ANNUAL REPORT
COMPREHENSIVE RESEARCH ON RICE
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PROJECT TITLE: Weed Control in Rice

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OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

I. To develop chemical methods of weed control in rice and to improve the efficacy and safety of herbicides now in use.

II. To study the biology and physiology of rice weeds in the field, greenhouse, and laboratory.

III. To study Londax-resistant weeds and develop a strategy for their control.

SUMMARY OF 1994 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVES:

OBJECTIVE I

To develop new chemical methods of weed control in rice and improve the efficacy and safety of herbicides now in use (Appendix A cross references trade name and common cheimcal names).

NEW HERBICIDES

Pretilichlor. The effectiveness of pretilichlor in controlling rice weeds in water-seeded rice was tested by applying it alone and in combination with bensulfuron and molinate to individually enclosed plots in a randomized complete block design with three replications. Table 1 shows a treatment list and the results. All applications used a spray volume of 25 GPA. Preflood surface (PFS) applications were made to the dry soil surface at rates of 0.5 and 1.0 lb ai/A three days before water seeding rice variety M202 on May 28 into three to four inches of water. This water level was maintained on all plots throughout the growing season. Both rates gave excellent weed control on all species with rice yields comparable to the bensulfuron plus molinate standard, but early injury to the rice seedlings reduced stand to

unacceptable levels. Increased rice tillering compensated for stand losses. Four rates of pretilichlor alone - 0.5, 0.75, 1.0, and 2.0 lb ai/A applied at the 3.3-leaf stage of rice 13 days after seeding (DAS), were compared with bensulfuron and molinate alone and in combination with pretilichlor. High winds prevented the application of these treatments at the two leaf stage of rice. Only the highest rate of pretilichlor alone provided significant control of all weed species and good yields, although it was not as effective as the bensulfuron plus molinate standard. The combinations of pretilichlor and molinate were more effective than molinate alone and just as effective as molinate plus bensulfuron in controlling watergrass (ECHOR) and sprangletop (LEFFA), but were less effective on ricefield bulrush (SCPMU). Although there was a slight improvement in watergrass control, the combinations of pretilichlor plus bensulfuron generally did not perform significantly better than bensulfuron alone nor as well as the molinate plus bensulfuron standard. Late applications of pretilichlor alone at the 4.8-leaf stage of rice 21 DAS provided little to no control. It appears that pretilichlor can be quite effective on a broad spectrum of rice weeds applied PFS, although with rice injury at the rates used in this experiment. Future studies should include lower rates PFS and earlier timing postflood

Mefenecet. Mefenecet alone and in combination with bensulfuron was compared to bensulfuron alone in a randomized complete block design with three replications. After the plots were flooded and rice variety M202 was water-seeded on May 28, a water depth of four to six inches was maintained throughout the growing season. An early application at the 3.3-leaf stage of rice 13 DAS, at rates of 0.67 and 1.12 lb ai/A, and a later application of the same rates at the 4.8-leaf stage of rice 21 DAS, were made in a spray volume of 25 GPA. Table 2 shows that the high rate gave partial control of watergrass (ECHOR) early, but this effect did not persist, and overall weed control and yields were not significantly better than the untreated control. The combinations with bensulfuron performed similarly to bensulfuron alone, giving partial control of watergrass, complete control of broadleaves and sedges and excellent yields. An application earlier than the 3.3-leaf stage was not possible because of high winds. Future studies should include preflood surface (PFS) and earlier postflood timings to determine the potential for mefenecet use in water-seeded rice.

KIH-6127. ***Preflood surface applications*** of KIH-6127 or Abolish were applied May 25 to a dry soil surface. Ordram 10G was applied to the soil surface and incorporated 2 inches with a spike tooth harrow. Flooding began May 26 and the flooded field was seeded May 28 with M202. The floodwater was established at 4 to 6 inches and was not lowered or removed during the growing season. The Londax was applied to the KIH-6127 plus Londax combinations plots on June 11. No rates of KIH-6127 alone or in combination with Londax caused any visible injury to the rice. KIH-6127 at rates of 72 g ai/A and 97 g ai/A alone or in combination with Londax gave excellent control of watergrass (Table 3a). The 36 g ai/A and 48 g ai/A gave satisfactory watergrass control of 70% to 83% but sprangletop was not controlled by any KIH-6127 or Londax treatment. Preflood surface treatments of KIH-6127 showed activity on ricefield bulrush at rates of 48 g ai/A and above. There was no activity at any rate of KIH-6127 on smallflower umbrella sedge or monochoria. The addition of Londax to KIH-6127 provided 100% control of ricefield bulrush, smallflower umbrella sedge and monochoria. Preflood treatments of Abolish gave 87% watergrass control and 100% control of sprangletop and smallflower umbrella sedge. Ricefield bulrush was not controlled by Abolish. The preflood treatment of Ordram gave only 67% watergrass control and no control of smallflower umbrella sedge or monochoria. All treatments of KIH-6127 + Londax gave higher rice yields than KIH-6127 alone, Abolish or Ordram (Table 3b).

The postflood applications of KIH-6127 alone or in combination with Londax were made June 11 when the rice (M202) was in the 5-leaf (1-tiller) stage. The application was made to rice growing in 4 inches of water. No rice injury was observed in any KIH-6127 treatment whether alone or in combination with Londax. All Treatments with KIH-6127 alone or in combination with Londax gave excellent control of watergrass, smallflower umbrella sedge and ricefield bulrush (Table 4a). Ordram treatment provided only 67% watergrass control and was significantly lower yielding than any KIH-6127 treatment (Table 4b).

KIH-2023. Standard treatments of Londax, Bolero or Londax + Ordram were applied, June 11, to flooded plots when the rice (M202) had reached the 3.3-leaf stage and the watergrass was in the 3.5- to 4-leaf stage. Once the rice had reached the 5-leaf (1-tiller) stage (June 21) the floodwater was lowered from 5 to 6 inches to 3 to 4 inches to expose 70% of the watergrass foliage. KIH-2023 + Silwet L-77 treatments were applied to both Londax treated or untreated plots at rates of 8, 12, 16 or 24 g ai/A and the floodwater was returned 48 hours later. At this time the watergrass, in the untreated plots, was in the 5- to 6-leaf stage and the watergrass in the Londax treated plots was in the 4- to 4.5-leaf. On July 8, the watergrass in the Londax only treated plots that did not receive KIH-2023 on June 21 had reached the 6-leaf (1.25-tiller) stage and were then treated with KIH-2023 + Silwet L-77. By delaying the KIH-2023 until the watergrass in the Londax-treated plots reached the 6- leaf (1-tiller) stage the rice had progressed to the 2.5-tiller stage. The

floodwater was maintained at 5 to 6 inches for this application. KIH-2023 alone was as effective as the combinations with Londax in controlling watergrass (Table 5a). Sprangletop was not controlled by KIH-2023 alone or in combination with Londax. Ricefield bulrush and smallflower umbrella sedge were 90% to 100% controlled by all rates of KIH-2023 alone. The combinations of Londax + KIH-2023 gave 100% control to both sedges and monochoria. The application of KIH-2023 at the 5-leaf stage caused some stunting and leaf burn of the rice soon after application in both the Londax treated and untreated plots especially with the 16 g ai/A and 24 g ai/A rates. The application of KIH-2023 made to 6- to 7-leaf watergrass showed some slight rice leaf discoloration but the visual symptoms did not persist. The Ordram + Londax application made at the 3.3-leaf stage of the rice gave early control of the watergrass but did not provide season long control of late watergrass. Bolero applied alone at the 3.3-leaf stage of rice did not give adequate watergrass control because the watergrass had progressed beyond the 3-leaf stage. Delaying the KIH-2023 applications until the 3-tiller stage decreased visual injury but did not significantly affect weed control or rice yield (Table 5b).

Evaluation of F-6285 and F-8426 for weed control in rice. Rates of F-6285 alone and F-8426 alone and in combination with X-77, Ordram, Londax or Whip were applied to rice 35 DAS when the rice (M202) was in the 3.8-tiller stage. A heavy population of watergrass was in the 4- to 5-tiller stage. Ricefield bulrush had 2- to 2.5-tillers and the monochoria was in the 4th leaf. There was a thin population of sprangletop and smallflower umbrella sedge in the trial area. Poor control of watergrass and ricefield bulrush was provided by F-6285 at rates of 0.25, 0.5 or 1.0 lb ai/A when applied 35 DAS and early leaf spotting and leaf burn to the rice weeds was evident (Table 6a). F-8426, at rates of 0.015, 0.031, 0.063 or 0.12 lb ai/A, alone or in combination with X-77 at 0.25% V/V did not give satisfactory control of watergrass but did show activity on ricefield bulrush, smallflower umbrella sedge and monochoria at rates at or above 0.031 lb ai/A. Herbicide activity increased with the addition of X-77. Injury to rice also increased and rice yield decreased (Table 6b) when X-77 was added. Watergrass control was enhanced with combinations of Ordram, Londax or Whip. F-6285, at rates of 0.5 or 1.0 lb ai/A plus X-77 at 0.25%, was applied to rice in the 2.5- to 3-leaf stage in a drained field (Table 15a) and the watergrass was controlled but the sprangletop was not controlled. The rice was severely injured at this timing and most plants did not recover (Table 15b).

