COMPREHENSIVE RESEARCH ON RICE

ANNUAL REPORT
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I. PROJECT: RM-1 Integration and Improvement of Agronomic Practices for Rice Production

II. PERSONNEL: Project Leader: D. E. Seaman, Specialist in Agronomy.
Principal UC Investigators: B. W. Brandon, Senior Agricultural Technician, and T. R. Woolsey, Laboratory Assistant.

III. LEVEL OF 1975 FUNDING: $10,000

IV. OBJECTIVES AND EXPERIMENTS:

Objective I. To evaluate new systems of rice culture in which improved crop management practices are integrated for maximum production efficiency of standard and improved rice varieties.

1. Experiments (5) to evaluate methods and materials for preparation of weighted seed coatings and the performance of coated seed sown by aircraft - Biggs, Knights Landing and Pleasant Grove.

2. Experiments (2) to evaluate performance of herbicides in seed coatings - Biggs.

3. An experiment on effects of coatings on seed viability - Biggs.

4. An experiment to evaluate herbicide performance in a field planted with coated seed - Biggs.

5. An experiment to obtain performance and residue data in support of registration of M-3432 (Drepamon^{R}) - Biggs.

Objective II. To develop new or alternative crop management practices, or combinations of them, that are likely to improve stand establishment, growth, yield and grain quality or to minimize management problems, costs and energy requirements.

1. Experiments (2) to evaluate methods of southern naiad control with respect to static-water management and interactions with nitrogen top dressing - Biggs.

2. Experiments (8) to evaluate alternatives to MCPA for control of sedges and broadleaf weeds - Biggs, Butte and Glenn Counties.

3. Experiments (5) to evaluate 5 promising herbicides and 7 new herbicide combinations and learn how they may be used to improve rice management - Biggs.

4. Experiments (3) to evaluate 10 new experimental herbicides - Biggs.

5. An experiment to evaluate 8 chemical alternatives to copper sulfate for control of algae and improvement of rice stands - Biggs.

6. Miscellaneous trials and services: a 10-acre aerial demonstration of Bolero[R] 10G efficacy, second-year Bolero treatments to provide residue samples, and management of 20 experimental plots for Chevron Chemical Company; collection of water and plant samples following Hydrothol-191[R] applications for residue analysis by Pennwalt Corporation; management of trial areas provided for Dow Chemical Company; a special trial to learn how RH 2915 can be used in rice for Rohm and Haas Company; trials to demonstrate efficacy of glyphosate (Roundup[R]) for levee- and border-weed control as requested by Monsanto Company; and a trial to provide rice-response data and residue samples in support of the registration of Hinosan[R] by Chemagro Division of Mobay Corporation - mostly at Biggs.

Objective III. To determine the agronomic requirements of short-stature rice varieties with respect to their culture and protection, and to develop management systems for optimum yield, chemical efficacy and economy of fertilizer and water.

An experiment was conducted involving interactions of plant height, nitrogen fertility and weed control using lines 70/3597 and 74/47 - Biggs.

Objective IV. To investigate the morphological, physiological, cultural or environmental factors affecting the responses of rice genotypes to herbicides and other agricultural chemicals.

No experiments were conducted toward this objective in 1975.

Objective V. To develop techniques of low-altitude aerial observation and photography for detection of cultural or management problems and the occurrence, distribution and control of weeds and algae in California rice fields.

These techniques were used to identify infestations of American pondweed for grower applications of Hydrothol-191, to evaluate herbicide performance, to estimate the distribution of riverbulrush and other perennial weeds, and to help determine supplemental nitrogen requirements of Rice Station fields - Butte, Colusa, Glenn, Sutter and Yolo Counties.

V. SUMMARY OF CURRENT YEAR'S WORK BY OBJECTIVE:

Objective I. Summary of work on new rice culture systems.

Aerial sowings of coated rice seed at 75 to 100 lb/A produced more uniform stands with less seedling drift than those of presoaked seed at higher rates, and they also gave very good yields. In a 11-acre field, coated S-6 sowed at only 59 lb/A yielded 58 cwt/A of dry rough rice. An economical seed coating process should be available next Spring using continuous-coating machinery being developed at Pleasant Grove.

The trial of herbicidal seed coatings confirmed the feasibility of using coated rice seed as a "granular" herbicide carrier and combining planting and weed control operations into one. Applied in seed coatings at 4 lb ai per acre, both Drepamon and NTN 4725 gave as good watergrass control as separate postflood applications of Ordram 10G at 4 lb ai/A with similar

grain-yield increases above the non-herbicide controls. The addition of simetryn to these coatings gave fair control of sedges and broadleaf weeds with slight increases in yield. These herbicidal coatings reduced seed viability seriously during storage, so coated seed with herbicides should be planted within 4 months of preparation to avoid viability loss.

