COMPREHENSIVE RICE RESEARCH

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PROJECT TITLE: Weed Control in Rice

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OBJECTIVES OF PROPOSED RESEARCH:

1. To test and screen herbicides for efficacy, safety and compatibility for tank mixtures or sequential treatments in order to develop, in integration with agronomic practices, weed control packages for the main rice production systems in California.

2. To continue searching and testing new compounds with potential for addressing critical weed control issues to establish their suitability and proper fit into the rice management systems of California. Encourage introduction of promising new chemicals to the California market.

3. To develop new alternatives to weed control through the exploration of agronomic opportunities, rice/weed competition to minimize herbicide costs and environmental impacts. To measure rice yield impact of specific weed species and develop a predictive approach.

4. To develop an understanding of herbicide resistance in weeds, provide diagnosis, test herbicides, and develop effective alternatives to manage this problem.

OBJECTIVE 1. *To test and screen herbicides for efficacy, safety and compatibility for tank mixtures or sequential treatments in order to develop, in integration with agronomic practices, weed control packages for the main rice production systems in California.*

Herbicide test plots were located at two different sites at the Rice Experiment Station (RES) in Butte County, one off-station site in Glenn County and one in Yuba County. One of the sites has Londax (bensulfuron-methyl)-resistant smallflower umbrellasedge. The off-station sites have resistant late watergrass as the main weed problem. The site in Glenn County was planted May 26, Yuba County was planted April 29, while planting at the Station occurred May 22 and June 3. Yield data is being presented this season for comparison between treatments, but are likely lower than what would be observed in large scale rice fields. Fertility management is lower in order to prevent lodging and poor harvest conditions with the plot combine.

All sprayed herbicide applications were made with a CO_2-pressurized (30 psi) hand-held sprayer equipped with a ten foot boom and 8002 nozzles, calibrated to apply 20 gallons of spray volume per acre. Applications with solid formulations were performed by evenly broadcasting the product over the plots.

Shark (carfentrazone)

Shark has been tested for several years on station and at off station sites in growers' fields and has demonstrated efficacy for controlling sedges and broadleaves. Because of problems in the past with non-target injury (i.e.- drift onto prunes), emphasis has been oriented towards using this product either in a DDA (direct-dry application) or DSA (direct-stream application). This season, in addition to the standard 1.2mm 40DF formulation, a 0.6mm extruded 40DF formulation and a 2% clay granule were tested. All three formulations were tested as direct-dry applications. The dry application into the water allows reduced potential for non-target drift, and to cover large acreages effectively for early weed control. The new formulations are being tested to determine the most efficacious formulation for dispersion of chemical and therefore control of target weeds. Shark is particularly important to California rice since resistance to Londax (bensulfuron) is widespread. Shark is an effective tool in California rice as it can be applied in combination with other into-water herbicides, and in sequential weed control operations.

Identical trials were set up, one early seeding (April 29, 2005) at a cooperators field and a late seeding (June 23, 2005) at the Rice Experiment Station (Tables 11 & 21). Each trial had Shark application timings of pre-flood surface, prior to weed emergence, 1-2 leaf stage rice, 3-4 leaf stage rice and 1-2 tiller rice. The bulrush population was much greater at the late seeded site than the early site. The lower bulrush population at the early site is partly due to excessive early competition by resistant late watergrass. This watergrass could not

be controlled by Clincher (cyhalofop) herbicide. Ricefield bulrush control was strongly related to its size at the time of application.
Best control was obtained when bulrush was just beginning to emerge from the soil surface. At that point the plant would absorb the chemical directly through the emerged (from Shark dissolved in water) or emerging (from Shark in the soil solution) tissues and perhaps even by root uptake. Thus, seedlings get killed as they emerge and receive light. Germination must have been rather synchronous, since by 60 DAS the control for both seeding dates was still high, suggesting few late emerging cohorts. Weed control at 40 DAS represents the herbicide's efficacy to remove weeds during the critical period of competition.
Consequently, under the cooler temperatures associated with the early seeding, the best application timing was when rice was at the 1-2 leaf stage, but for the late seeded site this timing was too late because bulrush had by then grown up to 0.75" tall and control was only about 50%, under these warmer conditions. At this timing (1-2 lsr) rice may have marginal tolerance to this herbicide. Applications of Shark to rice at the 2 leaf stage or less requires that the rice be well pegged in the soil. When bulrush was 2" tall control at either site was equally poor, of about 50%. Thus, bulrush size at application was key for herbicide effectiveness.
Therefore, Shark should be used as early as possible with bulrush plants well below 1" tall. For safety rice should have no less than 2 leaves and be well pegged. This favorable growth difference between rice and bulrush for achieving safety and maximum control is more likely to occur when rice is seeded early than when seeded late. Warmer temperatures in late seeded rice promote vigorous bulrush growth and emergence rates at a time when rice is still small, thus compromising the safety and control.
The effect of cold water on Shark effectiveness when rice is seeded very early still needs to be addressed.
The early planting was not harvested for yield due to the excessive resistant watergrass that caused lodging of the crop at that site.

Shark applied at the same time as Granite GR provided excellent broad-spectrum control and the second highest yield at the RES continuously flooded trial (Table 4). Shark would control ALS-resistant weeds that could escape Granite and would improve smallflower control. At a resistant watergrass site Shark applied at 2-3 leaf stage rice following a day of seeding (DOS) application of Cerano, provided good broad-spectrum control and the second highest yield for the continuously flooded trial (Table 22).

Prowl H_2O (pendimethalin)

Prowl is a selective herbicide for controlling annual grass (watergrass, barnyardgrass, sprangletop) and certain broadleaf weeds as they germinate and emerge. As a meristematic inhibitor, it interferes with the plant's cellular division and early growth. Prowl H_2O has substituted Prowl EC on the supplemental label for drilled and dry seeded rice in California. Prowl H_2O is a new water based capsule suspension (CS) formulation. Wet/dry cycles cause the capsule wall to rupture and release the pendimethalin. Prowl H_2O needs to be applied to moist soil without any standing water. Flooding causes the chemical to degrade and loose efficacy; also volatility losses are more rapid when this herbicide is applied to wet

soil surfaces. Prowl H_2O was tested in a pinpoint method both at a resistant watergrass site and at the RES. Prowl H_2O was also tested at the RES in a Leather's method trial and a drill seeded trial.

At the resistant site, the best broad-spectrum control and best yield for the pinpoint study was when Prowl H_2O was tank mixed with SuperWham (5-6 lsr) following an application of Cerano (DOS) (Table 3). The second best yield was with a tank mix of Prowl H_2O, Abolish and Regiment (4-5 lsr). A third tank mix with good results was Prowl H_2O plus SuperWham (5-6 lsr). None of these treatments were statistically significant. Prowl is intended to help when reflooding fields is slow allowing watergrass, sprangletop and barnyardgrass plants to emerge. This was not the case in this study due to the inability to keep water off the trial for the length of time to see this impact. Efficacy of these mixtures are probably mainly due to the tank mix partners of Prowl.

Prowl H_2O was tested in a pinpoint system at the RES site (Table 6). Prowl applied alone provided 58% control of watergrass and 36% control of sprangletop while improving yield over the untreated control. The best overall efficacy and yield were obtained with a tank mix of Prowl H_2O plus Regiment (3-5 lsr) followed by a Clincher application (1-3 till). Other good combinations are Prowl H_2O tank mixed with Clincher (3-5 lsr) followed by SuperWham (1-3 till) and Prowl H_2O tank mixed with SuperWham (3-5 lsr) followed by Clincher (1-3 till).

Prowl H_2O was tested for efficacy in a Leather's method trial at the RES (Table 7). Prowl H_2O (1-2 lsr) applied alone provided 66% control of watergrass and 28% control of sprangletop. One of the best overall weed control treatments and best yield was achieved with a tank mix of Prowl H_2O and Clincher (1-2 lsr) followed by a SuperWham application (1-3 till). A tank mix of Prowl H_2O and Clincher (1-2 lsr) followed by Regiment (1-3 till) provided less sedge control and lower yield.

Prowl H_2O was also tested in a drill seeded rice culture at the RES (Table 12). Prowl H_2O applied alone (delayed pre-emergent) provided 72% watergrass control and 92% sprangletop control. Improved control of grasses was achieved with Clincher in tank mix with Prowl H_2O (early post emergent) and improved grass and sedge control was achieved with a tank mix of Prowl H_2O and SuperWham (early post emergent). SuperWham and Clincher in these tank mixes provide control of established grass while the Prowl prevents establishment of germinating grasses. Prowl generally works better in dry/drill seeded aerobic conditions than in water seeded systems. In water seeded conditions Prowl works better when conditions require delayed or slow re-flood.

IR-5878 WG

IR-5878 is an ALS inhibitor that was tested for an eighth season at the RES for broad-spectrum activity at a site with susceptible watergrass and Londax-resistant smallflower umbrellasedge. The field preparation where the IR-5878 trials were run this season was delayed several times by rain events. It is speculated that this contributed to a fast

germination of weeds at the time of flood up for establishment. The precocious weed establishment at this site made control more challenging for all herbicides tested.

IR-5878 WG was tested in a standard pinpoint trial, a pinpoint application following a basin application of Cerano and in a Leather's method trial. The two pinpoint studies had IR-5878 applications at the 3-4 lsr timing (Tables 13 & 15). The control of watergrass was poor in both studies while control was good in 2004 when applied at 2-3 lsr. This suggests that IR-5878 needs to be applied very early for good efficacy on watergrass. Excellent bulrush control was achieved with IR-5878, but control of resistant smallflower umbrellasedge was marginal. There may be tank mix antagonism between IR-5878 and Clincher. Clincher normally controls sprangletop completely. When it is tank mixed with IR-5878 control of sprangletop is reduced to 70%, but when Clincher is applied separately on the same day after IR-5878, control is 98%. Watergrass control in this treatment is lower than would be expected with Clincher suggesting antagonism even when the two compounds are applied separately. Applying Clincher a few days prior to application of IR-5878 would likely eliminate any chance of antagonistic response. A similar effect may be happening with SuperWham. SuperWham normally controls 80% of watergrass when applied at this stage, but when in tank mix with IR-5878 the control is only 48%. Therefore, separate applications would be indicated in this situation also.

IR-5878 improves control of watergrass after a treatment of Cerano. Excellent control of bulrush and partial control of smallflower umbrellasedge is achieved after the initial application of Cerano, which does not control these weeds. Adding SuperWham as a tank mix partner of IR-5878 improves the control of broadleaf and sedge weeds and resulted in the highest yield of the study. Here again, watergrass control was not as high as would be expected from the Super Wham treatment, suggesting a tank mix problem.

IR-5878 did not perform well in the Leather's method experiment most likely due to the timing of the application at the 3-4 lsr (Table 14). The delay in application with this method resulted in a later application than even the pinpoint trials. Watergrass was already at the 1-2 tiller stage, resulting in poor control and low yields. Bulrush control was excellent but this did not translate to any yield advantage.

IR-5878 GR

This is the third season of experimentation with this granular formulation of IR-5878. This herbicide is being tested in a continuous flood system and applications were made into 16x25-ft flooded levee plots (Tables 16 & 17). The best overall weed control and yield was achieved with a treatment of Cerano and IR-5878 applied at 0.5 lsr followed by Clincher (1-3 Till). IR-5878 GR adds watergrass, bulrush and ducksalad control beyond that of Cerano applied alone. Lowering the rate of IR-5878 from 149 to 84 g ai/ha tends to lower the control of bulrush and ducksalad. The best yielding treatment in the program study (Cerano and IR-5878 GR applied at 0.5 lsr with a follow-up of SuperWham at 2-3 Till) was not the best weed control treatment. The best weed control treatment was IR-5878 (0.5 lsr) followed by Granite GR (2-3 lsr) followed by SuperWham (2-3 Till). This treatment had the second best yield in the study, but not statistically different from the highest yielding

treatment. In the trial looking at phytotoxicity there appears to be no apparent impact on rice by IR-5878. One of the best overall weed control treatments was Cerano (0.5 lsr) followed by IR-5878 (1-2 lsr) followed by Clincher (1-3 Till). It was also the best yielding treatment.

