice management through use of: (a) new herbicides, (b) new herbicide application methods, (c) favorable water-management methods, (d) new rice varieties and (e) rice seed coatings.

1. The unregistered herbicides butachlor and Dowco 356 were applied by water-running to separate small fields to determine their suitability for this new method of herbicide application to rice fields -- Biggs.

2. Water-run applications of Ordram and Bolero were compared at rates of 3 and 5 lb ai/A for weed-control efficacy and rice safety in an experiment that involved triplicated treatments among 0.9-acre main plots in which continuous flooding was maintained. The proposed construction of "plastic-sandwich" levees and ditches was completed at the Hamilton Road Facility to provide the land and water control required for this experiment -- Biggs.

3. An experiment to determine the influence of high spots and of prior rainfall on the efficacy of water-run herbicides and another to evaluate the efficacy of granular molinate retreatments following water-run molinate were conducted to learn how some problems of water-running herbicides may be avoided -- Biggs.

4. In another experiment with treatments replicated three times among 0.3-acre main plots, 4-lb ai/A water-run applications of Ordram and Bolero followed by discontinuous flooding were compared with respect to weed-control efficacy and rice safety -- Biggs.

5. An experimental water-run application of Ordram was made to a 57-acre field of the new short-stature, short-grain rice variety S-201 to evaluate weed-control efficacy, rice safety and some operational problems of water-running in a canal-irrigated field -- Nelson.

6. About 30 cwt of rice seed was coated for use among the various experiments of this project to take advantage of the convenience of coated seed and to evaluate other potential advantages of seed coatings. This included 22 cwt of variety M9 that was given a 20 percent Durakoat-Difolatan-Talc coating for aerial seeding the Hamilton Road Facility and some smaller batches that were prepared for experiments to evaluate activated charcoal as a seed-coating additive -- Biggs.

SUMMARY OF 1979 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

Objective I -- Herbicides and other chemicals.

None of the herbicides applied to cattail and riverbulrush before seedbed preparation was observed to have controlled these weeds any better than disk plowing alone.

The previously untested herbicides found promising and worthy of further development included acifluorfen (Rohm & Haas' Blazer and Mobil's

MC-10978), RH-8254, RH-5730 and RH-8817 (Rohm & Haas). The acifluorfen formulations mainly were active against sedges and broadleaf aquatic weeds, and they were most effective on these weeds in low-rate combinations with MCPA or Basagran. RH-8817 was the most outstanding, because at only 0.5 lb ai/A it controlled early and late watergrasses as well as 4 lb ai/A of granular Ordram and also gave excellent control of California arrowhead and monochoria.

A new formulation of bifenox (Mobil's Mowdown 4F) was found too injurious to rice when applied at rates higher than 2 lb ai/A before flooding and at 17 or 34 days after seeding, but its effective control of arrowhead, ducksalad, monochoria, roughseed bulrush and waterhyssop at lower rates might be useful where watergrass is controlled other ways.

Two new granular formulations of ethofumesate (Fisons' Nortron) gave fair control of watergrass, but both injured rice severely at most of the times and rates they were applied. Although one was formulated to release ethofumesate slower than the other, there was very little difference in selectivity or efficacy between them, and neither performed as well as the sprayable ethofumesate samples tested previously.

A sprayable formulation of the new herbicide MBR-18337 (3M Company) exhibited weed-control activity similar to that of propanil. Pre-flood applications of MBR-18337 at 2 lb ai/A completely controlled precocious barnyardgrass in the rice seedbed with sufficient residual activity to give 70 and 78 percent control of early and late watergrass, respectively. Later applications of MBR-18337 gave less watergrass control, but the plots yielded more rice grain than those treated with granular Ordram. A granular formulation of MBR-18337 also performed promisingly this year, but not enough was available for adequate evaluation. Improved formulations of this herbicide will be available for more thorough evaluation next year.

In an experiment comparing herbicides for post-emergence control of aquatic weeds in rice, silvex (Dow's Kuron) gave the best overall control of California arrowhead, ducksalad, monochoria and roughseed bulrush. It was less effective than MCPA in control of monochoria, but it controlled arrowhead as well as MCPA and ducksalad much better. Triclopyr (Dow) performed nearly as well as silvex and was inferior to MCPA only in control of monochoria. Although acifluorfen formulations and Basagran were as effective as silvex, triclopyr and MCPA on arrowhead, they gave much poorer control of ducksalad, monochoria and roughseed bulrush. These results indicate that silvex is a better alternative than Basagran for use in lieu of MCPA for aquatic weed control in rice, but if silvex usage is cancelled by the EPA in response to current challenges of environmentalist groups, perhaps triclopyr should be registered as the next-best alternative.