Trials at 2 locations showed that both granular and liquid formulations of Drepamon gave excellent control of watergrass without rice injury when applied at 4 or 8 lb ai/A before flooding or at 7 or 12 days after rice seeding. Yield increases resulting from Drepamon treatments were similar to those given by Ordram or Bolero formulations applied at appropriate times at 4 lb ai/A. The successful use of Drepamon as a seed-coating herbicide should support its continued development as a separately applied herbicide for rice.

The use of coated seed appeared not to affect the performance of preflood or post-seeding applications of granular or sprayable formulations of Ordram, Bolero, Drepamon or perfluidone (Destun^{R}). Granular formulations generally gave better weed control and higher rice yields than the sprayable formulations at the same rates, but these differences were not as great as was found last year with Ordram and Bolero.

Objective II. Summary of work on management practices.

Water management following Hydrothol-191 applications was found not to be as critical as with simetryn for submersed weed control. Granular Hydrothol-191 applied 38 days after seeding at 2 or 3 lb ae/A required a static-water period of only 3 days to achieve excellent control of southern naiad, while granular simetryn at 1 or 2 lb ai/A required more than 5 days of static water to give similar naiad control. Although simetryn was slow to act on naiad, it killed emersed California arrowhead, ducksalad, waterhyssop, waterplantain, monochoria and roughseed bulrush when applied at 38 or 48 days after seeding.

Southern naiad control by granular Hydrothol-191 increased grain yield 7 cwt/A where no urea top dressing was applied, but yield increases given by Hydrothol-191 were reduced to 6 and 4 cwt/A where urea-nitrogen was applied at 27 and 54 lb/A, respectively. Thus, nitrogen topdressing appeared to overcome the competitive effects of southern naiad. This suggests that chemical control of this weed might become less profitable at higher rates of nitrogen topdressings.

Formulations of silvex (Kuron^{R}) and 2,4,5-T (Veon 245^{R}) were found more acceptable than those of 2,4-D as alternatives to MCPA for post-emergence control of sedges and broadleaf weeds in rice. A sodium salt of MCPP (Lescopex^{R}), which, unlike the other phenoxy herbicides, is not registered for use in rice, also performed acceptably. Amine salts of 2,4-D were slightly more toxic to Colusa rice than silvex, 2,4,5-T or MCPA where all were applied 35 days after seeding (DAS) at 1 lb ae/A or 48 DAS at 1.25 lb ae/A. A dimethylamine salt of MCPA (Dow MCP Amine^{R}) caused slightly more rice injury than a sodium salt (Chiptox^{R}) at equivalent rates, but no corresponding differences in rice yield resulted. Aerial applications of these formulations performed about the same in control of aquatic weeds and sedges at the Rice Station this year, so it appears that the good control of ducksalad by Chiptox observed last year was related more to timing and rate of application than to formulation.

In a trial at the Rice Station, bentazon (Basagran^{R}) applied 35 DAS in solution with Cittowet surfactant at 1 or 2 lb ai/A controlled California arrowhead, roughseed bulrush and roundleaf waterhyssop nearly as good as MCPA applied 45 DAS at 1 lb ae/A. However, bentazon was ineffective on monochoria at 1 lb ai/A and only gave fair monochoria control at 2 lb ai per acre, while the MCPA application gave complete control.

Applications of bentazon + Cittowet made 44 days after Calrose rice was seeded at the Hamman Ranch in Butte County gave nearly complete control of riverbulrush at rates as low as 1 lb ai/A, while MCPA was ineffective at 1 lb ae/A. Good control of this perennial sedge also was given by silvex (Kuron) at rates as low as 0.75 lb ae/A, but silvex was slower acting and less effective than bentazon on riverbulrush even at higher rates. A late (65 DAS) aerial application of Kuron to a Glenn County ricefield at 1 lb ae/A also gave good, but slow-developing, control of riverbulrush.

In a Glenn County field, where riverbulrush had become so dense as to cause the grower not to risk planting rice, good initial control of this weed was given both by bentazon + Surfactant WK^{R} and glyphosate (Roundup^{R}) at rates as low as 1 lb ai/A, but Kuron was ineffective even at 2 lb ae per acre. An aerial application of bentazon + Surfactant WK to 6 acres of the same field at 1.5 lb ai/A also gave good initial control, but the riverbulrush regrew within 3 months in the absence of rice competition as it did among the plots treated with bentazon or glyphosate.

Granular molinate + simetryn and benthiocarb + simetryn were regarded as the most promising of 7 new herbicide combinations evaluated in a field that was infested mainly with watergrass and roughseed bulrush. The use of 1 lb ai/A of simetryn in combination with 4 lb ai/A of molinate or benthiocarb avoided the necessity of applying MCPA for sedge control, and these combinations were safe and effective either as preflood or postflood applications. Granular combinations of molinate + U 27267 and PP 888 + MCPA-IPE were unsatisfactory, but postflood applications of granular perfluidone + MCPA-IPE and molinate + bentazon performed nearly the same as the combinations with simetryn or the standard sequential applications of molinate and MCPA. A new granular formulation of Ordram + MCPA-IPE gave very good control of watergrass, California arrowhead and roughseed bulrush applied at 57 lb/A (4 + 0.7 lb ai/A, respectively) when the rice had emerged at 2 locations.