Granite GR (penoxsulam) alone and in combinations

Granite GR is an ALS inhibiting post-flood, post-emergence herbicide for selective control of susceptible grass (not active on sprangletop), broadleaf and sedge weeds in California rice. The granular formulation, Granite GR was first available commercially during the 2005 season. This product was applied into the water at 40 g ai/ha 8-9 days after seeding. It was tested alone and in combination with Bolero, Cerano, propanil, Clincher and Shark (Table 9). Most treatments provided good to excellent weed control. Plants at the 3 leaf stage exhibited noticeable root stunting. This effect was short lived and the plants recovered. The best yielding Granite combination was Granite GR (2-3 lsr) followed by Clincher (1-2 Till) followed by Stam (3 Till). Other good treatments were: Bolero (2-3 lsr) followed by Granite GR (2-3 lsr) followed by Stam (3 Till) and Granite GR (2-3 lsr) followed by Stam (5 lsr) followed by Grandstand (3 Till). A separate experiment tested the plant response and yield to label rates and double label rates of Granite GR compared to Cerano, Bolero, and Ordram (Table 10). Injury to the crop was not seen with Granite GR, Bolero or Ordram, while injury was significant with Cerano especially with the double rate. Early root stunting and plant stunting was noted with Granite GR, however doubling rate did not impact yield and yields with Granite 2X were comparable to those of the safest treatment. The Cerano treatments had lower yield than the rest of the treatments. This could be due to the notorious injury (bleaching) observed with Cerano 2X. Granite GR had slightly higher yields than either Bolero or Ordram, although not statistically significant.

Granite SC (penoxsulam) alone and in combinations

Granite SC is a liquid formulation of penoxsulam for foliar application. It is likely to be labeled for California beginning in 2006. It was tested in a pinpoint flood system with flood water dropped for an application at the 3-4 lsr (Table 8). It was applied at two rates (35 & 70g ai/ha) with a separate application of Clincher (3-4 lsr). It was compared to Regiment with separate application of Clincher (all at 3-4 lsr). Granite SC provided excellent broad-spectrum weed control and the highest yields for the study. The 70g rate provided slightly better weed control and yield than the 35g rate, however this may not be cost effective. The root stunting seen with the granular formulation was not noticeable with this formulation.

GWN-3040 (halosulfuron methyl)

Halsulfuron methyl is an ALS inhibitor that has been available for California rice production under the Monsanto trade name Sempra. Gowan chemical will be taking over marketing halsulfuron methyl in California under the trade name Sandia. Halsulfuron methyl is an ALS inhibitor that is used to control broadleaf and sedge weeds in rice. Halsulfuron can be applied directly to flooded rice or applied as a foliar spray in a pinpoint

flood system. When applied in a pinpoint flood system the tank mix with Regiment (1-2 Till) provided the best overall weed control and the best grain yield (Table 19). This mixture is not advisable given that both herbicides have the same mode of action and resistance to ALS inhibitors is widespread in California among sedges and broadleaf weeds. Repeated use of this mixture might even select for ALS resistance in grasses. It also performed well in tank mix with propanil or by itself. Later applications (1-2 Till) did not perform well and had lower yield.

When applied alone in continuously flooded rice, halsulfuron methyl (1-3 lsr) provides good watergrass control and excellent sedge control (Table 20). Better broad-spectrum control and higher yields were achieved when halsulfuron was either tank mixed with Abolish (1-3 lsr) or followed an application of Cerano (0.5 lsr).

WH-105

WH-105 is being tested alone and in combination with Cerano, Abolish, Bolero, Shark, and SuperWham (Table 18). Bulrush and watergrass were problematic in this field due to poor conditions for establishment (multiple rain events during field setup) leading to early growth of grasses and bulrush. Control by most herbicides was mediocre at this site. When applied alone (DOS-0.5 lsr), control of susceptible watergrass was excellent while control of bulrush and ducksalad was poor. The best yielding treatment was a pre-flood application of Abolish followed by an application of Cerano (0.5 lsr) then followed by a treatment of WH-105 (0.5 lsr). Watergrass was completely controlled while bulrush control was 64% and Ducksalad control was 13%. The second best treatment was the same except the Cerano was applied at half the standard rate. Other treatments that were effective for control of watergrass and bulrush were WH-105 (DOS-0.5 lsr) followed by SuperWham (1-3 Till) and WH-105 and Cerano applied at 0.5 leaf stage. Both of these treatments provided excellent watergrass control and good bulrush control. WH-105 was also tested with several other herbicides in combination granules. These granules need further study to determine their efficacy. The advantage of combination granules is the reduction of herbicide applications and reduction of potential drift.

OBJECTIVE 2. *To continue searching and testing new compounds with potential for addressing critical weed control issues to establish their suitability and proper fit into the rice management systems of California. Encourage introduction of promising new chemicals to the California market.*

In recognizing the need for developing herbicides to meet the cultural needs of growers throughout the state, our herbicide testing system was designed around the various types of irrigation schemes that growers use. These include: Continuous flood, pin-point flood, Leather's method and dry/drill seeding with flush irrigation.

Continuous flood system combinations

Continuous flood trials were conducted at the Hamilton Road site at the Rice Experiment Station and at two resistant sites on cooperator grower's land. The Hamilton Road site has

susceptible weed species while the two off station sites have resistant late watergrass. In most cases the applications were sequential comprising an initial application of Cerano, Granite GR, Bolero or Ordram for watergrass control followed by an application of Shark, Londax, Super Wham, or Regiment at various timings (Table 4) to control broadleaves, sedges, and in some cases late-emerging watergrass plants or those missed by the early treatment. Granite GR is a newly available granular herbicide that was tested alongside other standard herbicides used by growers. At the RES, one of the best treatments for weed control was Granite GR (2-3 lsr) followed by Stam (1 Till) (Table 4). This treatment also had the highest yield in this trial. Other good treatments for weed control and descending yield were: Shark (2-3 lsr) followed by Granite GR (2-3 lsr), Cerano (DOS) followed by Granite GR (2-3 lsr), Bolero (1-2 lsr) followed by Shark (2-3 lsr) followed by SuperWham (1-3 Till), and Abolish (PFS) followed by Granite GR (2-3 lsr).

At the Glenn County resistant late watergrass site there was no treatment that controlled the grass completely. The best treatment for weed control was Granite GR (2-3 lsr) followed by SuperWham (1-3 Till) (Table 1). Other good treatments were; Bolero (1-2 lsr) followed by SuperWham (1-3 Till) and Wham 60 DF (1-3 Till) alone. These two treatments provided less control of watergrass and smallflower umbrellasedge than the Granite GR followed by SuperWham. Granite GR tends to stunt the growth of rice by hindering root growth during the period that the chemical is active.

At the Yuba County resistant late watergrass site, control of watergrass was critical for yield of rice. The watergrass at this site is a very early and fast growing selection. The best watergrass control and highest yield was attained with a treatment of Granite GR (2-3 lsr) followed by a tank mix of SuperWham and a low rate of Whip (intended for sprangletop control) (1 Till) (Table 22). The second best treatment was Cerano (DOS) followed by Shark (2-3 lsr). This treatment was also highy efficacious on watergrass. The watergrass at this site appears to be resistant to Abolish and Bolero but was suppressed by Cerano and Granite.

Pin-point flood system combinations

Pin-point flood trials were conducted at the susceptible watergrass site at the RES and at resistant watergrass sites in Glenn County and Yuba County. All trials were drained several days prior to initial application and then re-flooded several days after application. Follow up applications of foliar herbicides requires lowering of water to achieve 70% weed exposure for effective treatment.

Main weeds were late watergrass, ricefield bulrush, smallflower umbrellasedge, sprangletop, and ducksalad. Many of the treatments tested at the susceptible RES site had similar yields (Table 5). The following treatment combinations gave good weed control: tank mix of Clincher, Stam and Granite SC (3-4 lsr); Clincher (3-4 lsr) followed by Granite SC (1-2 Till); Regiment (3-4 lsr) followed by SuperWham (1-2 Till); tank mix of SuperWham and 2,4-D (1-2 Till); Stam (1-2 Till); Wham (1-2 Till).

The best overall treatments at the Glenn County resistant site were: Regiment tank mixed with Abolish (3-4 lsr) followed by SuperWham (1 Till), SuperWham (3-4 lsr) followed by Regiment (1 Till), Clincher (3-4 lsr) followed by SuperWham (1 Till), Regiment (3-4 lsr) applied alone and SuperWham (3-4 lsr) followed by Clincher (1 Till) (Table 2). It appears that early (3-4lsr) applications of SuperWham are missing bulrush probably due to later flushes of this weed.

The best treatment at the Yuba County resistant site was a high rate of Regiment (4-5lsr) followed by a tank mix of SuperWham plus Whip (1-3 Till), although the yield was very low (Table 23). Future testing of the pinpoint method at this site should shift treatment timing to the 3-4 lsr in order enhance suppression of the vigorous watergrass.

Leather's method system

The Leather's method is a system where water seeding is followed by draining most of the initial flood water to encourage faster rice establishment. Final flood water is applied when the rice can sustain the flood. This method leaves the soil surface aerobic for an extended period of time, which allows certain weed species to flourish, especially sprangletop. Foliar herbicides are applied during this exposed period prior to final flood. Prowl H_2O and Granite SC are two new herbicides that were tested in this system. Prowl H_2O is a soil active compound that is effective on germinating weeds but not on established weeds. Granite SC is a foliar active herbicide that is effective on most rice weeds except sprangletop.

The best overall weed control and yield was achieved with a tank mix of Prowl H_2O and Clincher (1-2 lsr) followed by SuperWham (1-3 Till) (Table 7). Clincher provides the initial control of watergrass and sprangletop and Prowl provides the extended control of germinating grasses. SuperWham provides additional late season control of grasses, sedges and broadleaves. Granite SC (1-2 lsr) applied alone provided the second best yield and good control of watergrass, bulrush, smallflower umbrellasedge and ducksalad but poor control of spangletop. Other good treatments include: tank mix of Abolish and SuperWham (1-2 lsr), controlling watergrass, smallflower umbrellasedge and sprangletop and to a lesser extent bulrush and ducksalad; a tank mix of Granite SC and Clincher (1-2 lsr) had lowered control of most weed species as compared to Granite SC alone. The only exception is sprangletop, which was completely controlled by Clincher.

Drill seeded system

Rice seed was drilled into dry ground, then flush-irrigated for establishment. Additional flush irrigations were applied to insure good establishment. Standing water inhibits establishment of the rice that is drilled into the soil. The main weeds in this system were watergrass, ricefield bulrush and sprangletop. Herbicide timing included delayed pre-emergent (DPRE) after the first flush of irrigation, early post emergent (EPE) with rice at the 2-3 lsr, late post-emergent (4-6 lsr), and post permanent flood (PPF) with rice at the 1-2 tiller stage. The best yielding treatment and best broad-spectrum weed control was achieved

with a tank mix of Abolish and Regiment (4-5 lsr), a synergistic mixture on watergrass, followed by Clincher (PPF) (Table 12). Lower rates of Abolish and Regiment maintained high watergrass control, but control of sedges was poor. The second best yielding treatment was Abolish (DPRE) followed by Clincher (5-6 lsr). This treatment controlled a broad-spectrum of weeds except bulrush. Other good broad-spectrum treatments were: tank mix of Abolish and SuperWham (EPE), Shark (5-6 lsr) followed by Clincher (PPF), Clincher (5-6 lsr) followed by SuperWham (PPF), and SuperWham (5-6 lsr) followed by Clincher (PPF). Control of sprangletop is essential to respectable yields in a drill seeded crop; Abolish and Clincher control this weed. Shark (5-6 lsr) followed by either SuperWham or Regiment (PPF) did not control sprangletop and, therefore, had the lowest yields of the experiment.

OBJECTIVE 3. *To develop new alternatives to weed control through the exploration of agronomic opportunities, rice/weed competition to minimize herbicide costs and environmental impacts. To measure rice yield impact of specific weed species and develop a predictive approach.*

HERBICIDE RESISTANCE WEED MANAGEMENT SYSTEMS IN RICE USING ALTERNATIVE STAND ESTABLISHMENT TECHNIQUES

Rationale: Integrating cultural and chemical weed control practices may increase cost efficiency of weed management through the reduction of herbicide resistant weed populations, delayed evolution of herbicide resistance, and timely reduction of weed seed banks. Alternative cultural rice establishment techniques such as drill seeding, stale seedbed, or no-till may be used to manipulate weed species recruitment and expand herbicide options. In drill-seeded rice, pendimethalin (Prowl) may be used for soil residual control of many grass species. In stale seedbed systems, weeds that emerge prior to rice planting may be controlled with non-selective herbicides such as glyphosate (Roundup). These herbicides provide alternative mechanisms of action, may be less expensive, and may be more environmentally benign than some of the herbicides used in conventional water-seeded rice systems. Therefore, a large field experiment was established at the Rice Experiment Station to quantify weed species recruitment and the efficacy of herbicides unique to specific rice establishment systems.