Evaluation of HI-DEP (2,4-D), Solution (2,4-D), MCP Amine and 2,4-D Amine. Treatments of HI-DEP (2,4-D), Solution (2,4-D), MCP Amine or 2,4-D Amine at the rates of 0.75, 1.0 or 1.5 lb ai/A were applied to rice (M202) 35 or 47 DAS. At the 35 DAS treatment, the flood water was lowered from 4 to 6 inches to 2 to 4 inches to expose the rice weed foliage. The rice had 2.7-tillers at this time. The major weeds were ricefield bulrush, in the 2- to 3-tiller stage, and monochoria was in the 4-leaf stage. Treatments were applied in 10 gallons of spray solution per acre. The flood water was returned to the 4 to 6 inch level 48 hours after the application and not lowered for the 47 DAS treatments. The rice was in the 4.5-tiller stage and the ricefield bulrush had 5-tillers and was starting to flower. The monochoria was well established. The HI-DEP and Solution formulations of 2,4-D gave similar control of ricefield bulrush and monochoria to the standard MCP Amine and 2,4-D Amine treatments at 35 DAS (Table 7a). Rice root injury increased as the rate increased with all treatments except those involving the Solution formulation. The rice shoots were stunted early but the rice outgrew these symptoms. The 47 DAS treatments of HI-DEP or Solution did not increase control of ricefield bulrush over the MCP Amine or 2,4-D Amine at any rate. None of the later applications gave 100% control of the ricefield bulrush (Table 8a) and rice yields were always lower with the later applications (Table 8b).

Influence of water management and rate of Grandstand when applied to 5-leaf rice. On June 19 when the rice (M202) was in the 4.5-leaf stage water was completely drained or lowered to 2 inches in preparation for Grandstand, MCP Amine or 2,4-D Amine treatment. The Treatments were applied to 5-leaf rice on June 22 when the ricefield bulrush and smallflower umbrella sedge were in the 1- to 1.5-tiller stage and had not started to flower. The flood water was raised on all treatments to 5 to 6 inches 48 hours after treating and maintained for the remainder of the growing season. Although all treatments gave adequate smallflower umbrella sedge, ricefield bulrush and monochoria control the applications made to the drained field gave greater weed control than the same treatments applied with 2 inches of floodwater (Table 9a). Rice injury did not significantly change with the different water management systems. Watergrass and sprangletop were controlled with a late application of Whip 1 EC at 0.15 lb ai/A.

Timing of reflood after a Grandstand application to 1-tiller rice. Grandstand at 0.75 lb ai/A + X-77 at 0.25% was applied to drained rice once the rice (M202) had reached the 1-tiller stage and the ricefield bulrush and

smallflower umbrella sedge were in the 1- to 1.5-tiller stage and had not started to flower. Reflooding occurred 1, 2 or 3 days following the application. After standard application of MCPA or 2,4-D at 0.75 lb ai/A the plots were reflooded at the 1 day reflood timing. In this experiment the time of reflooding did not affect rice injury (Table 10a). Grandstand + X-77 did an excellent job in controlling smallflower umbrella sedge, ricefield bulrush and monochoria at all three flood back timings. A late application of Whip 1 EC at 0.15 lb ai/A was applied to all treatments for watergrass and sprangletop control.

Grandstand + X-77 in combination with Abolish, Londax, Whip or Pretichlor for weed control in rice. Combinations of Grandstand + Abolish or Grandstand + Pretichlor did not give adequate watergrass control (Table 11a) when applied at the 5-leaf or 1-tiller stage of the rice (M202). The ricefield bulrush and smallflower umbrella sedge were in the 1- to 1.5-tiller stage or 1.5- to 2-tiller stage and had not started to flower at the time of these applications. The tank mix combination of Grandstand + Whip provided early watergrass control (70% to 83%). The combination of Grandstand + X-77 + Whip caused immediate leaf burn and stunting of the rice plants but the rice outgrew these symptoms. Grandstand controlled smallflower umbrella sedge, ricefield bulrush and monochoria when applied as a tank mix with the grass herbicides. Grandstand applied for broadleaf and sedge control in combination with the grass herbicides was as effective as the combination of Grandstand + Londax with the population of weeds present in this experiment. The control treatment received a late application of Whip at 0.15 lb ai/A for watergrass and sprangletop control.

Whip 1 EC or Whip 360 for Watergrass and Sprangletop Control. The first application of Whip 1 EC at rates of 0.1 and 0.125 lb ai/A and Whip 360 at 0.042 and 0.05 lb ai/A were made June 21 to rice (M202) in the 5-leaf (1-tiller) stage. Watergrass was 6-leaf (1.5-tiller) and sprangletop was in the 5-leaf stage. On June 17, Londax at 1 oz ai/A was applied to the entire plot area for broadleaf and sedge weed control. On July 8, a second timing of Whip 1 EC at 0.15 lb ai/A was made to untreated plots and a second or split application of Whip 1 EC at 0.1 or 0.15 lb ai/A was made to plots previously treated June 21 with 0.1 lb ai/A of Whip 1 EC. A second timing of Whip 360 at 0.059 lb ai/A and a split application of 0.042 or 0.059 lb ai/A was also made to plots previously treated with Whip 360 at 0.042 lb ai/A on June 21. The rice was in the 3.8-tiller stage. The watergrass had 4-tillers and the sprangletop had 2-tillers. The early applications of Whip 1 EC at 0.1 and 0.125 lb ai/A gave from 83% to 94% watergrass control (Table 12a) and from 93% to 100% control of the sprangletop. Whip 360 also gave early control of both watergrass (87% to 100%) and sprangletop (97% to 100%). The single application of Whip 1 EC at 0.125 lb ai/A and Whip 360 at 0.05 lb ai/A caused the most injury to the rice (Table 12a) showing symptoms of stunting and leaf tip burn. The split application of Whip 1 EC or Whip 360 increased season long watergrass control over the higher single rate applied at the 1-tiller stage. The single application of Whip 360 at 0.059 lb ai/A applied at the 3-tiller rice was more effective than Whip 1 EC at 0.15 lb ai/A for controlling watergrass. The split applications of Whip 1EC gave higher rice yields (Table 12b) than the single applications of Whip 1EC at either timing.

Pre-flood Abolish, Bolero, Ordram 8E, or Ordram 10G alone or in combination with Londax. Treatments containing Abolish or Bolero were applied pre-flood surface and treatments of Ordram 8E or Ordram 10G were applied pre-flood incorporated on May 15. The floodwater was started immediately after the last application and the basin was completely flooded by May 17. The floodwater was maintained from 4 to 6 inches throughout the rice growing season. The Londax applications were applied as a tank mix with the liquid formulations or as a sequential application with the granular herbicides. A split treatment of Londax was made when the rice (M202) reached the 2-leaf stage. The pre-flood applications without the addition of Londax were comparable in the control of watergrass except Ordram 8E at 4 lb ai/A which only controlled 73% of the watergrass (Table 13a). Abolish or Bolero were more effective in the control of sprangletop than either formulation of Ordram. The addition of Londax increased watergrass control over the herbicide alone and gave excellent ricefield bulrush and smallflower umbrella sedge control. The Abolish or Bolero pre-flood surface treatment caused more rice injury than the Ordram treatments.

Post emergence applications of Abolish 8E, Bolero 10G, Ordram 8E or Ordram 10G alone or in combination with Londax applied to 2-leaf rice in 6 inch deep water. When the rice (M202) had reached the 2-leaf stage treatments were made into the floodwater. The granular applications of Ordram and Bolero gave better watergrass control then liquid formulations of Ordram or Abolish (Table 14a). The addition of Londax increased control of

watergrass, ricefield bulrush and smallflower umbrella sedge. Sprangletop was controlled with treatments of Abolish or Bolero. No rice injury was observed with any treatment when applied at the 2-leaf stage of rice.

Post emergence application of Abolish 8E, Bolero 10G, Ordram 8E, Ordram 10G, Goal or F-6285 alone or in combination with Londax or Grandstand + X-77 to drained rice in the 2.5- to 3-leaf stage. The rice (M202) was water-seeded into 6 inch deep water on May 20 and when the rice had reached the 1.5-leaf stage, on May 27, the floodwater was remove and the soil was allowed to dry. On June 4 the rice had reached the 2.5- to 3-leaf stage and the herbicide treatments were applied. Reflooding of the plots was started on June 6, 48 hours after the applications and the field was completely flooded to a 6 inch depth by June 8. The combinations of Abolish 8E or Ordram 8E with Londax or Grandstand and Londax + Grandstand were either applied as a tank mix or as a sequential application, applying one herbicide and immediately following with the other. All Grandstand applications were made with the addition of 0.25% V/V X-77. Abolish 8E, and Ordram 10G alone and the combinations of Abolish 8E + Londax, Bolero 10G + Londax or Ordram 10G + Londax all gave early watergrass control but failed to adequately control the heavy infestation of late emerging, late watergrass (Table 15a). The addition of Londax as a tank mix or sequential application increased ricefield bulrush and smallflower umbrella sedge control. The combinations of Grandstand + X-77, at the rate of .75 lb ai/A with Abolish 8E, Ordram 8E or Londax caused severe early injury to the rice. The rice became very chlorotic and the plants showed early temporary stunting but they did recover (Table 15a). The tank mix combinations were more injurious than the sequential treatments. Grandstand did control ricefield bulrush and smallflower umbrella sedge. Treatments of Goal at 0.5 or 1.0 lb ai/A were also applied but the watergrass was too large to be controlled. F-6285 at 0.5 or 1.0 lb ai/A caused severe injury to the rice at this timing and at these rates.

Rodeo for rice levee weed management. Rodeo at 2 lb ai/A + 1 % X-77 V/V or 4 lb ai/A + 1 % X-77 V/V was applied to weeds on established rice levies on July 15 using a Honda shielded levee sprayer. The applications were made in 10 gallons of spray solution per acre to a thick stand of watergrass 18 inches tall and a sparse population of broadleaf weeds. The initial application of Rodeo at both rates controlled the barnyardgrass but allowed the swamp smartweed (*Polygonum coccineum*), a perennial broadleaf weed to grow and become the dominate weed. A sequential application of 2 lb ai/A + X-77 or 4 lb ai/A + X-77 was made to selected levees on August 9, that had previously been treated with 2 lb ai/A or 4 lb ai/A. The swamp smartweed shoots had reached 9 to 15 inches long and watergrass had reinfestated the levees. On September 1 the single application of 2 lb ai/A + X-77 gave 75% watergrass and 70 % swamp smartweed control and the 4 lb ai/A + X-77 provided 83% watergrass control and 80 % smartweed control (Table 16). The sequential application of 2 lb ai/A + X-77 or 4 lb ai/A + X-77 increased control to 90 % or better for watergrass and 88% or better for swamp smartweed.