NTN 6867 and PP 888 both failed to perform in large plots this year as well as they did in a preliminary small-plot trial last year, so they will not be evaluated further unless more active formulations become available. The granular formulations used this year may be defective.

Preflood applications of granular perfluidone (Destun^{R}) at 2 lb ai/A were found to increase in rice injury the deeper they were incorporated, but this did not affect weed control or rice grain yield significantly. The non-incorporated application gave excellent control of watergrass, California arrowhead, roughseed bulrush and creeping spikerush, and a mean dry grain yield of 83 cwt/A, which was 22 cwt/A more than the untreated control.

R-32346, R-1611 and R-34018 were the most promising of 10 experimental herbicides evaluated for the first time this year in small-plot trials.

Granular formulations of simetryn, terbutryn, O6K, DPX 6774, linuron and R-31401 all gave better control of filamentous green and bluegreen algae than either copper sulfate or a copper-triethanolamine complex (Ricetrine) applied 9 days after flooding at water concentrations of 1 ppmw of active ingredient or copper metal. Terbutryn was the most effective algaecide of all, but it caused some injury to rice as did linuron and R-31401. Because of its safety and versatility in rice, simetryn is the most likely candidate for further development as an algaecide for California rice.

Objective III. Summary of work with short-stature rice varieties.

Data from the experiment on interactions of plant height, nitrogen fertility and weed control have not yet been fully analyzed, but they appear to support the following provisional conclusions: (1) at corresponding nitrogen fertilizer rates, the short-statured line 74/47 yielded from 7 to 12 cwt/A more grain than the taller line 70/3597 among plots having adequate weed control as well as among those without any weed control; (2) weed control increased the yield of each variety by nearly the same amount at each nitrogen level, and these increases were greatest where nitrogen was low and least where nitrogen was high; and (3) high rates of nitrogen fertilizer can compensate both of these rice lines for yield losses caused by poor weed control, as both appear to become more competitive with weeds as nitrogen rate is increased.

VI. PUBLICATIONS OR REPORTS:

Seaman, D. E. 1975. New developments in rice management. In: Program for Rice Field Day, Sept. 3, Rice Expt. Station, Biggs, Calif., pp. 8-12.

VII. CONCISE GENERAL SUMMARY OF 1975 RESULTS:

Aerial sowing trials were conducted for the first time this year with coated seed of 4 rice varieties. Use of coated seed avoided many problems concomitant to seed soaking. No problems were encountered during aircraft loading, sowing and growth of coated seed, which produced very uniform stands and good yields at low seeding rates.

Rice seed with coatings containing the new herbicides Drepamon or NTN-4725, or combinations of Drepamon and simetryn or NTN-4725 and simetryn, all gave very good watergrass control, good stands and high yields when sown in a weedy field. These results confirmed the feasibility of combining planting and weed control into one operation through use of the seed as the herbicide carrier.

Drepamon also was found very promising as an alternative to Ordram or Bolero in separate pre- or post-flood applications at 4 lb ai/A. There was no evidence that Drepamon controls weeds other than watergrass, but it was very safe to rice, and its possible use in seed coatings should support its continued development for water-seeded rice.

Granular formulations of Ordram, Bolero and Drepamon performed better than sprayable formulations applied at the same times and rates, although the weed control and yield increase differences were not as great as were found last year with Ordram and Bolero.

New herbicides that continued to show promise for improved rice management were simetryn, bentazon and perfluidone; and preliminary trials indicated that R-32346, R-1611 and R-34018 also may be useful. Simetryn was found very promising as an algaecide, as a submersed or emersed aquatic herbicide, as an additive to other herbicides in seed coatings, and in granular combinations with molinate, benthiocarb or Drepamon. Bentazon was found especially useful for control of riverbulrush, and it appeared promising as an alternative to MCPA except for control of monochoria and ducksalad. Perfluidone gave good broad-spectrum weed control, but it was somewhat injurious to rice at the rates used.

Among phenoxy-acid herbicides that might be used legally in rice as alternatives to MCPA, formulations of silvex and 2,4,5-T were found more acceptable than those of 2,4-D for reasons of safety and efficacy. Silvex was of special interest, because it gave nearly as good control of riverbulrush as bentazon, so it could be used for that purpose until bentazon becomes available.

In a submersed weed control trial, there were indications that nitrogen topdressing overcame the competitive effects of southern naiad and that chemical control of this weed might not be profitable at high rates of nitrogen. In another trial, increased rates of basal nitrogen fertilizer tended to compensate for yield losses caused by lack of emersed weed control in short and medium stature rice varieties. These varieties competed strongly with uncontrolled weeds, and they were increasingly competitive as nitrogen fertilizer rate was increased.