Establishment procedures for each treatment:

1. *Water-seeded, conventional*: Plots were established using conventional California water-seeding procedures that included spring tillage, flooding to a depth of approximately 4 in, and aerial rice seeding within two days of the permanent flood (Table 24). In 2004, plots were planted immediately after levees were completed, but in 2005 planting was delayed to coincide with the stale seedbed treatments. Rice seed (M202) was planted at a rate of 150 lbs per acre.

2. *Drill-seeded, conventional*: Plots were spring tilled and rice seed was planted approximately 0.5 in deep using a 10 ft wide grain drill. Rice seed (M202) was planted at a

rate of 100 lbs per acre. The permanent flood was applied approximately 30 d after planting in each year.

3. *Water-seeded, spring tillage, stale seedbed*: Plots were spring tilled and then flushed with water to induce weed emergence prior to a pre-plant application of glyphosate 2 d before application of the permanent flood and aerial rice seeding. In 2004, flushing included flooding the plots for 1 d before draining, but in 2005 plots remained flooded for 6 d to increase recruitment of aquatic weeds. Heavy rain in 2005 re-saturated the soil approximately 5 d after flushing but prior to application of the permanent flood. Rice seed (M202) was planted at a rate of approximately 150 lbs per acre.

4. *Water-seeded, no tillage, stale seedbed*: Plots were not tilled in the spring or fall in either year. The stale seedbed procedures included flushing in early to mid-May in each year followed by an application of glyphosate 2 d before establishing the permanent flood and aerial rice seeding. Rice seed (M202) was planted at a rate of approximately 150 lbs per acre.

5. *Drill-seeded, no tillage, stale seedbed*: Plots were not tilled in the spring or fall in either year. Plots were flushed in early to mid-May in each year prior to drill seeding. After flushing, at least 8 d was required in each year for the soil to adequately dry to permit planting with the tractor and grain drill. Rice seed (M202) was planted using similar procedures as treatment 2.

Weed recruitment among systems: Rice establishment systems greatly affected weed species recruitment and weed densities in each year. Drill-seeded rice treatments were dominated by grasses whereas water-seeded treatment were dominated by sedge and broadleaf weed species in each year (Table 25). Among water-seeded plots in 2005, smallflower umbrellasedge densities decreased by approximately 50% from the conventional to spring-tilled stale seedbed treatment, but decreased by approximately 90% from the spring-tilled stale seedbed to the no-till stale seedbed treatment. Between the drill-seeded plots, *Echinochloa* densities declined by approximately 85% but sprangletop densities increased 5-fold from the conventional to the no-till stale seedbed treatment. In 2004, one conventional drill-seeded plot contained 160 *Echinochloa* weeds per m^2, which caused 85% rice yield loss in the weedy check area. Across replications, rice yield loss in the weedy checks averaged 14% in the conventional water-seeded plots, 37% in the conventional drill-seeded plots, but less than 5% in each of the stale seedbed plots in 2004.

Since the weedy checks were located in the same area in each year, populations of weed species often increased from 2004 to 2005. Thus, weed populations in Table 2 represent post-emergence weed recruitment associated with each tillage system and potential increases in weed populations between years. In each water-seeded treatment, smallflower umbrellasedge populations increased by approximately 7-fold from 2004 to 2005 and redstem densities increased to 70 plants m^{-2} regardless of the density the previous year. In the drill-seeded treatments, grass weed species increased approximately 2-fold in the conventional and over 10-fold in no-till stale seedbed treatments from 2004 to 2005.

Herbicide applications and weed control: Adequate weed control was achieved with the selected herbicides for each treatment. In the water-seeded treatments 1 and 3, sedge weed

species were controlled (> 90%) with a late-season (3-4 rice tiller) application of propanil (6 lbs./a.i./acre) in 2004 and a tank-mixed application in 2005 of propanil/bensulfuron (6 lbs/a.i./acre, 0.6 oz/a.i./acre, respectively) for added control of greater redstem populations in all water-seeded treatments. No post-emergence herbicide was needed in the water-seeded, no-till, stale seedbed treatment in 2004 as weeds were not present. In the drill-seeded treatments, a tank-mixed application of pendimethalin/cyhalofop-butyl (1 lb./a.i./acre, 0.24 lbs./a.i./acre, respectively) resulted in > 85% control of these grass species. A late-post emergence application of propanil (6 lbs/a.i./acre) was needed for *Echinochloa* escapes in each drill-seeded plot in 2005. Glyphosate (1.2 lbs./a.e./acre) was applied approximately 2 d prior to the application of the permanent flood in each year. Glyphosate used in the stale seedbed systems greatly reduced post rice emergence weed densities in the water and drill-seeded systems.

As in 2004, there were no statistical differences in yield among the different systems. Yields In kg/ha at 14% moisture in 2005 were: *Water-seeded, conventional* 8170, *Drill-seeded, conventional* 8410, *Water-seeded, spring tillage, stale seedbed* 7382, *Water-seeded, no tillage, stale seedbed* 8175, *Drill-seeded, no tillage, stale seedbed* 8292.

Conclusions:

These results suggest that integration of cultural and chemical weed control practices provide additional options for weed management in continuous rice. Drill seeding rice followed by an early post-emergence application of pendimethalin may effectively reduce seed banks of grass species biotypes that are resistant of conventional water-seeded rice herbicides. Adding a stale seedbed component to this system will reduce post-emergence weed pressure in highly infested fields. In water-seeded/stale seedbed systems, eliminating spring tillage greatly reduced populations of sedge weed species. Modeling approaches are being evaluated to identify optimal rotations of these establishment systems for managing problematic weed species and herbicide resistant biotypes.

OBJECTIVE 4. *To develop an understanding of herbicide resistance in weeds, provide diagnosis, test herbicides, and develop effective alternatives to manage this problem.*

Diagnostic and detection of herbicide resistance

A study is being conducted to elucidate the basis for the current distribution of herbicide-resistant *Echinochloa* spp (early and late watergrass, and barnyardgrass) in California rice. Two-hundred and forty seed samples were collected in the fall of 2003 from throughout the rice growing region of the Sacramento Valley. Some grower-submitted samples were included in this group. All seed samples were tested for resistance to Bolero, Ordram, Regiment, Clincher. Because it is known that herbicides tend to be over active in greenhouse conditions, all materials were applied at ½ the standard rate and the standard rate. Bolero was applied at 2240 and 4480 g ai/ha at the 1-2 leaf stage of grass (lsg). Ordram was applied at 2240 and 4480 g ai/ha at the 1-2 lsg. Regiment was applied at 20 and 40 g ai/ha at the 1-3 tiller stage. Clincher was applied at the rates of 63 and 126 g ai/a at the 1-3 tiller stage. Susceptible and resistant controls are included in the test. The

resistance testing was used to select samples that are susceptible, partially resistant and highly resistant. These samples will have further testing and genetic analysis to determine their relatedness. This will allow

Mechanisms and distribution of herbicide resistance in weeds of rice.

We continued our work to characterize different mutations conferring resistance to ALS inhibitors in smallflower umbrellasedge. This is important to clarify the scope of usefulness of the different ALS inhibitors available and those seeking registration. We also continue our research on the dispersion of resistant smallflower biotypes. Clarification of the mechanism of resistance to thiocarbamates (Abolish, Bolero, ordram) is in progress. This is important, since repeated use of these herbicides drove the evolution of herbicide resistance in Echinochloa spp. In California; knowledge of the mechanism allows the design of herbicide use strategies for resistance management. We have elucidated, in collaboration with Dr. R. Tjerdeema's lab, the role of herbicide metabolism in Cerano (clomazone) toxicity to watergrass. This herbicide needs to be degraded to an active metabolite for toxicity and control. This process is inactivated by organophosphate insecticides that normally synergize other herbicides (and result in toxicity to rice). Use of this type of insecticide close to a Cerano treatment will lower its effectiveness on watergrass control (and may lower herbicide toxicity on rice as well). The mechanism of watergrass resistance to Granite (penoxsulam) is being investigated in greenhouse experiments. It is likely that this resistance is mediated by an enhanced degradation ability similar to that observed with resistance to other herbicides.

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CONCISE GENERAL SUMMARY OF RELEVANT RESULTS OF THIS YEAR'S RESEARCH

This year we continued to develop herbicide programs for water-seeded and drill seeded rice. Herbicide efficacy, including new compounds, tank-mix combinations and sequential applications continues to be a major emphasis of the program. We also tested new compounds, including one broad-spectrum herbicide that was available this season. Testing continues on several herbicides that have potential for the California market. This work was conducted at the Rice Experiment Station and on a cooperating grower's property in Glenn and Yuba Counties where highly resistant late watergrass exists. In addition, the program includes experiments that evaluate alternative crop establishment methods as a means of altering weed dynamics and diversifying herbicide options to manage herbicide-resistant weeds in rice. Research also addresses non-chemical options for weed management. Funding for our research program from the California Rice Research Board is expanded with additional funding from other grants.

Herbicide efficacy of currently registered and potential new herbicides has become a more crucial issue in recent years with the development of herbicide resistant weeds. Cerano, (clomazone) a pigment synthesis inhibitor,that has repeatedly demonstrated high efficacy to control barnyardgrass, watergrass (*Echinochloa* spp.) and sprangletop (*Leptochloa*

fascicularis), but has been less effective against herbicide-resistant watergrass. Very good broad-spectrum weed control was obtained with Cerano used in combination with SuperWham (propanil), Regiment (bispyribac-sodium) or Granite GR (penoxsulam). At the resistant site Granite GR followed by SuperWham provided good watergrass control. Shark (carfentrazone) into-the-water was tested at early (April 29) and late (June 3) planting times to determine efficacy against ricefield bulrush. Timing of Shark is dependent on the growth of bulrush at these different planting dates. Early season planting is during cooler weather where bulrush is slow to establish, but bulrush established faster under warmer weather conditions following the later seeding time. Bulrush control diminished drastically as plants grew larger and only 50% control was obtained by the time bulrush reached two inches tall. Therefore, Shark should be used as early as possible with bulrush plants well below 1" tall. For safety rice should have no less than 2 leaves and be well pegged. IR-5878 is a granular sulfamoylurea (ALS inhibitor) that worked well in continuously flooded systems in broad-spectrum programs involving Cerano, Super Wham or Clincher. The foliar formulation of IR-5878 did not perform as well in the pinpoint flood trial as the granular did in the continuously flooded trial.Granite GR (penoxsulam) is an ALS inhibiting post-flood herbicide for selective broad-spectrum control (not active on sprangletop and weak on resistant late watergrass). This formulation was available for use in 2005 and the SC foliar formulation will likely be available in 2006. The granular formulation worked well in continuously flooded rice. Plant and root stunting was noted during the period when the chemical is active in the water, but this effect diminishes over time. It performed well on susceptible weeds as a sequential following Cerano and Abolish, or followed by SuperWham (propanil) or Clincher. As with all ALS-inhibiting compounds, Granite will likely fail to control certain biotypes that are resistant to the mode of action of this compound. Regiment is a post emergent herbicide applied with a silicone surfactant. It is effective on watergrass, ricefield bulrush, and demonstrates good activity on California arrowhead. Regiment was tested alone, in tank mixes, and in sequences. A tank mix of Regiment and Abolish provided 79% control of resistant watergrass and 65% smallflower control.

Pinpoint flood systems generally involve one or more foliar active herbicides in tank mix or sequential applications. Regiment performed well in pin-point systems in sequence with Clincher (cyhalofop-butyl) and SuperWham. Tank mixes of Regiment and either Clincher or SuperWham were antagonistic. Clincher (cyhalofop-butyl) is a post-emergent ACCase inhibitor that controls watergrass and sprangletop and is very safe on rice. Clincher appears to work best when applied as a sequential in pin-point systems. Very good broad-spectrum control was obtained when Clincher followed SuperWham at susceptible and resistant watergrass sites. Prowl (pendimethalin) is a meristematic inhibitor that interferes with the plant's cellular division and early growth. The new H_2O (CS) formulation will replace the EC formulation on the dry/drill-seeded rice label in California, while the potential of this formulation will continue to be tested for water-seeded rice. This herbicide is active in aerobic moist soil but appears to be rapidly inactivated in flooded rice. Prowl H_2O could be used in water seeded pin-point rice where ability to rapidly reflood after foliar herbicide treatments is diminished by limited water supply or large checks.

The Leathers' method is a water-seeded system where the flood water is dropped after seeding in order to allow improved establishment of rice. This period of extended soil exposure also encourages certain weed species to establish. Prowl H_2O in tank mix with either SuperWham or Clincher provided excellent grass (barnyardgrass, watergrass and sprangletop) control. Prowl H_2O with a follow-up treatment of SuperWham also was an excellent treatment. Other good treatments (including sprangletop control) included: Abolish in tank mix or sequence with SuperWham, Clincher in sequence with SuperWham, Regiment or Granite SC.