OBJECTIVE II

To study the biology and physiology of rice weeds in the field, greenhouse, and laboratory.

Field Studies:

Competition: Using small plots, competition between short stature rice and watergrass, ricefield bulrush and smallflower umbrella sedge showed the critical time for weed removal to be when the first yield components of the rice plant, tiller number, were being initiated, approximately 20 DAS. Reduction in yield occurred with approximately 0.06 barnyardgrass plant per square foot; approximately 0.07-0.11 early watergrass plant per square foot; or 0.33 late watergrass plant per square foot. The number of ricefield bulrush and smallflower umbrella sedge plants required to reduce rice yields were in the order of 1 plant per square foot.

Comparison of Weed Abundance and Competition in Water-Seeded vs. Drill-Seeded Rice, 1991-1994: The potential loss of broadleaf herbicides in California rice production resulting from the development of bensulfuron-resistant weeds and from the possible lack of re-registration of phenoxy herbicides has prompted research into alternative methods of weed control. This past season was the final year of this four year study which was conducted to compare weed abundance and competition between water-seeded (WS) and drill-seeded (DS) rice systems and to

investigate the possibility of using cultural management to decrease weed pressure in continuous rice cropping systems.

The experiment was established in May, 1991 at the Rice Experiment Station, Butte County. Three herbicide treatments were designed to compare the impacts of grass versus broadleaf and sedge weeds on rice production in the two systems. Main plots were seeding establishment method, WS and DS. Subplot treatments included (1) bensulfuron (1oz ai/A), (2) molinate (4 and 9 lb ai/A for WS and DS, respectively) and (3) a combination of both herbicides. In 1994 WS and DS plots were switched in order to examine the effects of rotation between these two cultural systems on weed populations. Summary graphs for grass weed density, broadleaf weed density, sedge weed density, rice plant density, rice tiller density, and grain yield for all four years are presented in Figures 1 through 6, respectively. Plant densities illustrated in these figures were collected during the 10th week after seeding (68, 74, 71, and 74 DAS for 1991, 1992, 1993 and 1994, respectively).

Water-seeding rice suppressed grasses and provided higher yields when both grass and broadleaf herbicides were applied. The continuous flood inhibited the establishment of sprangletop and helped suppress barnyardgrass and watergrass. Yields in WS treatments which did not receive molinate for grass control were depressed 11-25% relative to the weed free WS treatment. In the absence of broadleaf herbicides the weed pressure in the WS treatment depressed yields 12-35% relative to the weed free WS treatment.

Drill-seeding rice suppressed broadleaf weeds however this system required increased rates and increased applications of herbicides for grass control, particularly as grass weeds were far more competitive with rice than broadleaf weeds. These increased applications of molinate provided complete control of barnyardgrass and watergrass, however significant numbers of sprangletop which established during the pre-flood period were not controlled. Yield in the DS treatment receiving both grass and broadleaf herbicides was 4-29% lower than the corresponding WS treatment. In the absence of molinate grass weeds infested the DS plots and discouraged harvest operations. In the absence of bensulfuron some aquatic weeds, predominantly monochoria, appeared later in the season, and yields in this treatment were reduced 1-25% relative to the DS treatment which received both herbicides.

Data collected in 1994 after switching the best WS plots with the best DS plots indicate that rotating between these two systems could improve control of broadleaf weeds, particularly monochoria which infested the WS plots in the absence of bensulfuron in previous years. Ricefield bulrush populations, however, remained high in WS plots in the absence of bensulfuron after rotation. Further research is needed to verify if changes in the weed populations after rotation were due to the different cultural systems or a consequence of environmental variability.

This study indicates that drill-seeding may provide an alternative means of controlling populations of aquatic broadleaf and sedge weeds in a continuous rice cropping system in the absence of broadleaf herbicides. However competitive grass species which establish during the pre-flood period are more difficult to control than under water-seeding where the continuous flood suppresses germination and growth of these weeds.

Greenhouse Studies:

KIH-2023: The effect of KIH-2023 + Silwet L-77 at rates of 12 or 48 g ai/A + 0.25% V/V was evaluated in the greenhouse for injury to rice roots. Rice seedlings (M-202) were grown in 1 gallon containers using Yolo Clay Loam soil until the 4-leaf or 1-tiller stage. The herbicides were applied using a linear spray chamber and the rice plants were returned to separate flooded basins. At one week intervals the rice plants from each treatment and the untreated control were carefully washed free of soil and were oven dried. Dry weights of roots indicated that KIH-2023 reduced root growth for two weeks following treatment. New roots were initiated after this time but total root biomass lagged behind the untreated control for an additional 2 weeks.

Tomato seedlings (Brigade) were sprayed with KIH-2023 + Silwet L-77 at rates of 16.2, 8.1, 4.0, 2.0, 1.0 and 0.5 g ai/A when the seedlings were in the 2-leaf stage and at the 4-leaf stage. Symptoms and dry weight showed that KIH-2023 severely affected growth at either growth stage when subject to rates of 4.0 g ai/A or above. Tomato seedlings treated in the 2-leaf stage showed symptoms within 48 hours but required 1 week for symptoms to appear when treated in the 4-leaf stage. obvious visual symptoms were present in the 0.5 g ai/A treatments at both growth stages even though effects on overall growth was minimal.

Bolero: Soil was collected from fields showing Bolero injury late in the season and placed in a greenhouse. The basins were divided into 2 groups, one received Bolero and one received no herbicide. The basins were planted with rice, allowed to grow to the 2-leaf stage and appropriate basins treated with Bolero. The rice plants are allowed to grow until heading, at which time the basins are dried and the plant residue chopped and mixed into the soil. We have completed 4 cycles and still are able to see the typical "Bolero" type symptoms reported from the field.

Copper: In a cooperative study with Dr. Crosby, Department of Environmental Toxicology, rice was grown in soil treated with copper at 50 ppm, 100 ppm, 200 ppm, and 500 ppm. Rice plants started showing reduced growth and yellowing of the plant at 100 ppm and eventually died at 500 ppm.

OBJECTIVE III

To study Londax-resistant weeds and develop a strategy for their control.

1994 Londax Resistance Monitoring: In 1994, field monitoring of Londax resistance was conducted via survey distributed to Pest Control Advisors (PCA's). The survey, conducted cooperatively by the University of California and DuPont, was designed to determine how widespread was Londax resistance and on what species. In addition, the survey solicited input from PCAs' on their experience with resistance management and control of resistant weeds.

Total sites with suspected Londax resistant weeds numbered 4,753 in 1994. Of those sites, 43% were California arrowhead, 24% redstem, 23% smallflower umbrella sedge and, 10% ricefield bulrush. The survey data account for 82% of 1994 California rice acreage (443,312 acres of an estimated 540,000). Subjectivity inherent in the survey approach to field evaluations does not allow for direct comparison of 1994 data to 1992 and 1993 data which was obtained via weed survival to overspray. However, independent of survey error, a substantial increase in the number of actual Londax resistant sites occurred in 1994 (Table 17). At least one resistant weed site was suspected in each of the counties where any rice is grown. Colusa county had the highest number of sites followed by Sutter, Yuba, Glenn, Yuba, Butte, Sacramento, Yolo, San Joaquin, Stanislaus, Fresno, and Tehema counties.

Qualitative survey results indicated that smallflower umbrella sedge was the most difficult Londax resistant weed to control with alternative herbicides and that which contributes most to yield reduction. Redstem was generally considered to be the most problematic resistant weed due to reasons other than yield reduction. Questions addressing resistance management strategies had variable responses without consensus.

It is quite clear that weed resistance continues to be a problem for California rice growers and that the utility of Londax in weed control may be diminished as a result.

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CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

The results of new herbicide screening indicated there are four possible new candidates for use in California water-seeded rice. Two (KIH-6127 and KIH-2023) are primarily grass herbicides but have some herbicidal activity on sedges and broadleaf weeds. The remaining two herbicides (F-8426 and triclopyr) are primarily sedge and broadleaf herbicides and have little effect on grass weeds. Three are experimental herbicides and will not be available for use by California growers in the near future. Triclopyr (Grandstand) is the most advanced and potentially could reach the California market first. Grandstand was most effective when applied before the sedge and broadleaf weeds had started to tiller and flower.

Research with presently registered herbicides suggested Abolish can be effectively used in a flush-drain culture early in the season similar to the Pin-Point Flood method used in the Southern U.S.. Abolish used in this manner controlled barnyardgrass, watergrass, sprangletop and smallflower umbrella sedge but was less effective for the control of ricefield bulrush. The herbicidal effect of MCPA and 2,4-D amine were essentially the same. 2,4-D amine was a little more active than MCPA but also slightly more injurious to the rice. This year's data would indicate growers could use either MCPA or 2,4-D amine with essentially the same results. The most critical issue is to apply the herbicide early, around 30 DAS, to well-rooted rice.

Whip provided excellent watergrass and sprangletop control but rice tolerance was marginal. Split applications provided better grass control and less injury to the rice than single higher rates because the split applications provided control of seedlings that emerged following the first application and the lower rates were less injurious to the rice. Applications made when the rice was in the 5-leaf to 1-tiller stage with 70% of the weed foliage exposed provided the best weed control and least rice injury and highest rice yields. Lowering the water to expose the weed foliage was as effective as draining the plot area. Uniform coverage of the rice and weed foliage was critical to minimize rice injury and maximize weed control.

Table 1a. Rice injury and weed control ratings for pretilichlor rates and timing alone and in combination with Londax or Ordram.