Post-flood applications of granular Ordram significantly reduced the grain yield of the new long-grain rice variety L-201 at rates of 5 and 10 lb ai/A, but not at 3 or 4 lb ai/A. This injury mainly was by stand reduction, which amounted to 31 and 79 percent, respectively, at 16 days

after the 5- and 10-lb ai/A applications. The actual yield reductions at these rates amounted to 21 and 45 percent, respectively, of the 86.8 cwt per acre mean yield of untreated plots in the experiment. Slight plant height reductions also occurred, but these were transitory and not statistically significant. Variety M9 was used as the check variety in this experiment, and it was not injured by granular Ordram at rates as high as 10 lb ai/A. These results suggest that future growers of variety L-201 probably should not use the high rates of granular Ordram now permitted by its California Special Local Need Label.

Variety L-201 was found even more susceptible to injury by granular Bolero. In a late-planted experiment, applications of granular Bolero made 12 days after seeding completely killed variety L-201 in two of the three treatment replications at rates as low as 4 lb ai/A, and only a few plants survived in retarded condition among plots of the third replication. At 120 days after seeding, the mean shoot biomass (above-ground dry weight) of variety L-201 was reduced 94, 98 and 96 percent by Bolero at 4, 5 and 10 lb ai/A, respectively. These treatments caused no significant reduction in biomass of the check variety M9. Since Bolero must be applied at a minimum rate of 4 lb ai/A for effective weed control, it appears that this herbicide cannot be used safely on variety L-201 when it is registered for California rice.

Early registration of Drepamon (Montedison) would be a likely solution to the problem of controlling watergrass in variety L-201 without crop injury. Both the granular and the emulsifiable formulations of Drepamon have given consistently excellent watergrass control at 4 or 5 lb ai/A among experiments each year since 1973. At appropriate times of application for effective weed control, Drepamon has never been observed to injure any short- or medium-grain varieties at rates as high as 10 lb ai/A. This year, both formulations of Drepamon were found not to injure varieties L-201, S-201 or M9 at 10 lb ai/A, whether they were applied before flooding, or at 7 or 12 days after seeding. This safety to water-seeded rice should make Drepamon a desirable alternative for watergrass control and hasten its registration and availability in California.

A 36-treatment experiment that occupied 2 of the 0.9-acre blocks at the Hamilton Road Facility was unsuccessful in distinguishing any significant differences among the slow-release granular molinate formulations Ordram-L, Ordram-P, Ordram-LP and Ordram-GM (Stauffer). Perhaps this experiment should have been conducted with rice variety L-201 instead of M9, because the expected increased rice safety of these formulations could not be determined where applications of standard Ordram 10-G failed to injure variety M9 at 10 lb ai/A. Differences in watergrass control also could not be determined, because the coated M9 apparently grew so well and uniformly that its competition severely suppressed the high watergrass populations that were expected. Mean dry grain yields ranged from 72 to 84 cwt/A and included that of the untreated control (74 cwt/A).

The experiment comparing granular and liquid formulations of Bolero, Drepamon and Ordram also showed very few significant differences between herbicides or between formulations of the same herbicide at 4 lb ai/A.

Granular Ordram consistently gave better watergrass control than its liquid formulation before and after flooding, while both formulations of Bolero performed similarly at either time. However, granular Drepamon gave similar weed control before flooding and performed better than its liquid formulation when applied after flooding. Based on mean dry grain yields, which were not significantly different, the best treatments of this experiment in decreasing numerical order were: pre-flood granular Ordram, post-flood granular Ordram-LP, pre-flood granular Ordram-LP, post-flood granular Drepamon and pre-flood liquid Drepamon.

Objective II -- Systems of rice management.

Preliminary evaluation of butachlor (Monsanto's Machete) and Dowco 356 (Dow) showed both to be unsatisfactory for water-run application to rice fields. Butachlor injured the rice and failed to control watergrass at 2 lb ai/A. Dowco 356 gave excellent weed control, including monochoria, at the same rate, but it was severely toxic to the rice.

Water-run applications of Ordram and Bolero among the separately irrigated blocks at the Hamilton Road Facility generally performed poorly in spite of fairly accurate application timing and good water-management practices. Contrary to its excellent performance in 1978, water-run Bolero at both 3 and 5 lb ai/A failed to give satisfactory control of late watergrass, although its control of early watergrass was very good. Water-run Ordram gave about the same control of early watergrass as Bolero at similar rates, but its control of late watergrass was better at 3 lb than Bolero at 5 lb per acre. The best weed control and highest rice grain yields given by either herbicide occurred only in the main-plot fields of the second replication where commercial rice had been grown during the three previous seasons and watergrass infestations had been kept under control. The poor watergrass and low grain yields of the other two replications probably was caused by the extremely dense watergrass infestations that had been allowed to develop for purposes of previous herbicide evaluation experiments. This explanation is based on the hypothesis that there is a potential watergrass density level beyond which these water-run herbicide applications become increasingly ineffective. If this hypothesis is correct, it means that water-run herbicide applications can only be successful in fields where the watergrass seed load was not allowed to become very dense.