Drill seeded rice is a system that allows use of different herbicides than water seeded rice, but also allows different weed species to flourish. Watergrass, barnyardgrass and sprangletop are three common weedy grasses found in this system. Good control can be achieved with Prowl H_2O alone or in combination with Clincher, SuperWham, or Regiment. Abolish in combinations with SuperWham, Regiment or Clincher were also very good treatments, as was also Clincher followed by SuperWham.

Research continued on alternative rice establishment systems for their potential to shift and reduce weed species recruitment and facilitate the use of alternative herbicides such as pendimethalin and glyphosate that have mechanisms of action capable of controlling weed biotypes resistant to herbicides used in conventional water-seeded rice. Evaluated rice establishment systems included 1) conventional water-seed rice, 2) conventional drill-seeded rice, 3) water-seeded rice after spring tillage and a stale seedbed, 4) water-seeded rice after a stale seedbed without spring tillage, and 5) drill-seeded rice after a stale seedbed without spring tillage. Species composition of weed communities were distinctly different among establishment systems, as the water-seeded systems were dominated by sedge and broadleaf weed species but the drill-seeded systems were dominated by grass weed species. In the drill-seeded systems, grass control from pendimethalin and cyhalofop-butyl was higher than 85%. Glyphosate used in the stale seedbed systems greatly reduced post rice emergence weed densities in the water and drill-seeded systems. Rice yields did not differ among these establishment systems. Therefore, the alternative rice establishment systems evaluated in this study may be used to effectively manipulate weed species recruitment and enable the use of herbicides that may control weed biotypes resistant to herbicides used in conventional water-seeded systems.

Resistant watergrass testing continues as a service to California rice growers. Testing has been done for Ordram, Bolero, Regiment, Clincher and Propanil. Additional herbicides that may be added are: Cerano, Granite and Prowl. This service is performed during the winter in order to deliver results to the growers by planting time in the spring.

Table 1. Continuous flood trial at resistant site.

			Percent injury[1]				% Weed Control[2]														
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	BAORO	Yield (lb/Acre)
	(g ai/ha)		1st trt		2nd trt		19-Jun				6-Jul					25-Jul					3-Oct
Untreated[4]	---	---					43	5	3	38	53	4	4	10	9	48	5	7	6	4	2763
SuperWham + COC	6726 + 1.25% v/v	1-3 Til	6	0			23	6	100	0	30	48	73	13	0	49	66	61	0	0	3603
Stam + COC	6727 + 1.25% v/v	1-3 Til	3	0			31	29	75	13	54	25	75	0	0	53	64	56	0	0	3912
Wham 60 DF + COC	6720 + 1.25% v/v	1-3 Til	0	0			19	18	75	0	35	25	73	13	13	79	66	68	0	0	5042
Regiment + Abolish	37 + 3360	1-3 Til	5	0			56	0	50	45	80	38	73	23	75	79	41	65	13	75	4867
Bolero fb. Superwham + COC	4480 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	8	0	35	53	75	41	46	25	98	0	68	60	80	88	13	50	5282
Bolero fb. Regiment + NIS	4480 fb 44.5 + .125% v/v	1-2 lsr fb. 1-3 Til	0	0	1	0	23	6	50	44	66	25	75	23	83	50	60	69	25	75	4586
Bolero fb. Regiment + Abolish	4480 fb. 37 + 3360	1-2 lsr fb. 1-3 Til	0	0	3	0	44	38	75	63	69	75	100	0	98	61	35	96	13	100	4665
Regiment + NIS fb. SuperWham + COC	44.5 + .125% v/v fb. 6726 + 1.25% v/	1-2 Til fb. 2-3 Til	0	0	0	0	44	19	50	3	45	0	75	13	0	59	95	94	13	0	4691
Cerano fb. Superwham + COC	673 fb. 6726 + 1.25% v/v	0.5 lsr fb. 1-3 Til	0	0	6	0	6	19	75	21	50	23	75	15	0	64	71	84	0	23	4467
Cerano fb. Regiment + NIS	673 fb. 44.5 + .125% v/v	0.5 lsr fb. 1-3 Til	0	0	0	0	25	29	75	19	39	25	25	13	0	40	38	31	0	0	4001
Cerano fb. Regiment + Abolish	673 fb. 37 + 3360	0.5 lsr fb. 1-3 Til	0	0	0	0	38	6	75	30	69	25	50	0	13	71	25	38	0	25	4247
Ordram fb. Shark	4485 fb. 224	1 lsr fb. 2-3 lsr	0	0	0	0	23	50	75	25	31	25	100	0	98	30	80	94	13	98	3443
Shark fb. Clincher + COC	224 fb. 315 + 1.25%v/v	2-3 lsr fb. 1-3 Til	0	0	0	0	19	29	100	6	21	23	75	0	75	20	45	94	30	100	3375
Granite GR fb. SuperWham + COC	40 fb 6726 + 1.25% v/v	2-3 lsr fb. 1-3 Til	0	3	6	0	23	44	100	54	81	0	75	75	0	84	71	100	81	25	4945
Shark fb. SuperWham + COC	224 fb. 6726 + 1.25%v/v	2-3 lsr fb. 1-3 Til	0	0	8	0	44	44	75	44	71	41	50	13	75	71	83	100	0	63	4343
LSD (P=0.05)																					1184

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), PFS (pre-flood surface), PPI (pre-plant incorporated).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 26, 2005 with 150 lbs per acre of M104.
2. Trial managed as a continuous flood.
3. Treatment dates: 0.5 lsr (June 1), 1-2 lsr (June 3), 2-3 lsr (June 7), 1-3 till (June 21)
4. Watergrass was 1-2 leaf, barnyardgrass was 2 leaf on June 1.
   Watergrass was 2 leaf, barnyardgrass was 2 leaf on June 3.
   Watergrass was 2-3 leaf, bulrush was 1 inch, ducksalad was 1 inch June 7.
   Watergrass was 1 tiller, smallflower was 1 inch, california arrowhead was 2 inches, ducksalad was 2 inches June 21.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 1: Air temperature 85^{o} F, wind 2 MPH from the southeast.
   Weather conditions on June 3: Air temperature 81^{o} F, wind 5 MPH from the north, northwest.
   Weather conditions on June 7: Air temperature 71^{o} F, wind 1-2 MPH from the south.
   Weather conditions on June 21: Air temperature 78^{o} F, wind 3-4 MPH from the south.
   Weather conditions on July 6: Air temperature 78^{o} F, wind 3-4 MPH from the south.

Table 2. Pinpoint Trial at Resistant off station site

			Percent injury[1]				Weed Control[2]													
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	BAORO	Yield/Acre (14%)
	(g ai/ha)		1st trt		2nd trt		16-May				6-Jul				25-Jul					1-Oct
Untreated[4]							10	3	3	18	21	2	16	26	14	6	4	6	5	4985
Regiment + NIS	37 + 0.125% v/v	3-4 lsr	0	0			80	50	50	40	70	54	71	63	69	88	98	35	35	5074
Regiment + Abolish	37 + 3360	3-4 lsr	3	0			80	53	39	78	58	93	81	91	70	78	75	89	100	4982
Abolish	3360	3-4 lsr	1	0			19	29	10	36	18	72	38	70	23	69	80	61	96	4887
Clincher + COC fb. Stam + Granite SC + CC	15 + 1.25% v/v fb. 6726 + 35 + 1.25% v/	3-4 lsr fb. 1 Til	0	0	0	0	76	0	0	0	59	39	61	84	68	79	11	30	50	4896
Clincher + COC fb. Super Wham + COC	315 + 1.25% v/v fb. 6726 + 1.25% v/v	3-4 lsr fb. 1 Til	0	5	4	0	78	3	5	14	74	5	29	46	79	95	31	39	54	5525
Super Wham + COC fb. Clincher + COC	6726 + 1.25% v/v fb. 315 + 1.25% v/v	3-4 lsr fb. 1 Til	6	0	0	0	74	68	69	71	76	63	59	49	83	31	100	43	46	5249
Regiment + NIS fb. Clincher + COC	44.5 + .125% v/v fb. 315 + 1.25% v/v	3-4 lsr fb. 1 Til	0	0	0	0	71	30	43	49	56	90	79	78	84	78	83	39	73	4467
Regiment + Abolish fb. Clincher + COC	37 + 3360 fb. 315 + 1.25% v/v	3-4 lsr fb. 1 Til	1	0	5	0	80	69	76	78	38	70	61	74	48	74	100	41	68	4558
Regiment + Abolish fb. SuperWham + COC	37 + 3360 fb. 6726 + 1.25% v/v	3-4 lsr fb. 1 Til	0	5	3	0	83	54	63	69	79	90	81	93	83	98	100	71	90	5815
Regiment. + NIS fb. Super Wham + COC	44.5 + .125% v/v fb. 6726 + 1.25% v/v	3-4 lsr fb. 1 Til	1	3			68	39	19	46	46	65	60	93	81	95	79	25	68	4814
Super Wham + COC	6726 + 1.25% v/v	1 Til	1	0			68	0	0	3	50	35	18	25	60	71	50	29	25	4317
Regiment + NIS	44.5 + 0.125% v/v	3-4 lsr	3	0			71	18	21	39	61	90	81	67	64	96	71	34	39	5253
Super Wham + COC fb. Regiment + NIS	4484 + 1.25% v/v fb. 44.5 + 0.125% v/v	3-4 lsr fb. 1 Til	5	1	1	0	79	31	38	40	88	88	83	48	93	55	100	69	25	5596
Regiment + Whip fb. SuperWham + COC	44.5 + 32 fb. 6726 + 1.25% v/v	3-4 lsr fb. 1 Til	0	5	5	0	43	23	1	6	59	76	26	13	79	83	96	25	20	5058
LSD (P=0.05)																				1652

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem) SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), PFS (pre-flood surface), PPI (pre-plant incorporated).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 26, 2005 with 150 lbs per acre of M104.
2. Trial managed as a pinpoint flood with drain on June 10 and reflood June 15.
3. Treatment dates: 3-4 lsr (June 13), 1 Till (June 21)
4. Watergrass was 3 leaf, bulrush was 1-2 leaf, smallflower ws 1-2 leaf, ducksalad was 1-2 leaf on June 13.
   Watergrass was 1 tiller, smallflower was 1 inch, california arrowhead was 2 inches, waterhyssop was 4 leaf on June 21.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 13: Air temperature 91^{o} F, wind 3 MPH from the south, southeast.
   Weather conditions on June 21: Air temperature 78^{o} F, wind 3.5 MPH from the south.

Table 3. Prowl H2O Resistant site

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]												Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	BAORO	AMMCO	ECHPH	SCPMU	CYPDI	HETLI	BAORO	AMMCO	
	(g ai/ha)		1st trt		2nd trt		6-Jul						25-Jul						
Untreated[4]	---	---					14	9	2	10	14	9	21	5	13	5	8	15	3508
Regiment + NIS	44.5 + 0.125% v/v	5-6 lsr	1	0			71	94	100	38	54	68	51	50	73	41	50	56	4569
Super Wham + COC	6726 + 1.25% v/v	5-6 lsr	30	5			63	100	100	89	31	56	66	94	94	48	41	56	4491
Prowl H20 + Regiment + NIS	1120 + 44.5 + 0.125% v/v	5-6 lsr	4	0			70	88	100	25	100	71	50	50	85	31	94	63	4317
Prowl H20 + Super Wham + COC	1120 + 6726 + 1.25% v/v	5-6 lsr	33	4			91	100	100	60	100	94	86	83	94	50	63	78	4854
Prowl H20 + Regiment + NIS fb. Clincher + COC	20 + 44.5 + 0.125% v/v fb. 315 + 1.25% v	5-6 lsr fb. 2-3 Til	13	1	0	0	63	98	88	45	100	89	58	38	78	25	100	69	4335
Prowl H20 + Super Wham + COC fb. Clincher + COC	20 + 6726 + 1.25% v/v fb. 315 + 1.25% v	5-6 lsr fb. 2-3 Til	19	4	0	0	73	69	100	38	85	87	74	98	95	44	100	83	4851
Regiment + Abolish + Prowl H2O	37 + 3360 + 1120	4-5 lsr	3	0			51	75	100	38	100	100	69	63	95	39	100	100	5087
Cerano	673	DOS					58	0	75	35	0	13	65	0	0	31	0	0	3946
Cerano fb. Super Wham + COC	673 fb. 6726 + 1.25% v/v	DOS fb. 5-6 lsr			25	5	96	88	100	86	13	31	94	81	93	44	0	25	4537
Cerano fb. Super Wham + Prowl H20 + COC	673 fb. 6726 + 1120 + 1.25% v/v	DOS fb. 5-6 lsr			35	5	96	94	100	71	100	69	95	100	98	69	100	60	5443
Cerano fb. Regiment + Prowl H20 + NIS	673 fb. 44.5 + 1120 + 0.125% v/v	DOS fb. 5-6 lsr			5	0	91	75	100	25	98	44	89	35	68	38	100	56	4747
Cerano fb. Regiment + Abolish	673 fb. 37 + 3360	DOS lsr fb. 4-5 lsr			6	0	86	94	100	75	100	90	84	63	95	75	100	79	3757
LSD (P=0.05)																			1504

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 26, 2005 with 150 lbs per acre of M104.
2. Trial managed as a pinpoint flood with drain on June 13 and reflood June 17.
3. Treatment dates: DOS (May 26), 4-5 lsr (June 16), 5-6 lsr (June 16), 2-3 Till (June 27)
4. Watergrass was 1 leaf on May 26.
   Watergrass was 4 leaf, bulrush was 0.5 inch, smallflower was 0.5 inch, ducksalad was 0.75 inch on June 16.
   Watergrass was 2 tiller, bulrush was 3 inches, smallflower was 3 inches, ducksalad was 2 inches on June 27.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 26: Air temperature 90^{o} F, wind 2 MPH from the west.
   Weather conditions on June 16: Air temperature 61^{o} F, wind 3.5 MPH from the south, southeast.
   Weather conditions on June 27: Air temperature ^{o} F, wind 0-1 MPH from the south.