				Weed Control[2]										
			Rice injury	HETLI	BARAO	MOOVA		SCPMU		CYPDI		ECHOR		LEFFA
				(date)										
Treatment	Rate	Timing[1]	(6/24)	(6/24)	(6/24)	(6/24)	(7/24)	(6/24)	(7/24)	(7/24)	(6/24)	(7/27)	(10/4)	(7/27)
	ai/A		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Untreated			0	7	10	0	0	0	3	47	7	0	18	60
pretilichlor	0.5 lb	PFS	47	100	100	100	100	100	73	100	95	70	90	100
pretilichlor	1.0 lb	PFS	75	100	100	100	100	100	87	100	83	77	89	100
Londax	1.0 oz	3.3 *l*	0	100	100	100	100	100	100	100	70	50	55	47
Ordram	4.0 lb	3.3 *l*	0	43	93	43	0	30	27	80	67	53	72	80
pretilichlor	0.5 lb	3.3 *l*	3	73	100	27	0	17	17	90	43	30	58	67
pretilichlor	0.75 lb	3.3 *l*	0	56	100	7	33	32	0	90	50	37	48	90
pretilichlor	1.0 lb	3.3 *l*	3	90	100	60	0	48	30	80	53	30	55	93
pretilichlor	2.0 lb	3.3 *l*	3	81	100	62	33	88	72	97	77	67	82	100
pretilichlor + Londax	0.5 lb + 1	3.3 *l*	3	100	100	97	100	100	100	100	80	60	75	60
pretilichlor + Londax	1.0 lb + 1	3.3 *l*	0	96	100	97	100	100	97	100	85	57	80	73
pretilichlor + Ordram	0.5 lb + 4	3.3 *l*	0	75	100	53	33	93	70	97	95	87	95	95
pretilichlor + Ordram	1.0 lb + 4	3.3 *l*	0	90	100	92	0	90	47	100	88	73	90	100
Ordram + Londax	4.0 lb + 1	3.3 *l*	8	100	100	100	100	100	98	100	92	85	99	97
pretilichlor	0.5 lb	4.8 *l*	0	47	70	30	33	10	20	63	27	10	37	67
pretilichlor	1.0 lb	4.8 *l*	0	33	37	13	0	0	7	63	20	3	32	53
pretilichlor + Londax	0.5 lb + 1	4.8 *l*	7	96	100	100	100	93	100	100	87	60	70	43
pretilichlot + Londax	1.0 lb + 1	4.8 *l*	3	93	100	97	100	96	100	100	87	57	55	47
CV (%)			60.2	18.5	15.5	30.4	53.6	25.8	29.6	12.8	24.9	29.6	28.7	19.4
LSD (0.05)			9	24	23	33	46	28	29	19	28	25	32	24

[1] PFS = preflood surface, *l* = leaf stage sice
[2] HETLI = ducksalad, BARAO = waterhyssop, MOOVA =monochoria, SCPMU = smallflower umbrella sedge, CYPDI = ricefield bulrush, ECHOR = watergrass, LEFFA = sprangletop

Table 1b. Days to 50% heading and rice yields of pretilichlor rates and timing alone and in combination with Londax or Ordram.

Ttreatment	Rate	Timing[1]	Days to 50% heading	Yield at 14% moisture
	(ai/A)		(DAS)[2]	(lb/A)
Untreated			88	4180
pretilichlor	0.5 lb	PFS	86	8680
pretilichlor	1.0 lb	PFS	86	9030
Londax	1.0 oz	3.3 *l*	86	7970
Ordram	4.0 lb	3.3 *l*	84	6650
pretilichlor	0.5 lb	3.3 *l*	87	6450
pretilichlor	0.75 lb	3.3 *l*	87	6250
pretilichlor	1.0 lb	3.3 *l*	87	6560
pretilichlor	2.0 lb	3.3 *l*	84	8450
pretilichlor + Londax	0.5 lb + 1 oz	3.3 *l*	84	7490
pretilichlor + Londax	1.0 lb + 1 oz	3.3 *l*	82	9100
pretilichlor + Ordram	0.5 lb + 4 lb	3.3 *l*	84	9560
pretilichlor + Ordram	1.0 lb + 4 lb	3.3 *l*	83	8457
Ordram + Londax	4.0 lb + 1 oz	3.3 *l*	83	9510
pretilichlor	0.5 lb	4.8 *l*	86	5070
pretilichlor	1.0 lb	4.8 *l*	87	4400
pretilichlor + Londax	0.5 lb + 1 oz	4.8 *l*	85	7779
pretilichlor + Londax	1.0 lb + 1 oz	4.8 *l*	84	6900
CV (%)			2.4	15.4
LSD (0.05)			3	1880

[1] PFS = preflood surface, *l* = leaf stage sice
[2] DAS = days after seeding
There were no significant differences among treatments for Rice height or Rice Lodging.

Table 2. Rice injury, weed control ratings and rice yield for mefenecet rates and timing alone and in combination with Londax.

				Weed Control[2]									
			Rice injury	HETLI	MOOVA		SCPMU		CYPD	ECHOR			Yield at 14%
				(date)									
Ttreatment	Rate	Timing[1]	(6/24)	(6/24)	(6/24)	(7/24)	(6/24)	(7/24)	(7/24)	(6/24)	(7/27)	(10/4)	moisture
	(ai/A)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(lb / acre)
Untreated			0	23	20	0	40	23	90	33	37	42	6410
Londax	1 oz	3.3 *l*	7	100	100	100	100	100	100	92	67	88	9350
mefenecet	0.67 lb	3.3 *l*	0	40	30	0	37	13	77	47	23	40	4990
mefenecet	1.12 lb	3.3 *l*	5	57	40	33	57	20	90	70	37	63	5920
mefenecet + Londax	0.67 lb + 1 oz	3.3 *l*	0	95	97	100	100	100	100	88	63	75	8820
mefenecet + Londax	1.12 lb + 1	3.3 *l*	0	98	100	100	100	100	100	88	70	90	9290
mefenecet	0.67 lb	4.8 *l*	0	50	47	0	57	0	93	56	43	58	6020
mefenecet	1.12 lb	4.8 *l*	0	53	50	0	50	17	97	63	37	53	6460
mefenecet + Londax	0.67 lb + 1 oz	4.8 *l*	0	80	90	100	83	100	100	85	63	72	8450
mefenecet + Londax	1.12 lb + 1 oz	4.8 *l*	0	92	93	100	93	100	100	93	77	73	9060
CV (%)			275	29.2	26.8	34.2	30.5	22.9	69	17.4	20.6	20.6	8.0
LSD (0.05)			6	34	31	31	37	23	11	21	23	23	1020

[1] *l* = leaf stage sice

[2] HETLI = ducksalad, MOOVA =monochoria, SCPMU = smallflower umbrella sedge, CYPDI = ricefield bulrush, ECHOR = WATERGRASS.

There were no significant differences among treatments for weed ratings of BARAO and LEFFA, Days to 50% heading, Rice height, and Rice lodging.

Table 3a . Rice injury and weed control ratings for KIH-6127 applied pre-flood surface alone or in combination with Londax.

					Weed Control[2]				
			Rice injury		ECHOR	LEFFA	SCPMU	CYPDI	MOOVA
						(date)			
	Rate	Timing[1]	(6/11)	(8/4)	(8/4)	(8/4)	(8/4)	(8/4)	(8/4)
	(ai/A)		(%)	(%)	(%)	(%)	(%)	(%)	(%)
KIH-6127	36 g	PFS	0	0	80	60	17	57	00
KIH-6127	48 g	PFS	0	0	73	57	53	50	33
KIH-6127	72 g	PFS	0	0	97	53	60	60	0
KIH-6127	97 g	PFS	0	0	95	70	80	47	0
KIH-6127 + LONDAX	36 g + 1 oz	PFS + *3.3 l*		0	83	50	100	100	100
KIH-6127 + LONDAX	48 g + 1 oz	PFS + *3.3 l*		0	83	57	100	100	100
KIH-6127 + LONDAX	72 g + 1 oz	PFS + *3.3 l*		0	97	70	100	100	100
KIH-6127 + LONDAX	97 g + 1 oz	PFS + *3.3 l*		0	100	77	100	100	100
ORDRAM	4 lb	PFI	0	0	67	90	27	83	0
BOLERO	4 lb	PFS	0	0	87	100	0	100	0
Untreated			0	0	43	80	13	90	0

[1] PFS = pre-flood surface, PFI = pre-flood incorporated *l* = leaf stage rice.
[2] ECHOR = watergrass, LEFFA - sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge, MOOVA = monochoria

Table 3b . Days to 50% heading, rice height, percent lodging and rice yield from KIH-6127 applied pre-flood surface alone and in combination with Londax.

	Rate	Timing[1]	Days to 50% heading	Rice hieght	Lodging	Rice Yield at 14% moisture
	(ai/A)		(DAS)[2]	(cm)	(%)	(lb/A)
KIH-6127	36 g	PFS	84	82	45	6710
KIH-6127	48 g	PFS	83	83	30	8190
KIH-6127	72 g	PFS	83	86	32	8270
KIH-6127	97 g	PFS	82	84	2	8420
KIH-6127 + LONDAX	36 g + 1 oz	PFS + *3.3 l*	83	84	2	9820
KIH-6127 + LONDAX	48 g + 1 oz	PFS + *3.3 l*	83	82	2	10020
KIH-6127 + LONDAX	72 g + 1 oz	PFS + *3.3 l*	82	84	5	9860
KIH-6127 + LONDAX	97 g + 1 oz	PFS + *3.3 l*	82	83	0	10160
ODRAM	4 lb	PFI	84	80	7	6370
BOLERO	4 lb	PFS	86	81	18	5240
Untreated			79	81	15	5070

[1] PFS = pre-flood surface, PPI = pre-flood incorporated, *l* = leaf stage rice
2 DAS = days after seeding

Table 4a. Rice injury and weed control ratings for KIH-6127 applied alone or in combination with Londax at the 5-leaf (1-tiller) growth stage of rice.