Watergrass control by water-run Ordram was completely lost on shallowly flooded "mesa" plots that were used to simulate high spots in a rice field. Even though no soil was exposed after initial flooding and water-run treatment, the rice stand was thinnest and watergrasses were densest on these plots where roughseed bulrush and waterhyssop also grew more densely than in other parts of the field. This poor weed control on mesa plots could have been caused either by a rapid loss of herbicide from the shallow water or by pre-wetting of the soil by sub-irrigated "filtered" water which precluded subsequent herbicide sorption when the high spots finally were flooded.

Simulated rainfall of 3.5 inches prior to a water-run Ordram application adversely affected watergrass control, but there was no significant effect with 0.8 inch. Reports of grower applications that were interrupted by more than 0.5 inch of rainfall indicated poor watergrass control in areas where the soil was wet by rain before it was flooded with treated water.

In a small field where water-run Ordram practically failed to control watergrasses at 3 lb ai/A, retreatments with granular Ordram 14 days after flooding at 3, 4 and 5 lb ai/A gave 80 to 90 percent control of early and late watergrass and increased the mean dry grain yield of rice from 19 to 67, 71 and 77 cwt/A, respectively. While retreatment with granular Ordram is a good way to correct a water-run failure, using granular Ordram alone at 4 or 5 lb ai/A probably would be the best choice for such a densely watergrass infested field.

The adverse effects of discontinuous flooding after water-run herbicide application were confirmed very definitely by the replicated experiment in which water-run Ordram and Bolero were compared among separately flooded 0.3-acre main plots. As expected, drainage and periodic flush irrigation that began 6 days after the initial flooding and treatment caused nearly as much watergrass and sprangletop to grow among water-run Ordram plots as among untreated ones. However, water-run Bolero also failed to control watergrass (mainly late form) satisfactorily under the same conditions, although it gave excellent control of sprangletop, ducksalad and waterhyssop. The poor watergrass control by water-run Bolero was very disappointing after it performed so well in discontinuously flooded plots in 1978. If the problems of its reduced control of watergrass this year can be understood and corrected, water-run Bolero could become very important in rice management.

An experimental water-run Ordram application at 4 lb ai/A to a 57-acre field gave good watergrass control except in the intake check, which was retreated with granular Ordram. One of the operational problems of water-running occurred when the metering device malfunctioned and the application was interrupted about four hours. However, the rice variety S-201 was not injured, and the field yielded over 82 cwt/A of dry Foundation seed.

The results of an experiment to compare coated and uncoated, presoaked rice seed with respect to stand establishment and seedling drift were obscured when some of the screen-ring plots were accidentally overseeded. In another experiment, no significant differences were found in the growth and yield of rice from water-sown uncoated-presoaked seed, coated seed without activated charcoal, coated seed with 1 percent charcoal or coated seed with 3 percent charcoal. These results probably were obscured by an accidental field drainage which exposed the young seedlings to a dry north wind. Besides that, the experiment was not planted until May 23, and the grain yields of all plots were rather low. However, the aerial seeded coated variety M9 produced very uniform stands and yielded about 80 cwt/A where weed control was adequate.

PUBLICATIONS OR REPORTS:

Seaman, D. E. 1978. Annual report to the California Rice Research Board, Project RM-1, 6 pp.

Seaman, D. E. 1979. Alternatives in rice grassy weed control. In: Program for Rice Field Day, Calif. Rice Exp. Sta., Biggs, Sept. 5, 1979, pp. 7 - 15.

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

A new formulation of bifenox and two formulations of acifluorfen were found promising for sedge and broadleaf weed control in rice, and the experimental herbicides RH-8254, RH-5730 and RH-8817 also showed promise for control of watergrass and other weeds in rice. Further evaluation of MBR-18337 showed that its activity was similar to propanil except that it also may be used effectively before flooding. Silvex was found to be a better MCPA alternative than bentazon, and it was most effective for control of ducksalad. Triclopyr was found nearly as effective as silvex.

The new long-grain rice variety L-201 was found to be injured rather severely by post-flood applications of granular Ordram at 5 lb ai/A or higher and by granular Bolero at 4 lb ai/A or higher. These findings indicate that future growers of variety L-201 probably should not use the high rates of granular Ordram now permitted by its California Special Local Need label and that granular Bolero probably cannot be used for watergrass control in variety L-201 after its registration. However, current and past results indicated that the use of Drepamon should enable variety L-201 growers to control watergrass without crop injury as soon as this new herbicide becomes registered for use in California rice.

Water-run applications of Ordram were found to be adversely affected by prior rainfall, high spots in the field and discontinuous flooding. Where the water-run applications were followed by continuous flooding, Ordram and Bolero gave about the same control of the early form of watergrass, but both failed to give satisfactory control of late watergrass at 3 or 5 lb ai/A among fields that were very densely infested with the late form.

Among fields that were drained and flush-irrigated after initial flooding and treatment, water-run Ordram gave very little control of watergrass and no control of sprangletop, ducksalad or waterhyssop. Under similar water management conditions, water-run Bolero gave excellent control of sprangletop, ducksalad and waterhyssop, but it failed to control watergrass.