Table 4. Continuous flood trial at Hamilton Road.

			Percent injury[1]					Weed Control[2]												
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	7 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	Yield (lb/A)
	(g ai/ha)		1st trt		2nd trt		3rd trt	24-Jun				14-Jul				2-Aug				
Untreated[4]	---	---						4	17	1	19	20	12	5	14	42	16	13	14	3320
Cerano fb. Londax	673 fb.71	DOS fb. 2-3 lsr		13	75	14		100	99	100	100	100	100	100	100	100	100	93	100	5938
Cerano fb. Superwham + COC	673 fb. 6726 + 1.25% v/v	DOS fb. 1-3 Til		11	0	0		100	21	75	98	100	98	100	100	98	75	80	100	5823
Cerano fb. Regiment + NIS	673 fb. 37 + .125% v/v	DOS fb. 1-3 Til		14	0	0		98	45	50	100	100	44	100	96	97	30	8	91	4985
Cerano fb. Superwham+ Grandstand+ C	673 fb. 6726 + 280 + 1.25% v/v	DOS fb. 1-3 Til		14	0	0		100	43	100	98	100	100	100	95	99	92	93	100	5737
Cerano fb. Grandstand	673 fb. 280	DOS fb. 1-3 Til		10	0	0		99	63	75	100	100	80	100	98	98	22	35	99	5664
Cerano fb. Granite GR	673 fb. 40	DOS fb. 2-3 lsr		11	49	15		100	86	100	100	100	100	100	100	99	100	100	100	5527
Cerano fb. Granite SC + COC	673 fb. 40 + 2.5% v/v	DOS fb. 1-3 Til		11	0	0		100	56	100	94	100	98	100	100	100	67	83	101	5539
Cerano fb. Granite GR	448 fb. 40	DOS fb. 2-3 lsr		8	33	8		100	96	100	100	100	96	100	100	99	98	100	100	6194
Bolero fb. Superwham + COC	4480 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	1	0	0	0		70	65	100	71	96	99	100	69	89	87	100	75	5737
Bolero fb. Regiment + NIS	4480 fb. 37 + .125% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0		75	13	100	54	99	96	100	44	96	87	98	28	4782
Bolero fb. Granite GR	4480 fb. 40	1-2 lsr fb. 2-3 lsr	1	0	3	1		100	98	100	99	100	96	100	100	99	97	100	100	5935
Bolero fb. Granite SC + COC	4480 fb. 40 + 2.5% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0		76	44	100	41	100	91	100	91	98	91	100	84	5912
Bolero fb. Shark	4480 fb. 224	1-2 lsr fb. 2-3 lsr	0	0	0	0		75	90	100	93	61	75	100	98	50	65	100	99	4864
Bolero fb. Shark fb. SuperWham + COC	4480 fb. 224 fb. 6726 + 1.25% v/v	1-2 lsr fb. 2-3 lsr fb. 1-3 til	0	0	3	1	0	90	73	100	85	100	100	100	98	92	98	100	100	6060
Bolero fb. Shark fb. Regiment + NIS	4480 fb. 224 fb. 37 + .125% v/v	1-2 lsr fb. 2-3 lsr fb. 1-3 til	0	0	1	1	0	91	50	100	93	100	95	100	100	95	85	100	91	5476
Shark fb. Granite GR (fb. Foliar if needed	224 fb. 40	2-3 lsr	3	3				100	69	100	75	100	98	100	100	99	94	100	100	6297
Shark fb. Clincher + COC	224 fb. 315 + 1.25% v/v	2-3 lsr fb. 1-3 Til	3	0	0	0		85	24	100	24	96	38	100	85	86	23	82	92	5244
Abolish fb. SuperWham + COC	4480 fb. 6726 + 1.25% v/v	PFS bf. 1-3 til	0	0	0	0		94	64	100	75	100	100	100	85	97	87	100	85	5633
Abolish fb. Regiment	4480 fb. 37 + .125% v/v	PFS bf. 1-3 til	0	0	0	0		99	46	100	94	100	70	100	86	97	75	99	75	5098
Ordram 15G + Londax	4480 fb. 71	1-2 lsr	0	0				91	44	75	13	95	68	75	13	94	38	69	23	5607
Ordram 15G fb. Shark	4480 fb. 224	1-2 lsr	0	0				91	68	75	60	99	85	50	38	95	58	60	24	5099
Ordram 15G fb. SuperWham + COC	4480 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 til	0	0	0	0		100	89	100	78	100	100	100	75	100	99	100	80	5697
Cerano fb. Shark	673 fb. 224	DOS fb. 2-3 lsr		10	46	9		100	49	100	100	98	31	100	100	93	41	71	100	5512
Granite GR	40	2-3 lsr	3	1				91	44	75	13	95	68	75	13	94	38	69	23	5934
Granite GR fb. Stam 80 EDF + COC	40 fb. 6726 + 2.5% v/v	2-3 lsr fb. 1Till	0	1	0	0		100	69	75	96	100	100	100	100	98	100	100	100	6342
Granite GR fb. Clincher + COC	40 fb. 280 + 2.5% v/v	2-3 lsr fb. 3-4 lsg	0	0	1	0		100	69	100	88	100	100	100	100	98	100	100	100	5845
Abolish fb. Granite GR	4480 fb. 40	PFS fb. 2-3 lsr	0	0	0	3		100	100	100	100	100	98	100	100	99	97	100	100	6029
LSD (P=0.05)																				952

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Abolish applied June 1 to dry soil prior to flood
2. Trial seeded June 3, 2005 with 150 lbs per acre of M206
3. Treatment dates: PFS (June 1), DOS (June 3), 1-2 lsr (June 14), 2-3 lsr (June 15), 3-4 lsg (June 21), 1-3 Till (June 30)
4. Trial managed as a permanent flood with flood water at 4-5 inches.
5. No weeds were visible when Cerano was applied on day of seeding June 3.
   Watergrass was 3 leaf, ricefield bulrush was 3 leaf, ducksalad was 3 leaf and red stem was 2 leaf on June 13.
   Watergrass was 3 leaf, ricefield bulrush was 3 leaf, ducksalad was 3 leaf and red stem was 2 leaf on June 14.
   Watergrass was 3 leaf, ricefield bulrush was 3 leaf, ducksalad was 3 leaf and red stem was 2 leaf on June 15.
   Watergrass was 3-4 leaf, ricefield bulrush was 4 leaf, ducksalad was 3-4 leaf and smallflower was 2-3 leaf on June 21.
   Watergrass was 1-2 tiller, ricefield bulrush was 5", ducksalad was 6-7" and smallflower was 4" on June 30.
6. Spray applications made with 20 gallons/acre using 8003 nozzles.
7. Weather conditions on June 1: Air temperature 69° F, wind 5-6 MPH from the Northwest.
   Weather conditions on June 3: Air temperature 72° F, wind 5-8 MPH from the northwest.
   Weather conditions on June 13: Air temperature 75° F, wind 4-9 MPH from the northwest.
   Weather conditions on June 14: Air temperature 82° F, wind 1-4 MPH from the west.
   Weather conditions on June 15: Air temperature 71° F, wind 5-6 MPH from the southwest.
   Weather conditions on June 21: Air temperature 68° F, wind 6-8 MPH from southeast.
   Weather conditions on Julne 30: Air temperature 82° F, water temperature 76°F, wind 2.5 MPH from the west.

Table 5. Pinpoint Trial at Hamilton Road

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]												Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	
	(g ai/ha)		1st trt		2nd trt		24-Jun				14-Jul			2-Aug					
Untreated[4]							25	19	25	5	11	11	3	15	6	8	18	9	4665.4
Regiment + Abolish	25 + 3360	3-4 lsr	0	0			100	44	100	13	100	63	100	100	100	78	25	92	5340.0
Regiment + Abolish	30 + 3360	3-4 lsr	0	0			100	63	100	48	100	56	100	100	86	77	48	100	5513.9
Regiment + NIS	25 + 0.125% v/v	3-4 lsr	0	0			100	54	100	0	99	38	75	98	96	56	48	60	5182.2
Regiment + NIS	30 + 0.125% v/v	3-4 lsr	0	0			100	44	100	0	98	53	100	98	94	65	49	31	5185.4
Regiment + NIS	37 + 0/125% v/v	3-4 lsr	0	0			100	35	100	25	98	65	100	98	88	73	46	67	5527.9
Abolish	3363	3-4 lsr	0	0			100	31	100	25	88	0	75	86	34	62	19	99	5140.9
Clincher + COC fb. Stam + Granite SC + COC	315 + 1.25% v/v fb. 6726 + 35 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	0	0	0	100	23	100	0	100	100	100	100	100	100	83	100	5578.4
Clincher + Stam + Granite SC + COC	315 + 6726 + 35 + 1.25% v/v	3-4 lsr	0	0			100	93	100	66	100	100	100	100	100	99	90	100	5732
Clincher + COC fb. Stam + COC	315 + 1.25% v/v fb. 6726 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	0	0	0	100	50	100	19	100	70	75	100	100	97	72	100	5598
Clincher + Granite SC + COC	315 + 35 + 1.25% v/v	3-4 lsr	0	0			100	56	100	20	100	98	100	100	99	80	75	100	5515
Clincher + COC fb. Granite SC + COC	315 + 1.25% v/v fb. 35 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	0	0	0	100	0	100	50	100	100	100	98	99	100	87	100	5750
Clincher + COC fb. Regiment + NIS	315 + 1.25% v/v fb. 37 + .125% v/v	3-4 lsr fb. 1-2 Til	0	3	4	0	100	54	100	66	100	94	75	98	100	88	66	100	5529
Super Wham + COC fb. Clincher + COC	6726 + 1.25% v/v fb. 315 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	0	1	0	100	71	100	43	100	80	98	99	98	87	61	100	5604
Super Wham + COC fb. Regiment + NIS	6726 + 1.25% v/v fb. 37 + .125% v/v	3-4 lsr fb. 1-2 Til	0	5	3	0	100	85	100	69	100	88	100	99	100	100	81	100	5338
Regiment + NIS fb. Clincher + COC	30 + .125% v/v fb. 315 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	0	0	0	100	49	100	30	100	70	98	99	100	71	71	92	5720
Regiment. + NIS fb. Super Wham + COC	30 + .125% v/v fb. 6726 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	13	3	0	100	25	100	0	100	94	100	99	100	100	77	54	5769
Regiment + 2,4-D + NIS	37 + 123 + .125% v/v	1-2 Til	3	0			100	6	100	31	96	98	100	94	100	100	87	79	4634
SuperWham + 2,4-D + COC	6726 + 123 + 1.25% v/v	1-2 Til	1	0			100	13	100	36	90	100	100	89	100	100	92	68	5757
SuperWham + COC	6726 + 1.25% v/v	1-2 Til	0	0			100	0	100	24	79	91	100	83	92	97	78	29	5564
Stam + COC	6726 + 1.25% v/v	1-2 Til	0	0			100	6	100	23	79	89	100	90	100	99	78	70	5832
Wham 60 DF + COC	6726 + 1.25% v/v	1-2 Til	3	0			75	6	75	20	78	98	100	81	92	90	77	57	5825
Clincher + COC fb. Londax (Tinned)	315 + 1.25% v/v fb. 71	3-4 lsr fb. 1-2 Til	0	0	0	0	100	13	100	41	100	83	91	99	87	86	55	100	5585
Regiment + Whip + NIS fb. SuperWham + COC	30 + 32 + 0.125% v/v fb. 6726 + 1.25% v/v	3-4 lsr fb. 1-2 Til	0	13	5	0	100	25	100	6	100	84	100	99	94	99	53	100	5618
SuperWham + Whip + COC	6726 + 32 + 1.25% v/v	3-4 lsr	0	0			100	6	100	23	79	89	100	90	100	99	78	70	5607
Clincher + COC	315 + 1.25% v/v	3-4 lsr	0	0			100	19	100	48	100	13	25	98	23	33	24	100	5231
Clincher + COC fb. Regiment + Grandstand + N	315 + 1.25% v/v fb. 37 + 280 + 0.125% v/v	3-4 lsr fb. 1-2 Til	0	0	0	0	100	31	100	19	100	98	100	99	88	98	67	100	5347
Super Wham + Abolish + COC	4484 + 4484 + 1.25% v/v	3-4 lsr	0	0			100	100	100	100	100	84	98	99	88	98	71	100	5534
Regiment + Shark + NIS	30 + 112 + 0.125% v/v	3-4 lsr	0	0			100	95	100	98	64	89	100	72	100	60	63	35	5703
Shark	112	3-4 lsr	0	0			100	91	100	98	23	44	100	38	100	95	46	49	5494
SuperWham + MCPA + COC	6726 + **?** + 1.25% v/v	1-2 Til	5	0			100	25	100	0	89	100	100	88	100	100	91	81	5015
Regiment + MCPA + NIS	37 + **?** + .125% v/v	1-2 Til	3	0			100	34	100	25	100	100	100	98	100	100	94	90	4658
LSD (P=0.05)																			669