			Weed Control[1]					
		Rice injury		ECHOR	LEFFA	SCPMU	CYPDI	MOOVA
					(date)			
	Rate	(7/8)	(7/8)	(8/4)	(8/4)	(8/4)	(8/4)	(8/4)
	(ai/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
KIH-6127	36 g	0	87	77	73	97	100	0
KIH-6127	48 g	0	97	87	77	97	90	0
KIH-6127	72 g	0	100	93	77	100	97	0
KIH-6127	97 g	0	100	97	83	100	100	33
KIH-6127 + LONDAX	36 g + 1 oz	0	100	97	80	100	100	100
KIH-6127 + LONDAX	48 g + 1 oz	0	93	83	67	100	100	100
KIH-6127 + LONDAX	72 g + 1 oz	0	100	87	77	100	97	100
KIH-6127 + LONDAX	97 g + 1 oz	0	100	100	73	70	100	100
ORDRAM	4 lb	0	80	67	87	10	93	0
UNTREATED		0	50	43	80	13	90	0

[1] ECHOR = watergrass, LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge, MOOVA = monochoria.

Table 4b . Days to 50% heading of rice, rice height, percent rice lodged at harvest and rice yield for KIH-6127 when applied alone or in combination with Londax at the 5-leaf (1-tiller) growth stage of rice.

	Rate	Days to 50% heading	Rice height	Lodging	Yield at 14% moisture
	(ai/A)	(DAS)[1]	(cm)	(%)	(lb/A)
KIH-6127	36 g	79	85	8	8540
KIH-6127	48 g	80	85	8	8530
KIH-6127	72 g	80	86	12	9520
KIH-6127	97 g	79	81	0	8420
KIH-6127 + LONDAX	36 g + 1 oz	79	85	25	8780
KIH-6127 + LONDAX	48 g + 1 oz	79	87	7	9130
KIH-6127 + LONDAX	72 g + 1 oz	79	82	0	9550
KIH-6127 + LONDAX	97 g + 1 oz	79	87	0	9140
ORDRAM	4 lb	81	85	3	7310
UNTREATED		79	82	10	6500

[1] DAS = days after seeding

Table 5a. Rice injury and weed control ratings for KIH-2023 applied postemergence alone and in combination with Londax.

			Rice Injury		Weed Control[1]					
					ECHOR		LEFFA	SCPME	CYPDI	MOOVA
	Rate	Timing[2]	(7/8)	(8/4)	(7/8)	(8/4)	(date) (8/4)	(8/4)	(8/4)	(8/4)
	(ai/A)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
KIH-2023	8 g	*5 l*	10	0	93	80	73	97	100	0
KIH-2023	12 g	*5 l*	10	0	87	70	67	93	97	0
KIH-2023	16 g	*5 l*	17	0	93	77	60	97	100	0
KIH-2023	24 g	*5 l*	20	0	97	83	63	100	100	0
Londax + KIH-2023	1 oz + 8 g	*3.3 l + 5 l*	10	0	87	80	73	100	100	100
Londax + KIH-2023	1 oz + 12 g	*3.3 l + 5 l*	13	0	93	83	73	100	100	100
Londax + KIH-2023	1 oz + 16 g	*3.3 l + 5 l*	20	0	87	77	70	100	100	100
Londax + KIH-2023	1 oz + 24 g	*3.3 l + 5 l*	20	0	100	97	73	100	100	100
Londax + KIH-2023	1 oz + 8 g	*3.3 l + 6 l w*	-	0	-	80	82	100	100	100
Londax + KIH-2023	1 oz + 12 g	*3.3 l + 6 l w*	-	0	-	77	73	100	100	100
Londax + KIH-2023	1 oz + 16 g	*3.3 l + 6 l w*	-	0	-	87	73	100	100	100
Londax + KIH-2023	1 oz + 24 g	*3.3 l + 6 l w*	-	0	-	77	70	100	100	100
Bolero 10G	4 lb	*3.3 l*	7	0	63	37	87	57	97	0
Londax + Ordram 10G	28 + 4 lb	*3.3 l*	0	0	77	50	82	100	100	67
Untreated			0	0	20	7	67	40	80	0

[1] ECHOR = watergrass, LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge
[2] *l* = leaf stage rice, *l w* = leaf stage watergrass

Table 5b. Days to 50% heading of rice, rice height, percent lodging and rice yield of KIH-2023 applied postemergence alone and in combination with Londax.

	Rate	Timing [1]	Days to 50% heading	Rice height	Lodging	Yield at 14% moisture
	(ai /A)		(DAS)[2]	(cm)	(%)	(lb/A)
KIH-2023	8 g	*5 l*	81	82	2	9380
KIH-2023	12 g	*5 l*	84	80	0	8200
KIH-2023	16 g	*5 l*	85	82	3	8240
KIH-2023	24 g	*5 l*	83	82	0	8490
Londax + KIH-2023	1 oz + 8g	*3.3 l + 5 l*	81	84	10	8870
Londax + KIH-2023	1 oz + 12g	*3.3 l + 5 l*	81	82	0	8740
Londax + KIH-2023	1 oz + 16g	*3.3 l + 5 l*	83	84	0	9010
Londax + KIH-2023	1 oz + 24g	*3.3 l + 5 l*	80	81	0	9430
Londax + KIH-2023	i oz + 8g	*3.3 l + 6 l w*	82	83	7	7930
Londax + KIH-2023	1 oz + 12g	*3.3 l + 6 l w*	82	85	2	8150
Londax + KIH-2023	1 oz + 16g	*3.3 l + 6 l w*	80	84	0	7990
Londax + KIH-2023	1 oz + 24g	*3.3 l + 6 l w*	82	82	0	7620
Bolero 10G	4 lb	*3.3 l*	86	78	35	5670
Londax+ Ordram 10G	1 oz + 4 lb	*3.3 l*	84	80	2	7580
Untreated			84	82	7	6220

[1] *l* = leaf stage rice, *l w* = leaf stage watergrass
[2] DAS = days after seeding

Table 6a. Weed control and rice injury evaluation for F-6285 alone and F-8426 alone or in combination with X-77, Ordram, Londax or Whip applied to rice 35 days after seeding.

		Rice injury		Weed Control[1]				
				ECHOR	LEFFA	SCPMU	CYPDI	MOOVA
	Rate	(7/15)	(8/4)	(8/4)	(date) (8/4)	(8/4)	(8/4)	(8/4)
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
F8426	0.015	0	0	15	80	60	95	90
F8426 + X-77	0.015 + 0.25%	10	0	55	95	60	95	50
F8426	0.031	05	0	35	85	40	95	70
F8426 + X-77	0.031 + 0.25%	13	05	15	75	95	90	90
F8426	0.063	08	03	55	70	75	95	70
F8426 + X-77	0.063 + 0.25%	20	05	30	90	90	100	100
F8426	0.12	05	0.5	60	80	75	100	75
F8426 + X-77	0.12 + 0.25%	23	08	50	75	95	100	95
F8426 + Ordram	0.031 + 4.0	05	0	85	90	70	100	100
F8426 + Londax	0.031 + 0.063	0	0	85	70	90	100	90
F8426 + Whip	0.031 + 0.067	13	03	85	75	85	100	85
Whip	0.067	05	0	85	75	35	100	65
F6285	0.25	0	0	40	90	55	90	25
F6285	0.5	03	0	35	65	50	75	65
F6285	1.0	03	0	55	75	55	70	90
Untreated		0	0	20	95	35	95	40

[1] ECHOR = watergrass, LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge, MOOVA = monochoria

Table 6b. Evaluation of F-6285 alone and F-8426 alone or in combination with X-77, Ordram, Londax or Whip applied to rice 35 days after seeding.

	Rate	Days to 50% heading	Rice height	Lodging	Yield @ 14% moisture
	(lb ai/A)	(DAS)[1]	(cm)	(%)	(lb/A)
F8426	0.015	85	90	30	4490
F8426 + X-77	0.015 + 0.25%	82	87	50	6260
F8426	0.031	84	82	5	5710
F8426 + X-77	0.031 + 0.25%	85	85	33	3800
F8426	0.063	83	88	25	5990
F8426 + X-77	0.063 + 0.25%	84	87	75	3810
F8426	0.12	80	87	10	6610
F8426 + X-77	0.12 + 0.25%	86	82	48	3200
F8426 + Ordram	0.031 + 4.0	83	84	8	5650
F8426 + Londax	0.031 + 0.063	82	91	3	6650
F8426 + Whip	0.031 + 0.067	85	87	85	3940
Whip	0.067	84	87	18	5890
F6285	0.25	82	87	5	6000
F6285	0.5	86	87	15	5830
F6285	1.0	82	85	28	5160
Untreated		83	88	20	4550

[1] DAS = days after seeding

Table 7a. Evaluation of HI-DEP, Solution, MCPA, or 2,4-D for rice injury and weed control when applied to rice 35 days after seeding.

				Weed Control[1]			
				SCPMU		MOOVA	
	Rate	Rice root injury	Rice shoot injury	(date) (7/18)	(9/13)	(7/18)	(9/13)
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)
HI-DEP (2,4-D)	0.75	17	0	53	100	100	98
HI-DEP (2,4-D)	1.00	20	0	70	100	100	100
HI-DEP (2,4-D)	1.50	23	0	83	100	100	100
MCP Amine	0.75	10	0	83	100	100	100
MCP Amine	1.00	17	0	77	100	100	100
MCP Amine	1.50	23	0	73	100	100	100
2.4-D Amine	0.75	10	0	77	100	100	100
2,4-D Amine	1.00	23	0	70	100	100	100
2,4-D Amine	1.50	27	0	83	100	100	100
Solution (2,4-D)	0.75	13	0		100	100	100
Solution (2,4-D)	1.5	07	0		100	100	100
Untreated	-	0	0	03	07	0	23

[1] SCPMU = ricefield bulrush, MOOVA = monochoria

Table 7b. Days to 50% heading, rice height, percent lodged rice and rice yield for HI-DEP, Solution, MCPA, or 2,4-D when applied to rice 35 days after seeding.

	Rate	Days to 50% heading	Rice height	Lodging	Yield at 14% moisture
	(lb ai/A)	(DAS)[1]	(cm)	(%)	(lb/A)
HI-DEP (2,4-D)	0.75	87	67	0	5990
HI-DEP (2,4-D)	1.00	87	71	0	6270
HI-DEP (2-4,D)	1.50	83	68	0	5710
MCP Amine	0.75	87	69	0	6960
MCP Amine	1.00	87	69	0	6910
MCP Amine	1.50	86	73	0	6540
2.4-D Amine	0.75	86	71	0	6500
2,4-D Amine	1.00	84	69	0	6150
2,4-D Amine	1.50	84	70	0	6060
Solution (2,4-D)	0.75	86	77	0	6420
Solution (2,4-D)	1.50	85	75	0	5740
UNTREATED	-	85	73	0	5700

[1] DAS = days after seeding

Table 8a. Evaluation of HI-DEP, Solution, MCPA, or 2,4-D for rice injury and weed control when applied to rice 47 days after seeding.

				Weed Control[1]			
				SCUMU		MOOVA	
	Rate	Root injury	Shoot injury	(date) (7/14)	(9/13)	(7/14)	(9/13)
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)
HI-DEP (2,4-D)	0.75	10	0	37	85	80	100
HI-DEP (2,4-D)	1.00	10	0	47	83	83	100
HI-DEP (2,4-d)	1.50	13	0	60	90	90	100
MCP Amine	0.75	10	0	43	83	73	100
MCP Amine	1.00	10	0	50	90	80	100
MCP Amine	1.50	10	0	53	95	87	100
2.4-D Amine	0.75	10	0	43	90	73	100
2,4-D Amine	1.00	10	0	53	93	87	100
2,4-D Amine	1.50	17	0	53	92	87	100
Solution (2,4-D)	0.75	13	0	63	80	100	100
Solution (2,4-D)	1.50	10	0	47	87	100	100
Untreated	-	0	0	3	7	0	23

[1]SCPMU = ricefield bulrush, MOOVA = monochoria

Table 8b. Days to 50% heading, rice height, percent lodging and rice yield for HI-DEP, Solution, MCPA, or 2,4-D when applied to rice 47 days after seeding.

	Rate	Days to 50% heading	Rice height	Lodging	Yield at 14% moisture
	(lb ai/A)	(DAS)[1]	(cm)	(%)	(lb/A)
HI-DEP (2,4-D)	0.75	87	72	0	5830
HI-DEP (2,4-D)	1.00	83	74	0	5700
HI-DEP (2,4-D)	1.50	87	75	0	5700
MCP Amine	0.75	87	73	0	6520
MCP Amine	1.00	87	74	0	6260
MCP Amine	1.50	87	76	0	5610
2.4-D Amine	0.75	87	75	0	5690
2,4-D Amine	1.00	87	74	0	6000
2,4-D Amine	1.50	84	72	0	5360
Solution (2,4-D)	0.75	87	75	0	5840
Solution (2,4-D)	1.50	85	73	0	5180
Untreated	-	85	73	0	5700

[1]DAS = Days after seeding.

Table 9a. Influence of water management and rate of Grandstand on rice injury and weed control when applied at 5-leaf growth stage of rice.

				Weed Control[1]				
				CYPDI	SCPMU		MOOVA	
					(date)			
	Rate	Water depth	Rice injury	(8/4)	(8/4)	(9/13)	(8/4)	(9/13)
	(lb ai/A)	(inches)	(%)	(%)	(%)	(%)	(%)	(%)
Grandstand + X-77	0.50 + 0.25%	0	3	98	100	100	90	100
Grandstand + X-77	0.75 + 0.25%	0	3	100	100	98	98	100
Grandstand + X-77	1.0 + 0.25%	0	0	98	100	100	100	100
MCP Amine	1.0	0	10	100	100	100	100	100
2,4-D Amine	1.0	0	0	100	98	100	100	100
Grandstand + X-77	0.50 + 0.25%	2	3	97	97	93	67	87
Grandstand + X-77	0.75 + 0.25%	2	7	100	90	93	73	90
Grandstand + X-77	1.0 + 0.25%	2	3	100	98	97	88	97
MCP Amine	1.0	2	2	100	90	93	88	95
2,4-D Amine	1.0	2	0	100	98	100	85	100
Untreated		2	0	77	33	0	70	50

[2] CYPDI = smallflower umbrella sedge, SCPMU = ricefield bulrush, MOOVA = monochoria

Table 9b. Influence of water management and rate of Grandstand on days to rice heading, rice height and rice yield.

	Rate	Water depth	Days to 50% heading	Rice height	Yield at 14% moisture
	(lb ai/A)	(inches)	(DAS)[1]	(cm)	(lb/A)
Grandstand + X-77	0.50 + 0.25%	0	85	71	5950
Grandstand + X-77	0.75 + 0.25%	0	86	69	5360
Grandstand + X-77	1.0 + 0.25%	0	86	68	4770
MCP Amine	1.0	0	87	75	5040
2,4-D Amine	1.0	0	87	71	6130
Grandstand + X-77	0.50 + 0.25%	2	87	67	3870
Grandstand + X-77	0.75 + 0.25%	2	87	74	4420
Grandstand + X-77	1.0 + 0.25%	2	87	73	3880
MCP Amine	1.0	2	86	73	5210
2,4-D Amine	1.0	2	89	73	4270
Untreated		0	87	73	6650

[1] Days after seeding

Table 10a. Timing of reflood after Grandstand application to 1 tiller rice on rice injury and weed control.

				Weed Control[2]				
				CYPDI	SCPMU		MOOVA	
						(date)		
		Reflood[1]	Rice injury	(8/4)	(8/4)	(9/13)	(8/4)	(9/13)
	(lb ai/A)	(days)	(%)	(%)	(%)	(%)	(%)	(%)
Grandstand + X-77	0.75 + 0.25%	1	7	97	100	100	98	100
Grandstand + X-77	0.75 + 0.25%	2	13	98	100	100	98	100
Grandstand + X-77	0.75 + 0.25%	3	0	100	100	100	97	100
MCP Amine	0.75	1	7	100	98	97	100	100
2,4-D Amine	0.75	1	3	100	100	100	100	100
Untreated	-	1	0	77	33	0	70	50

[1] Days after treatment to reflooding
[2] CYPDI = smallflower umbrella sedge,SCPMU = ricefield bulrush, MOOVA = monochoria

Table 10b. Effect of timing of reflood after Grandstand application to 1 tiller rice on days to 50% heading, rice height and rice yield.

	Rate	Reflood[1]	Days to 50% heading	Rice height	Yield at 14% moisture
	(lb ai/A)	(days)	(DAS)[2]	(cm)	(lb / acre)
Grandstand + X-77	0.75 + 0.25%	1	86	72	5960
Grandstand + X-77	0.75 + 0.25%	2	87	67	5350
Grandstand + X-77	0.75 + 0.25%	3	87	70	6370
MCP Amine	0.75	1	86	72	7180
2,4-D Amine	0.75	1	85	74	6130
Untreated	-	1	87	73	6650

[1] Days from treating to reflooding.
[2] Days after seeding

Table 11a. Grandstand in combination with Abolish, Londax, Whip and Pretichlor on weed control and rice injury when applied to 5-leaf or 1-tiller rice.

					Weed Control[2]							
					ECHOR		LEFFA	CYPDI	SCPMU		MOOVA	
	Rate	Timing [1]	Water depth	Rice injury	(8/4)	(9/13)	(8/4)	(8/4)	(date) (8/4)	(9/13)	(8/4)	(9/13)
	(lb ai/A)		(inches)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Grandstand + X-77 + Abolish	0.5 + 0.25% + 4.0	*5 l*	0	0	57	40	90	100	100	100	97	100
Grandstand + X-77 + Abolish	1.0 + 0.25% + 4.0	*5 l*	0	3	47	27	97	98	100	100	97	100
Grandstand + X-77 + Londax	0.75 + 0.25% + 1 oz	*5 l*	2	3	40	33	70	97	100	100	93	100
Grandstand + X-77 + Whip	0.5 + 0.25% + 0.125	*1 t*	4	3	78	67	97	93	100	97	67	100
Grandstand + X-77 + Whip	0.75 + 0.25% + 0.125	*1 t*	4	3	83	77	93	98	97	100	87	100
Grandstand + X-77 + Whip	1.0 + 0.25% + 0.125	*1 t*	4	10	70	73	97	100	98	100	100	100
Grandstand + X-77 + pretilichlor	0.75 + 0.25% + 0.75	*1 t*	4	10	47	0	87	100	100	100	97	100
control	-		2	0	37	-	60	77	33	0	70	50

[1] *l* = leaf stage rice, *t* = rice tillers

[2] ECHOR = watergrass, LEFFA = sprangletop, CYPDI = smallflower unbrella sedge, SCPMU = ricefield bulrush, MOOVA = monochoria

Table 11b. Days to 50% heading, rice height, and rice yields for Grandstand in combination with Abolish, Londax, Whip or Pretichlor when applied at the 5-leaf to 1-tiller rice.

	Rate	Timing[1]	Water depth	Days to 50% hesding	Rice height	Yield at 14% moisture
	(lb ai/A)		(inches)	(DAS)[2]	(cm)	(lb/A)
Grandstand + X-77 + Abolish	0.5 + 0.25% + 4.0	*5 l*	0	82	77	7260
Grandstand + X-77 + Abolish	1.0 + 0.25% + 4.0	*5 l*	0	83	83	6080
Grandstand + X-77 + Londax	0.75 + 0.25% + 1 oz	*5 l*	2	87	70	4160
Grandstand + X-77 + Whip	0.5 + 0.25% + 0.125	*1 t*	4	81	77	6630
Grandstand + X-77 + Whip	0.75 + 0.25% + 0.125	*1 t*	4	79	77	6840
Grandstand + X-77 + Whip	1.0 + 0.25% + 0.125	*1 t*	4	82	78	6630
Grandstand + X-77 + pretilichlor	0.75 + 0.25& + 0.75	*1 t*	4	84	83	581
Untreated	-		2	87	73	6650

[1] *l* = leaf stage rice, *t* = rice tillers
[2] DAS = days after seeding

Table 12a. Whip 1EC or Whip 360 timing and rate on grass control in rice.