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a pinpoint flood with flood water drained June 14 reflood June 22.
3. Treatment dates: 3-4 lsr (June 20), 1-2 Till (june 30)
4. Watergrass was 3 leaf, ricefield bulrush was 1.5 inches and ducksalad was 1.5 inches on June 20.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches, smallflower umbrellasedge was 4 inches and ducksalad was 6-7 inches on June 30.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 20: Air temperature 80^{o} F, wind 0-1 MPH from the south.
   Weather conditions on June 30: Air temperature 82^{o} F, wind 3 MPH from the west.

Table 6. Prowl H2O pinpoint

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]												Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	HETLI	ECHPH	SCPMU	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	
	(g ai/ha)		1st trt		2nd trt		24-Jun			14-Jul				2-Aug					
Untreated[4]	---	---					3	14	1	8	6	5	5	26	6	6	10	7	4268
Prowl H2O + COC	1120 + 1.25% v/v	3-5 lsr	0	0			0	0	19	59	0	0	94	58	11	7	17	36	5181
Regiment + NIS	30 + 0.125% v/v	3-5 lsr	0	0			25	3	3	100	63	94	94	95	96	18	55	23	5736
Super Wham + COC	6726 + 1.25% v/v	3-5 lsr	0	0			75	83	95	98	69	91	94	96	92	71	73	88	5771
Clincher + COC	315 + 1.25% v/v	3-5 lsr	0	0			45	0	0	100	13	25	56	98	28	18	33	99	5504
Prowl H20 + Regiment + NIS	1120 + 30 + 0.125% v/v	3-5 lsr	0	0			0	6	5	100	73	85	100	95	95	5	63	39	5653
Prowl H20 + Super Wham + COC	1120 + 6726 + 1.25% v/v	3-5 lsr	0	0			100	76	89	100	88	75	100	98	89	83	74	94	5996
Prowl H20 + Clincher + COC	1120 + 315 + 1.25% v/v	3-5 lsr	0	0			63	4	23	100	0	25	100	90	1	3	28	100	5865
Prowl H20 + Super Wham + Clincher + COC	1120 + 6726 + 315 + 1.25% v/v	3-5 lsr	0	0			100	61	68	100	98	100	100	98	100	74	93	95	6217
Prowl H20 + Regiment + NIS fb. Clincher + COC	1120 + 30 + 0.125% v/v fb. 315 + 1.25% v/v	3-5 lsr fb. 1-3 Till	0	0	0	0	50	23	25	100	60	91	74	98	95	34	78	96	6589
Prowl H20 + Super Wham + COC fb. Clincher + COC	1120 + 6726 + 1.25% v/v fb. 315 + 1.25% v/v	3-5 lsr fb. 1-3 Till	0	0	0	0	100	93	98	100	100	100	100	99	100	100	81	100	6258
Prowl H20 + Clincher + COC fb. Super Wham + COC	1120 + 315 + 1.25% v/v fb. 6726 + 1.25% v/v	3-5 lsr fb. 1-3 Till	0	21	6	0	79	0	19	100	100	100	100	98	100	100	79	98	6495
Abolish + Super Wham	4480 + 6726	3-5 lsr	0	0			100	91	94	100	100	100	100	97	100	99	82	100	6380
Untreated[4]	---	---					2	15	1	11	10	5	2	28	31	3	23	24	4510
LSD (P=0.05)																			807

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a pinpoint flood with flood water drained June 14 reflood June 22.
3. Treatment dates: 3-5 lsr (June 20), 1-3 Till (June 30)
4. Watergrass was 3 leaf, ricefield bulrush was 1.5 inches and ducksalad was 1.5 inches on June 20.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches, smallflower umbrellasedge was 4 inches and ducksalad was 6-7 inches on June 30.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 20: Air temperature 80^{o} F, wind 0-1 MPH from the south.
   Weather conditions on June 30: Air temperature 82^{o} F, wind 3 MPH from the west.

Table 7. Leather's method

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]														Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	HETLI	BAORO	LEFFA	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	
	(g ai/ha)		1st trt		2nd trt		24-Jun				14-Jul					2-Aug					
Untreated[4]	---	---					28	14	1	1	18	5	4	2	5	29	7	1	8	15	4326
Prowl H20 + COC	1120 + 1.25% v/v	1-2 lsr	0	0			81	18	50	25	78	25	38	100	80	66	6	25	34	28	5169
Clincher + COC	280 + 1.25% v/v	1-2 lsr	0	0			90	6	50	48	99	25	25	75	100	99	21	48	25	88	5415
Super Wham + COC	3363 + 1.25% v/v	1-2 lsr	0	0			94	76	100	88	89	50	25	94	100	80	53	92	31	63	5264
Prowl H20 + Clincher + COC	1120 + 280 + 1.25% v/v	1-2 lsr	0	0			91	20	25	25	100	31	50	100	100	97	17	29	42	100	5656
Prowl H20 + Super Wham + COC	1120 + 3363 + 1.25% v/v	1-2 lsr	0	0			94	100	100	100	94	31	69	100	99	91	43	83	52	91	5678
Prowl H2O + Super Wham + Clincher + COC	1120 + 3363 + 315 + 1.25% v/v	1-2 lsr	0	0			98	80	100	100	100	63	50	100	100	97	52	63	66	99	4999
Prowl H20 + Super Wham + COC fb. Clincher + CO	120 + 3363 + 1.25% v/v fb. 315 + 1.25% v/	1-2 lsr fb. 1-3 Til	0	0	0	0	100	98	100	100	100	73	100	100	100	93	71	92	84	91	5832
Prowl H20 + Clincher + COC fb. Super Wham + CO	120 + 280 + 1.25% v/v fb. 6726 + 1.25% v/	1-2 lsr fb. 1-3 Til	0	0	0	0	75	40	75	50	100	100	100	100	100	98	100	100	88	100	6297
Prowl H20 + Clincher + COC fb. Regiment + NIS	1120 + 280 + 1.25% v/v fb. 30 + 0.125% v/v	1-2 lsr fb. 1-3 Til	0	0	4	0	100	45	69	63	100	98	100	100	100	98	91	82	95	99	5838
Prowl H20 + COC fb Regiment + NIS	1120 + 1.25 % v/v fb. 30 + 0.125% v/v	1-2 lsr fb. 1-3 Til	0	0	3	0	100	29	100	50	100	90	100	100	50	95	92	79	88	50	5637
Granite SC + COC	30 + 2.5% v/v	1-2 lsr	0	0			100	100	100	100	96	100	100	100	50	97	93	83	93	50	6204
Granite SC + Clincher + COC	30 + 280 + 2.5% v/v	1-2 lsr	0	0			100	74	75	75	100	94	100	100	100	93	80	74	76	100	6100
Clincher + COC fb. Granite GR (Tinned)	280 + 1.25% v/v fb. 40	2-3 lsr fb. Perm. Flood	0	0	0	0	75	54	75	50	100	44	75	100	100	98	44	87	59	98	6060
Abolish	4480	1-2 lsr	0	0			100	73	100	100	76	88	94	100	75	73	61	100	70	96	6016
Abolish fb. Super Wham + COC	4480 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	1	0	75	56	75	50	98	100	100	100	100	93	100	100	98	92	6071
Abolish + Super Wham	4480 + 3363	1-2 lsr	1	0			100	94	100	81	96	98	73	100	100	93	73	100	65	97	6144
Clincher + COC fb. Super Wham + COC	280 + 1.25% v/v fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	5	0	75	0	0	0	100	100	100	100	100	98	100	100	97	99	6101
Clincher + COC fb. Regiment + NIS	280 + 1.25% v/v fb. 30 + 0.125% v/v	1-2 lsr fb. 1-3 Til	0	0	4	0	100	18	75	25	100	94	100	100	100	98	93	60	78	100	5770
Bolero (Tinned) fb Super Wham + COC	4480 fb 6726 + 1.25% v/v	post flood fb 1-3 Till	6	0	6	0	100	10	100	50	83	100	100	100	50	80	99	100	97	50	4707
Untreated							1	15	1	1	29	4	23	26	3	27	28	2	12	5	4701
LSD (P=0.05)																					996

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a Leathers method with flood water drained June 5, skim of water until reflood June 22.
3. Treatment dates: 1-2 lsr (June 14), 2-3 lsr (June 21), post flood (June 29), 1-3 Till (June 30)
4. Watergrass was 3 leaf, ricefield bulrush was 1 inch, redstem was 0.25 inch and ducksalad was 0.75 inch on June 14.
   Watergrass was 4 inches, ricefield bulrush was 1.5 inches, smallflower umbrellasedge was 2-3 inches and ducksalad was 1.5 inches on June 21.
   Watergrass was 1-2 tillers, ricefield bulrush was 5 inches, smallflower umbrellasedge was 4 inches and ducksalad was 6-7 inches on June 29.
   Watergrass was 1-2 tillers, ricefield bulrush was 5 inches, smallflower umbrellasedge was 4 inches and ducksalad was 6-7 inches on June 30.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 14: Air temperature 85^{o} F, wind 2 MPH from the southeast.
   Weather conditions on June 21: Air temperature 68^{o} F, wind 5-8 MPH from the southeast.
   Weather conditions on June 29: Air temperature 71^{o} F, wind 1-2 MPH from the east, southeast.
   Weather conditions on June 30: Air temperature 85^{o} F, wind 1-2 MPH from the west, northwest.

Table 8 . Ganite SC Foliar

			% injury[1]		Weed Control[2]													
Treatment	**Rate**	**Timing[3]**	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	Yield (lb/A)
	(g ai/ha)		1st trt		24-Jun				14-Jul				2-Aug					
Untreated[4]	---	---			15	21	6	4	39	2	4	5	38	8	2	5	7	4438
Granite SC + COC fb. Clincher + COC	35 + 2.5% v/v fb. 315 +1.25% v/v	3-4 lsr fb. 3-4 lsr	0	1	87	81	100	75	100	100	100	95	98	100	91	98	98	5709
Granite SC + COC fb. Clincher + COC	70 + 2.5% v/v fb. 315 +1.25% v/v	3-4 lsr fb. 3-4 lsr	0	0	35	81	75	50	100	100	100	100	95	100	100	100	90	5728
Regiment + NIS fb. Clincher + COC	38 + 0.125 % v/v fb. 315 +1.25% v/v	3-4 lsr fb. 3-4 lsr	0	5	84	79	102	52	100	100	100	100	96	100	100	77	93	4722
Regiment + NIS fb. Clincher + COC	76 + 0.125 % v/v fb. 315 +1.25% v/v	3-4 lsr fb. 3-4 lsr	0	8	82	76	100	75	100	100	100	100	95	99	83	87	88	5295
Clincher + COC	315 +1.25% v/v	3-4 lsr	0	0	59	76	50	52	100	63	31	23	95	0	49	16	100	5397
LSD (P=0.05)																		2514

[1] % Injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] PFS (pre-flood surface), PPI (pre-plant incorporated), fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a pinpoint flood with flood water drained June 14 reflood June 22.
3. Treatment dates: 3-4 lsr (June 20)
4. Watergrass was 3 leaf, ricefield bulrush was 1.5 inches and ducksalad was 1.5 inches on June 20.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 20: Air temperature 76^{o} F, wind 0-1 MPH from the south.