					Weed Control[1]			
					ECHOR		LEFFA	
			Rice injury		(date)			
	Rate	Timing[2]	(7/8)	(7/27)	(7/8)	(7/27)	(7/8)	(7/27)
	(lb ai/A)		(%)	(%)	(%)	(%)	(%)	(%)
Whip 1EC + Whip 1EC	0.1 + 0.1	*1 t* + *3 t*	10	05	88	84	94	89
Whip 1EC + Whip 1EC	0.1 + 0.15	*1 t* + *3 t*	10	03	82	80	100	96
Whip 360 + Whip 360	0.042 + 0.042	*1 t* + *3 t r*	05	08	90	89	98	93
Whip 360 + Whip 360	0.042 + 0.059	*1 t* + *3 t*	0	03	88	79	98	99
Whip 1EC	0.125	*1 t*	25	0	94	53	100	95
Whip 360	0.050	*1 t*	18	03	100	63	100	86
Whip 1EC	0.15	*3 t*	-	03	-	78	-	90
Whip 360	0.059	*3 t*	-	05	-	93	-	98
Untreated	-	-	0	0	0	23	05	50

[1] ECHOR = watergass, LEFFA = sprangletop
[2] *t* = rice tiller

Table 12b. Whip 1EC or Whip 360 timing and rate on days to 50% heading of rice, rice height, percent lodged rice at harvest and rice yield.

	Rate	Timing[1]	Days to 50% heading	Rice height	Lodging	Yield @ 14% moisture
	(lb ai/A)		(DAS)[2]	(cm)	(%)	(lb/A)
Whip 1EC + Whip 1EC	0.1 + 0.1	*1 t* + *3 t*	82	86	4	9140
Whip 1EC + Whip 1EC	0.1 + 0.15	*1 t* + *3 t*	81	83	10	9230
Whip 360 + Whip 360	0.042 + 0.042	*1 t* + *3 t*	82	84	2	8620
Whip 360 + Whip 360	0.042 + 0.059	*1 t* + *3 t*	81	85	2	8940
Whip 1EC	0.125	*1 t*	84	88	24	7430
Whip 360	0.050	*1 t*	83	86	2	9040
Whip 1EC	0.15	*3 t*	81	82	0	7310
Whip 360	0.059	*3 t*	80	80	3	8630
Untreated	-	-	85	87	20	6220

[1] *t* = rice tiller
[2] DAS = days after seeding

Table 13a. Evaluation of preflood applications of Abolish 8E, Bolero 10G, Ordram 8E or Ordram 10G alone or in combination with Londax.

				Weed Control[1]				
				ECHOR		LEFFA	SCPMU	CYPDI
			Rice injury			(date)		
	Rate	Timing[2]	(6/20)	(6/20)	(7/14)	(7/14)	(7/14)	(7/14)
	(lb ai/A)		(%)	(%)	(%)	(%)	(%)	(%)
Ordram 8E	4.0	PFI	0	83	73	70	50	80
Ordram 8E	5.0	PFI	0	97	90	70	67	87
Ordram 8E + Londax	4.0 + 1 oz	PFI	0	100	93	73	100	100
Ordram 8E + Londax	5.0 + 1 oz	PFI	0	100	100	80	100	100
Ordram 8E + Londax	4.0 + 1 oz	PFI *+ 2 l*	0	93	83	77	100	100
Ordram 8E + Londax	5.0 + 1 oz	PFI *+ 2 l*	0	100	97	80	100	100
Abolish	4.0	PFS	13	93	90	100	63	100
Abolish + Londax	4.0 + 1 oz	PFS	17	100	97	100	100	100
Abolish + Londax	4.0 + 1 oz	PFS *+ 2 l*	13	97	97	100	100	100
Londax	1 0z	PFS	5	77	63	67	97	100
Londax	1 oz	*2 l*	0	73	63	70	100	100
Ordram 10G	4.0	PFI	0	97	87	70	63	77
Ordram 10G + Londax	4.0 + 1 oz	PFI	0	100	90	83	100	100
Ordram 10G + Londax	4.0 + 1 oz	PFI *+ 2 l*	0	100	93	87	100	100
Bolero 10G	4.0	PFS	5	93	80	100	23	97
Bolero 10G + Londax	4.0 + 1 oz	PFS	13	100	93	100	100	100
Bolero 10G + Londax	4.0 + 1 oz	PFS *+ 2 l*	8	100	97	100	100	100
Untreated	-		0	20	0	67	17	70

[1] ECHOR = watergrass. LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umprella sedge
[2] PFI = preflood incorporated, PFS = preflood surface. *l* = leaf stage rice.

Table 13b. Days to 50% heading, rice height, percent lodging and rice yield for preflood applications of Abolish 8E, Bolero 10G, Ordram 8E or Ordram 10G alone or in combination with Londax.

	Rate	Timing[1]	Days to 50% heading	Rice height	Lodging	Yeild at 14% moisture
	(lb ai/A)		(DAS)[2]	(cm)	(%)	(lb/A)
Ordram 8E	4.0	PFI	86	86	27	3420
Ordram 8E	5.0	PFI	83	85	17	5020
Ordram 8E + Londax	4.0 + 1 oz	PFI	83	84	3	6490
Ordram 8E + Londax	5.0 + 1 oz	PFI	83	85	0	7010
Ordram 8E + Londax	4.0 + 1 oz	PFI + *2 l*	83	80	3	5910
Ordram 8E + Londax	5.0 + 1 oz	PFI + *2 l*	82	85	3	6720
Abolish	4.0	PFS	83	87	37	5670
Abolish + Londax	4.0 + 1 oz	PFS	83	87	0	8350
Abolish + Londax	4.0 + 1 oz	PFS + *2 l*	83	86	0	7760
Londax	1 oz	PFS	84	82	38	5450
Londax	1 oz	*2 l*	83	85	53	5000
Ordram 10G	4.0	PFI	83	85	0	5440
Ordram 10G + Londax	4.0 + 1 oz	PFI	84	83	0	7910
Ordram 10G+ Londax	4.0 + 1 oz	PFI + *2 l*	83	84	0	6090
Bolero 10G	4.0	PFS	83	83	20	5040
Bolero 10G + Londax	4.0 + 1 oz	PFS	84	84	0	7970
Bolero 10G + Londax	4.0 + 1 oz	PFS + *2 l*	84	89	3	7260
Untreated	-		83	86	43	4420

[1] PFI = preflood incoroprated, PFS = preflood surface, *l* = leaf stage rice
[2] DAS = days after seeding

Table 14a. Evaluation of Abolish 8E, Bolero 10G, Ordram 8E or Ordram 10G alone or in combination with Londax applied at 2-leaf stage rice.

			Weed control[1]				
			ECHOR		LEFFA	SCPMU	CYPDI
		Rice injury	(date)				
	Rate	(6/20)	(6/20)	(7/14)	(7/14)	(7/14)	(7/14)
	(lb ai/A)	(%)	(%)	(%)	(%)	(%)	(%)
Ordram 10G	4.0	0	97	83	80	57	87
Ordram 10G + Londax	4.0 + 1 oz	0	100	93	87	100	100
Bolero 10G	4.0	0	100	93	100	43	100
Bolero 10G + Londax	4.0 + 1 oz	0	100	97	100	100	100
Ordram 8E	4.0	0	83	77	77	43	80
Ordram 8E + Londax	4.0 + 1 oz	0	93	90	80	100	100
Abolish 8E	4.0	0	87	80	100	37	100
Abolish 8E + Londax	4.0 + 1 oz	0	93	87	100	100	100
Londax	1 oz	0	70	53	73	100	100
Untreated	-	0	23	0	73	27	90

[1] ECHOR = watergrass, LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge

Table 14b. Days to 50% heading, rice height, percent lodging, and rice yield for Abolish 8E, Bolero 10G, Ordram 8E or Ordram 10G alone or in combination with Londax applied at the 2-leaf stage rice.

	Rate	Days to 50% heading	Rice height	Lodging	Yield at 14% moisture
	(lb ai/A)	(DAS)[1]	(cm)	(%)	(lb /A)
Ordram 10G	4.0	83	83	10	4700
Ordram 10G + Londax	4.0 + 1 oz	83	83	0	7630
Bolero 10G	4.0	85	86	83	2700
Bolero 10G + Londax	4.0 + 1 oz	83	81	20	5490
Ordram 8E	4.0	82	90	0	5940
Ordram 8E + Londax	4.0 + 1 oz	82	80	0	6730
Abolish 8E	4.0	85	87	53	3120
Abolish 8E + londax	4.0 + 1 oz	84	81	25	5760
Londax	1 oz	84	83	27	5970
Untreated	-	87	79	83	2600

[1] DAS = days after seeding

Table 15a. Evaluation of Abolish, Bolero, Ordram 10G, Ordram 8E, Goal or F-6285 alone, or in combination with Londax or Grandstand + X-77 on rice injury and weed control when applied to drained rice in the 2.5- to 3-leaf stage.

				Weed Control[1]				
				ECHOR		LEFFA	SCPMU	CYPDI
			Rice injury			(date)		
	Rate		(6/20)	(6/20)	(7/14)	(7/14)	(7/14)	(7/14)
	(lb ai/A)		(%)	(%)	(%)	(%)	(%)	(%)
Abolish 8E	4.0		13	70	43	90	37	83
Bolero 10G	4.0		0	56	13	87	80	90
Abolish 8E + Londax	4.0 + 1 oz		10	73	40	93	100	100
Abolish 8E + Londax	4.0 + 1 oz	Tank mix	10	77	37	97	100	100
Bolero 10G + Londax	4.0 + 1 oz		0	76	37	87	100	100
Ordram 8E	4.0		0	50	33	87	80	77
Ordram 10G	4.0		0	83	50	87	70	63
Ordram 8E + Londax	4.0 + 1 oz		8	60	40	80	100	100
Ordram 8E + Londax	4.0 + 1 oz	Tank mix	10	63	43	63	100	100
Ordram 10G + Londax	4.0 + 1 oz		0	80	60	77	100	100
Londax	1 oz		0	53	37	87	100	100
Untreated	-		0	0	0	90	47	77
Abolish 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%		40	67	34	100	100	100
Abolish 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	47	65	50	93	100	100
Ordram 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%		43	57	47	97	100	100
Ordram 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	50	57	27	100	100	100
Londax + Grandstand + X-77	4.0 + 0.75 + 0.25%		43	43	13	83	100	100
Londax + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	47	50	26	93	100	100
Goal	0.5		0	37	27	80	90	100
Goal	1.0		0	53	40	75	40	80
F-6285	0.5		67	80	60	0	10	100
F-6285	1.0			90	80	0	100	100

[1] ECHOR = watergrass, LEFFA = sprangletop, SCPMU = ricefield bulrush, CYPDI = smallflower umbrella sedge.

Table 15b. Days to 50% heading of rice, rice height, percent lodging and rice yield for Abolish, Bolero, Ordram 10G, Ordram 8E, Goal or F-6285 alone, or in combination with Londax or Grandstand + X-77 applied to drained rice in the 2.5- to 3-leaf.

	Rate		Days to 50% heading	Rice height	Lodging	Yield @ 14% moisture
	(lb ai/A)		(DAS)[1]	(cm)	(%)	(lb/A)
Abolish 8E	4.0		85	81	33	4170
Bolero 10G	4.0		87	79	56	3790
Abolish 8E + Londax	4.0 + 1 oz		85	86	0	6100
Abolish 8E+ Londax	4.0 + 1 oz	Tank mix	86	79	0	6120
Bolero 10G + Londax	4.0 + 1 oz		86	87	0	5670
Ordram 8E	4.0		85	84	3	3860
Ordram 10G	4.0		84	79	0	4710
Ordram 8E + Londax	4.0 + 1 oz		83	85	0	6710
Ordram 8E + Londax	4.0 + 1 oz	Tank mix	86	84	0	6590
Ordram 10G + Londax	4.0 + 1 oz		84	87	0	6450
Londax	1 oz		86	84	0	5310
Untreated	-		88	77	47	2660
Abolish 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%		88	83	13	4590
Abolish 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	87	86	43	3620
Ordram 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%		89	86	23	5760
Ordram 8E + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	89	80	20	3940
Londax + Grandstand + X-77	4.0 + 0.75 + 0.25%		88	84	0	3920
Londax + Grandstand + X-77	4.0 + 0.75 + 0.25%	Tank mix	87	81	0	5550
Goal	0.5		83	85	10	4840
Goal	1.0		82	88	5	4630
F-6285	0.5		89	85	45	2120
F-6285	1.0		89	85	0	1160

[1] DAS = days after seeding

Table 16. Control of watergrass and swamp smartweed on rice levees from single or repeat applications of Rodeo plus X-77.

	Rate	Weed Control[1]	
		ECHOR	POLCC
	(lb ai/acre)	(%)	(%)
Rodeo + X-77	2 + 1%	75	70
Rodeo + X-77	4 + 1%	83	80
Rodeo + X-77	2 + 1% 2 + 1%	94	88
Rodeo + X-77	2 + 1% 4 + 1%	92	90
Rodeo + X-77	4 + 1% 2 + 1%	95	87
Rodeo + X-77	4 + 1% 4 + 1%	95	89
Control		0	0

[1] ECHOR = watergrass, POLCC = swamp smartweed

Table 17a. Herbicide Resistance in California Rice 1992-1994[1].

	Weed Species[2]					
	SAGMO	CYPDI	SCPMU	AMMAU/ AMMCO	BAORO	TOTAL
1992	2	2	0	0	0	4
1993	51	15	5	1	1	73
1994	2045	1096	472	1140	0	4753

[1] 1992 sites confirmed by DuPont lab
1993 sites confirmed by field rating of 2X overspray plots
1994 sites are unconfirmed (BAORO not included on survey)

[2]BAYER CODE conversions
SAGMO = *Sagittaria montevidensis* (California arrowhead)
CYPDI = *Cyperus difformis* (smallflower umbrellaplant)
SCPMU = *Scirpus mucronatus* (ricefield bulrush)
AMMAU/AMMCO = *Ammannia auriculata / Ammannia coccinea* (redstem)
BAORO = *Bacopa spp.* (waterhyssop)

Table 17b. Number of resistant sites of all species.

	Butte	Colusa	Fresno	Glenn	Placer	Sac.	San.J.	Stan.	Sutter	Tehema	Yolo	Yuba	Total
1992	0	0	0	0	0	0	0	0	2	0	0	2	4
1993	14	7	0	9	2	4	1	0	25	0	0	11	73
1994	336	1314	3	519	418	271	56	48	1059	2	109	618	4753

Figure 1: Grass weed density (plants m^{-2})

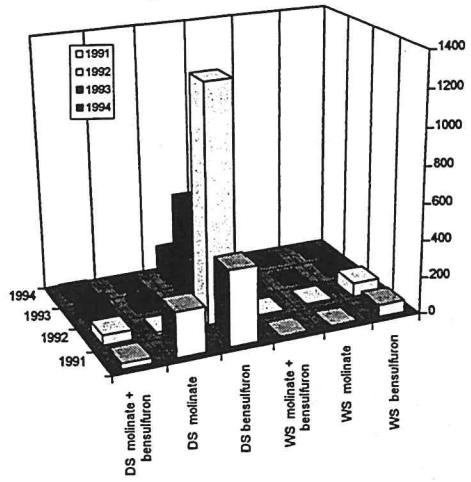


Figure 2: Broadleaf plant density (plants m^{-2})

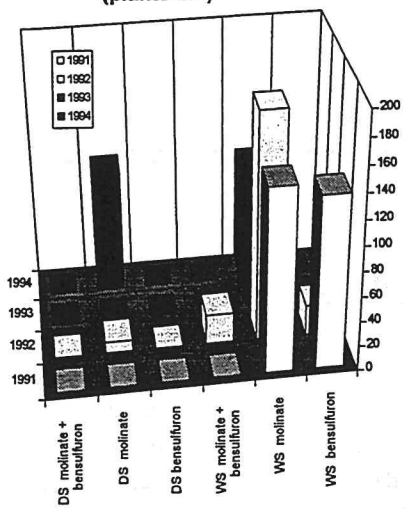


Figure 3: Sedge weed density (plants m^{-2})

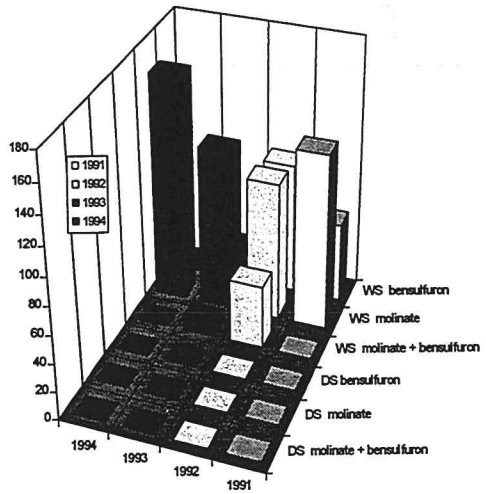


Figure 4: Rice plant density (plants m^{-2})

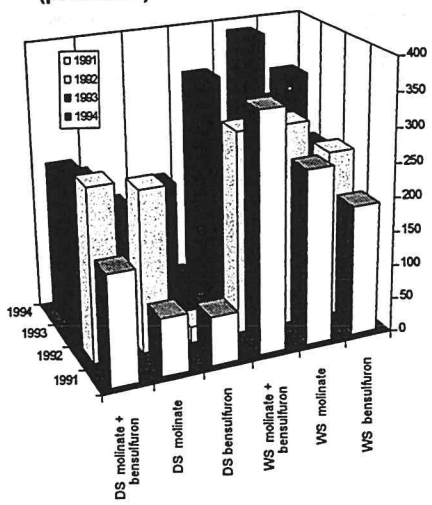


Figure 5: Rice tiller density (tillers m^{-2})

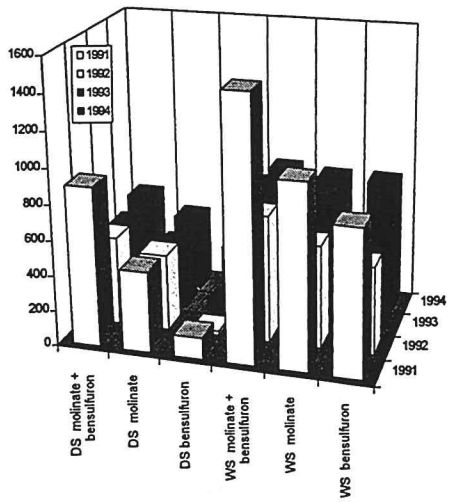
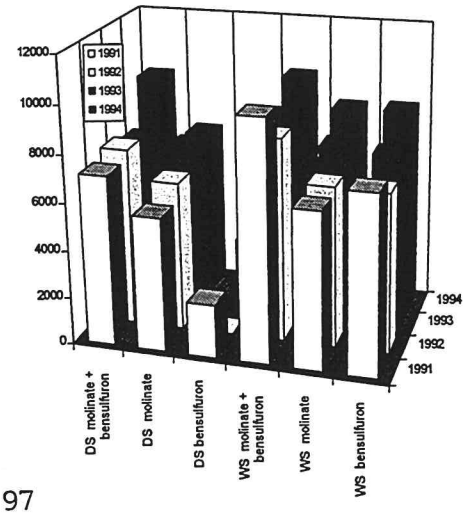


Figure 6: Rice grain yield (kg ha^{-1})



Appendix A

Trade Names and Common Names and Manufacturers of Herbicides.

Trade Name	Common Name	Manufacturer
Abolish	thiobencarb	Valent
Bolero	thiobencarb	Valent
Goal	oxyfluorfen	Rohm and Haas
Grandstand	triclopyr	DowElanco
Londax	bensulfuron	DuPont
Ordram	molinate	DuPont
Sofit	pretilichlor	Ciba Giegy
Whip	fenoxoprop	AgrEvo
(none in U.S.)	mefenecet	Miles