Table 9. Granite GR (DE 638) in Water

Treatement	Rate	Timing[3]	Percent injury[1]				% Weed Control[2]						Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHOR	SCPMU	HETLI	ECHOR	SCPMU	HETLI	
	(g ai/ha)		1st trt		2nd trt		24-Jun			14-Jul			4-Oct
Untreated[4]	---	---					10	5	4	10	9	14	4315
Stam 80 EDF + COC	4480 + 2.5% v/v	5lsg-1Till	0	0			6	11		80	100	79	5494
Clincher + COC	280 + 2.5% v/v	5lsg-1Till	0	0			6	23	13	91	66	25	5254
Cerano fb. Granite GR	673 fb. 40	0.5 lsr fb. 2-3 lsr	15	13	10	0	98	81	88	100	100	100	4586
Shark 40 DF fb. Granite	112 fb. 40	2-3 lsr fb. 2-3 lsr (day after Shark)	0	3			99	26	63	99	93	100	4929
Granite GR	40	2-3 lsr	0	0			98	79	50	100	100	100	5089
Granite GR fb. Stam 80 EDF + COC	40 fb. 4480 + 2.5% v/v	2-3 lsr fb. 5lsg-1Till	4	0	0	0	98	44	75	100	100	100	5131
Granite GR fb. Clincher + COC	40 fb. 280 + 2.5% v/v	2-3 lsr fb. 5lsg-1Till	1	0	0	0	100	81	100	100	100	100	5189
Granite GR fb. Clincher + Stam 80 EDF + COC	40 fb. 280 + 4480 + 2.5% v/v	2-3 lsr fb. 5lsg-1Till	0	0	0	0	98	78	99	100	100	100	4856
Granite GR fb. Clincher + COC fb. Stam 80 EDF + COI	40 fb. 280 + 2.5% v/v fb. 4480 + 2.5% v/	2-3 lsr fb. 5lsg-1Till fb. 1 WA 5 lsg	0	0	0	0	99	38	94	100	99	100	5329
Granite GR fb. Stam 80 EDF + COC fb. Grandstand	40 fb. 4480 + 2.5% v/v fb. 280	2-3 lsr fb. 5lsg-1Till fb. 3 Til	0	0	0	0	99	31	54	100	98	100	5255
Granite GR fb. Shark 40 DF	40 fb. 112	2-3 lsr fb. 1-2 till	0	0	0	0	99	26	85	100	84	100	5086
Bolero fb. Granite GR	4480 fb. 40	2-3 lsr	0	0			96	66	73	100	100	100	5004
Bolero fb. Granite GR fb. Stam 80 EDF + COC	4480 fb. 40 fb. 4480 + 2.5% v/v	2-3 lsr fb. 1 WA 5 lsg	0	0	0	0	99	73	63	100	100	100	5302
LSD (P=0.05)													656

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a continuous flood with 3-4 inches.
3. Treatment dates: 0.5 lsr (June 10), 2-3 lsr (June 15), 5 lsg-1 Till (June 29), 1 WA 5 lsg (July 7)
4. Watergrass was 1 leaf, ricefield bulrush was 0.75 inch, smallflower umbrellasedge was 0.5 inch and ducksalad was 1.0 inch on June 10.
   Watergrass was 2 leaf, ricefield bulrush was 1.0 inch, smallflower umbrellasedge was 1.0 inch and ducksalad was 1.0 inch on June 15.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches, smallflower umbrellasedge was 4 inches and ducksalad was 6-7 inches on June 29.
   Watergrass was 3 tiller, ricefield bulrush was 12 inches, smallflower umbrellasedge was 8 inches and ducksalad was flowering on July 7.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 10: Air temperature 69^{o} F, wind 5-6 MPH from the south, southwest.
   Weather conditions on June 15: Air temperature 80^{o} F, wind 2-5 MPH from the west, northwest.
   Weather conditions on June 29: Air temperature 71^{o} F, wind 1-3 MPH from the east, southeast.
   Weather conditions on July 7: Air temperature 70^{o} F, wind 2-3 MPH from the south.

Table 10. Granite GR continuous flood (yield)

			Percent injury[1]				% Weed Control[2]											
Treatement	**Rate**	**Timing[3]**	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	HETLI	ECHPH	SCPMU	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	Yield (lb/A)
	(g ai/ha)		1st trt		2nd trt		24-Jun			14-Jul				2-Aug				4-Oct
Untreated[4]	---	---					10	29	8	11	19	11	4	15	15	2	6	4475
Cerano fb. Clincher + COC	673 fb. 315 + 1.25% v/v	1-2 DAS fb. 3-4 lsr	60	11	0	0	98	31	60	100	0	53	65	99	2	0	83	4656
Cerano fb. Clincher + COC	1346 fb. 315 + 1.25% v/v	1-2 DAS fb. 3-4 lsr	85	13	14	0	95	16	80	100	0	86	50	98	0	0	85	3898
Granite GR fb. Clincher + COC	40 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	0	1	96	79	100	98	96	100	100	98	96	100	100	4981
Granite GR fb. Clincher + COC	80 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	3	4	98	95	98	100	100	100	100	99	100	100	100	5021
Bolero 15G fb. Clincher + COC	4480 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	0	0	98	45	49	100	23	9	93	100	33	91	35	4869
Bolero 15G fb. Clincher + COC	8960 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	0	0	94	59	80	100	63	71	98	99	55	100	75	4750
Ordram 15G fb. Clincher + COC	4480 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	0	0	96	81	43	99	58	0	25	100	55	89	10	4894
Ordram 15G fb. Clincher + COC	8960 fb. 315 + 1.25% v/v	7-12 DAS fb. 3-4 lsr	0	0	0	0	99	78	81	100	100	46	98	100	97	100	46	4958
Clincher + COC	315 + 1.25% v/v	3-4 lsr	0	0			91	21	24	100	23	10	31	96	25	33	25	5117
LSD (P=0.05)																		552

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a continuous flood with 3-4 inches.
3. Treatment dates: 1-2 DAS (June 6), 7-12 DAS (June 13), 3-4 lsr (June 21)
4. No weeds visible on June 6.
   Watergrass was 1-2 leaf, ricefield bulrush was 1.0 inch and ducksalad was 1.0 inch on June 13.
   Watergrass was 3 leaf, ricefield bulrush was 2 inches and ducksalad was 2 inches on June 21.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 6: Air temperature 66^{o} F, wind 5-6 MPH from the west.
   Weather conditions on June 13: Air temperature 80^{o} F, wind 2-5 MPH from the west, northwest.
   Weather conditions on June 21: Air temperature 68^{o} F, wind 2-4 MPH from the south, southeast.

Table 11. Shark H2O late seeding

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]												Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	
	(g ai/ha)		1st trt		2nd trt		24-Jun				14-Jul				2-Aug				
Untreated[4]	--	--					28	10	1	9	10	15	6	3	21	17	10	5	3851
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	PFS fb. 1-3 Til	0	0	0	0	70	16	79	63	99	0	60	25	96	0	73	70	3628
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	PFS fb. 1-3 Til	0	0	0	0	89	0	100	79	99	2	39	31	94	0	100	76	3228
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	PWE fb. 1-3 Til	0	0	0	0	64	50	98	23	98	48	6	25	93	6	85	38	5004
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	PWE fb. 1-3 Til	0	0	0	0	60	55	100	73	98	88	51	98	95	69	100	94	4897
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	1-2 Til fb. 1-3 Til	0	0	0	0	52	94	73	30	91	58	25	25	92	54	90	53	5326
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	63	68	50	68	90	50	63	98	93	37	92	79	5052
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	3-4 lsr fb. 1-3 Til	0	0	0	0	69	79	50	50	95	48	24	94	97	31	94	76	5310
Shark 40 DF (repackaged) F4826 (RP) 40 DF fb. Clincher + C(	224 fb. 315 + 1.25% v/v	3-4 lsr fb. 1-3 Til	0	0	0	0	71	52	79	81	100	23	13	50	95	19	99	54	4270
Shark 0.6mm granule F8426 (RD) 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	1-2 Til fb. 1-3 Til	0	0	0	0	58	53	79	60	98	40	24	50	96	20	58	41	4814
Shark 0.6mm granule F8426 (RD) 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	84	78	77	85	99	61	31	100	98	45	100	58	4783
Shark 2% Clay granule F8426 (ASC) 2G fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	64	95	102	61	98	61	35	100	97	37	100	86	4951
Londax fb. Clincher + COC	71 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	70	99	100	85	100	100	83	25	98	99	82	94	5221
Untreated	--	--					21	8	1	6	3	23	6	2	18	13	25	20	4565
LSD (P=0.05)																			557

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), PWE (pre-weed emergence), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a continuous flood with 3-4 inches.
3. Treatment dates: PFS (June 1), PWE (June 10), 1-2 lsr (June 14), 3-4 lsr (June 21), 1-3 Till (June 30)
4. No weeds visible on June 1 prior to flood.
   No weeds visible on June 10.
   Watergrass was 3 leaf, ricefield bulrush was 0.75 inch and ducksalad was 1 inch and redstem 0.25 inch on June 14.
   Watergrass was 3 leaf, ricefield bulrush was 2 inches and ducksalad was 2 inches on June 21.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches and ducksalad was 6-7 inches on June 30.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches and ducksalad was 6-7 inches on July 1.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 1: Air temperature 69^{o} F, wind 5-6 MPH from the north northwest.
   Weather conditions on June 10: Air temperature 80^{o} F, wind 2-5 MPH from the west, northwest.
   Weather conditions on June 14: Air temperature 80^{o} F, wind 3-5 MPH from the south, southwest.
   Weather conditions on June 21: Air temperature 68^{o} F, wind 2-4 MPH from the south, southeast.
   Weather conditions on June 30: Air temperature 85^{o} F, wind 2-3 MPH from the west, northwest.
   Weather conditions on July 1: Air temperature 85^{o} F, wind 2-3 MPH from the west, northwest.

Table 12. Drill seeded trial

			Percent injury[1]				Weed Control[2]										
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	ECHPH	SCPMU	CYPDI	LEFFA	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	Yield (lb/A)
	(g ai/ha)		1st trt		2nd trt		24-Jun	14-Jul				2-Aug					
Untreated[4]	---	---					41	79	1	1	33	59	2	1	11	44	1737
Prowl H2O	1120	DPRE	0	0			74	78	44	52	88	72	30	50	86	92	4574
Prowl H2O + Clincher + COC	1120 + 315 + 1.25 % v/v	EPE	4	0			90	91	19	25	98	93	0	38	91	96	5336
Prowl H2O + Super Wham + COC	1120 + 4484 + 1.25 % v/v	EPE	20	0			90	94	100	100	79	93	53	83	73	85	5295
Prowl H2O + Super Wham + Whip + COC	1120 + 4484 + 42 + 1.25 % v/v	EPE	28	0			91	88	100	100	93	88	53	83	79	85	4905
Prowl H2O + Regiment + NIS	1120 + 37 + 0.125 % v/v	EPE	1	0			69	71	69	75	33	84	55	58	58	72	4161
Prowl H2O + Regiment + Whip + NIS	1120 + 37 + 42 + 0.125 % v/v	EPE	5	0			75	78	25	25	91	75	26	42	94	94	4207
Prowl H2O fb. Super Wham + COC	1120 fb. 6726 + 1.25 % v/v	DPRE fb. 5-6 lsr	0	0	0	0	74	76	38	50	86	79	43	67	80	94	4841
Prowl H2O fb. Clincher + COC	1120 fb. 315 + 1.25 % v/v	DPRE fb. 5-6 lsr	0	0	0	0	86	100	0	25	100	99	4	41	87	97	4969
Prowl H2O fb. Regiment + NIS	1120 fb. 12.5 + 0.125% v/v	DPRE fb. PPF	0	0	1	0	81	91	100	100	93	95	54	90	95	98	5264
Abolish	4480	DPRE	0	0			64	6	81	100	93	28	86	100	99	64	3740
Abolish + Super Wham + COC	4480 + 4484 + 1.25 % v/v	EPE	39	0			93	88	100	100	95	92	62	92	91	98	5727
Regiment + Abolish	25 + 3360	EPE(3+lsr)	3	0			48	15	100	100	90	35	94	100	93	96	3508
Abolish fb. Super Wham + COC	4480 fb. 6726 + 1.25 % v/v	DPRE fb. 5-6 lsr	0	0	0	0	65	63	98	100	95	72	64	92	99	99	4581
Abolish fb. Clincher + COC	4480 fb. 315 + 1.25 % v/v	DPRE fb. 5-6 lsr	0	0	0	0	65	98	81	100	100	100	40	92	98	92	5806
Abolish fb. Regiment + NIS	4480 fb. 12.5 + 0.125% v/v	DPRE fb. PPF	0	0	4	0	53	94	100	100	96	95	83	100	98	97	5153
Regiment + Abolish fb. Clincher + COC	15 + 2240 fb. 315 + 1.25 % v/v	4-5 lsr fb. PPF	4	0	0	0	10	94	44	50	80	99	48	67	90	95	5733
Regiment + Abolish fb. Clincher + COC	25 + 3360 fb. 315 + 1.25 % v/v	4-5 lsr fb. PPF	1	0	0	0	10	94	98	100	94	100	79	92	93	94	5929
Shark fb. Clincher + COC	168 fb. 315 + 1.25% v/v	5-6 lsr fb. PPF	0	0	6	0	3	91	98	100	86	94	73	83	81	78	5711
Shark fb. Super Wham + COC	168 fb. 6726 + 1.25% v/v	5-6 lsr fb. PPF	4	0	4	0	29	83	100	100	14	94	92	100	67	38	3677
Shark fb. Regiment + NIS	168 fb. 12.5 + 0.125% v/v	5-6 lsr fb. PPF	1	0	5	0	21	84	100	100	5	73	98	100	69	38	3010
Super Wham + COC fb. Clincher + COC	6726 + 1.25% v/v fb. 315 + 1.25% v/v	5-6 lsr fb. PPF	0	0	3	0		99	25	50	96	98	32	67	73	72	5460
Clincher + COC fb. Superwham + COC	280 +1.25% v/v fb. 6726 + 1.25% v/v	5-6 lsr fb. PPF	6	0	4	0	4	99	63	75	99	99	79	79	100	91	5655
LSD (P=0.05)																	1057

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded June 3, 2005 with 150 lbs per acre of M206
2. Trial managed as a drill/dry seeded with initial flush on June 3, additional flush on June 13 and final flood on June 28.
3. Treatment dates: 4-5 lsr (June 22), 5-6 lsr (June 27), PPF (June 30)
4. No weeds visible on June 10.
   Watergrass was 1.5 leaf, ricefield bulrush was 0.5cm on June 15.
   Watergrass was 4 leaf on June 22.
   Watergrass was 1-2 tiller on June 27.
   Watergrass was 2+ tiller, sprangletop was 4 leaf on June 30.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 10: Air temperature 80^{o} F, wind 2-5 MPH from the west, northwest.
   Weather conditions on June 15: Air temperature 68^{o} F, wind 4-6 MPH from the south, southwest.
   Weather conditions on June 22: Air temperature 84^{o} F, wind 1-3 MPH from the west.
   Weather conditions on June 27: Air temperature 65^{o} F, wind 2-4 MPH from the south, southeast.
   Weather conditions on June 30: Air temperature 85^{o} F, wind 2-3 MPH from the west, northwest.

Table 13. IR5878 following Cerano

Treatment	Rate	Timing[3]	Percent injury[1]				% Weed Control[2]													Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	AMMCO	
	(g ai/ha)		1st trt		2nd trt		14-Jun				1-Jul					22-Jul					
Control (Cerano applied to entire basin)[4]	673	0.5 lsr	0	0			3	3	6	1	16	3	3	8	5	8	14	13	4	5	3846
Cerano fb IR5878 50WG + NIS	673 fb 73.5 + 0.15%v/v	0.5 lsr fb 3-4 lsr	0	0	0	0	63	65	61	75	46	98	70	76	93	44	91	48	19	13	4586
Cerano fb IR5878 50WG + SuperWHAM + NIS	673 fb 73.5 + 4484 + 0.15%v/v	0.5 lsr fb 3-4 lsr	0	0	0	0	88	100	96	100	70	100	100	85	98	51	98	100	86	100	5850
Cerano fb IR5878 50WG + Abolish	673 fb 73.5 + 3363	0.5 lsr fb 3-4 lsr	0	0	0	0	66	23	19	75	61	100	84	81	98	48	65	39	19	54	5386
Cerano fb IR5878 50WG + Prowl H2O + NIS	673 fb 73.5 + 1171 + 0.15%v/v	0.5 lsr fb 3-4 lsr	0	0	0	0	44	13	0	0	64	84	31	74	100	40	89	19	0	0	4561
LSD (P=0.05)																					1400

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Control weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a pinpoint flood after initial water hold for Cerano. Water drained June 9 and final flood on June 13.
3. Treatment dates: 0.5 lsr (May 28), 3-4 lsr (June 10)
4. Watergrass was 2 leaf, bulrush was 3 leaf, smallflower was 3 leaf, ducksalad was 4 leaf and redstem was 3 leaf on May 28.
   Watergrass was 1-2 tiller, ricefield bulrush was 3-4 leaf, smallflower was 3-4 leaf, ducksalad was 4 leaf and redstem was 3 leaf on June 10.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 28: Air temperature 76^{o} F, wind 10-22 MPH from the south, southeast.
   Weather conditions on June 10: Air temperature 73^{o} F, wind 1-2 MPH from the south, southwest.

Table 14. IR5878 Leather's method

			% injury[1]		% Weed Control[2]										
Treatment	**Rate**	**Timing[3]**	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEEFA	Yield (lb/A)
	(g ai/ha)		1st trt		1-Jul					22-Jul					
Untreated					76	3	23	6	6	58	14	33	1	3	830
IR5878 50WG + NIS	73.5 + 0.15%v/v	Prior to perm. Flood	1	0	58	95	9	98	98	15	96	0	50	0	1000
IR5878 50WG + NIS	147 + 0.15%v/v	Prior to perm. Flood	0	0	56	93	6	98	91	28	96	0	50	0	1298
IR5878 50WG + Clincher + NIS	73.5 +280 +0.15%v/v	Prior to perm. Flood	1	0	70	93	4	100	76	43	98	0	50	13	1890
IR5878 50WG + SuperWHAM + NIS	73.5 + 4484 + 0.15%v/v	Prior to perm. Flood	3	0	58	100	76	73	96	33	98	69	25	0	2967
IR5878 50WG + Abolish	73.5 + 3363	Prior to perm. Flood	0	0	59	98		100	100	30	98	0	100	0	1453
IR5878 50WG + Prowl H2O + NIS	73.5 + 1171 + 0.15%v/v	Prior to perm. Flood	0	0	69	98	44	100	100	20	95	16	100	0	2252
Granite SC + Clincher + COC	35 + 280 + 0.15% v/v	Prior to perm. Flood	0	0	69	100	66	75	75	61	74	25	75	25	3315
Clincher + COC	280 + 0.15% v/v	Prior to perm. Flood	0	0	58	41	13	38	54	13	0	0	0	0	1362
LSD (P=0.05)															1566

[1] % Injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop) BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a Leathers method with flood water dropped after seeding and held with a skim until final flood on June 16.
3. Treatment dates: Prior to perm. Flood (June 15)
4. Watergrass was 1-2 tiller, bulrush was 3 leaf, smallflower was 3 leaf, arrowhead 3 leaf, waterhyssop 4-6 leaf, sprangletop 2-3 leaf on June 15.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 15: Air temperature 65^{o} F, wind 1-3 MPH from the southwest.

Table 15. IR5878 pinpoint flood

Treatment	Rate	Timing[3]	% injury[1]		% Weed Control[2]														Yield (lb/A)
			7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	LEFFA	AMMCO	
	(g ai/ha)		1st trt		14-Jun				1-Jul					22-Jul					
Untreated					25	11	18	3	59	8	6	9	5	40	14	13	9	1	2007
IR5878 50WG + NIS	73.5 + 0.15%v/v	3-4 lsr	0	0	15	16	16	0	36	99	18	85	88	18	100	23	18	25	2342
IR5878 50WG + NIS	147 + 0.15%v/v	3-4 lsr	0	0	43	55	51	50	56	98	50	98	100	11	100	50	37	50	1222
IR5878 50WG + Clincher + NIS	73.5 + 280 +0.15%v/v	3-4 lsr	0	0	34	44	48	38	45	95	60	93	100	28	100	61	70	50	731
IR5878 50WG + NIS fb. Clincher + COC	73.5 + 0.15%v/v fb. 280 + 1.25%v/v	3-4 lsr fb. 3-4 lsr	0	0	43	16	24	0	58	98	58	85	84	34	100	43	98	44	3124
Granite SC + Clincher + COC	40.4 + 280 + 1.25% v/v	3-4 lsr	3	1	40	41	51	30	91	100	95	100	100	89	100	76	98	98	3313
IR5878 50WG + SuperWHAM + NIS	73.5 + 3363 (4484) + 0.15%v/v	3-4 lsr	0	0	46	95	94	98	69	100	100	93	100	48	100	100	68	100	3088
IR5878 50WG + Abolish	73.5 + 3363	3-4 lsr	0	0	43	61	59	94	26	100	71	88	100	19	99	70	69	88	1399
IR5878 50WG + Prowl H2O + NIS	73.5 + 1171 + 0.15%v/v	3-4 lsr	0	0	13	23	43	27	34	98	45	76	100	18	100	44	25	75	433
Regiment + Abolish	30 +3363	3-4 lsr	0	0	54	68	73	54	84	98	95	96	100	78	78	94	48	100	4293
LSD (P=0.05)																			2665

[1] % Injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a pinpoint flood, water dropped June 5 and final flood on June 13.
3. Treatment dates: 3-4 lsr (June 10)
4. Watergrass was 1-2 tiller, bulrush was 3 leaf, smallflower was 3 leaf, ducksalad was 4 leaf, redstem was 3 leaf on June 10.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 10: Air temperature 71^{o} F, wind 1-2 MPH from the south.

Table 16. IR5878 perm. Flood for Phyto.

Treatment	Rate	Timing[3]	Percent injury[1]						% Weed Control[2]											Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	HETLI	ECHPH	SCPMU	HETLI	AMMCO	
	(g ai/ha)		1st trt		2nd trt		3rd trt		14-Jun				1-Jul			22-Jul				
Untreated									13	16	26	4	30	11	9	31	19	16	5	1467.4
Cerano	673	0.5 lsr	5	5					19	25	100	0	46	0	6	48	16	0	25	2931.5
Cerano + IR5878 0.5GR fb Clincher + COC	673 + 74.5 fb 315 + 0.15%v/v	0.5 lsr fb 1-3 Till	4	4	0	0			83	38	100	98	96	25	38	100	18	44	25	5809.4
Cerano + IR5878 0.5GR fb Clincher + COC	673 + 149 fb 315 + 0.15%v/v	0.5 lsr fb 1-3 Till	6	6	0	0			80	61	100	100	94	38	86	100	36	31	0	5612
Cerano + IR5878 0.5GR fb Clincher + COC	1346 + 149 fb 315 + 0.15%v/v	0.5 lsr fb 1-3 Till	5	5	0	0			68	91	100	75	96	28	83	100	54	50	0	6264.9
Cerano fb IR5878 0.5GR fb Clincher + COC	673 fb 74.5 fb 315 + 0.15%v/v	0.5 fb 1-2 lsr fb 1-3 Till	5	5	5	6	0	0	44	51	100	100	78	0	64	93	44	38	0	5929.1
Cerano fb IR5878 0.5GR fb Clincher + COC	673 fb 149 fb 315 + 0.15%v/v	0.5 fb 1-2 lsr fb 1-3 Till	5	5	2	4	0	0	44	60	75	70	93	90	64	98	80	49	0	7219.7
Cerano fb IR5878 0.5GR fb Clincher + COC	673 fb 84 fb 315 + 0.15%v/v	0.5 fb 1-2 lsr fb 1-3 Till	4	4	0	3	0	0	65	73	100	98	79	25	33	98	29	6	6	6558.9
Granite GR	40.4	2-3 lsr	4	5					74	53	75	63	98	84	95	95	89	40	0	6516.7
LSD (P=0.05)																				1161.4

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a continuous flood.
3. Treatment dates: 0.5 lsr (May 28), 1-2 lsr (June 2), 2-3 lsr (June 6), 1-3 Till (June 27)
4. Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 28.
   Watergrass was 3 leaf, bulrush was 3 leaf, smallflower was 3 leaf, ducksalad was 2 leaf on June 2.
   Watergrass was 4 leaf, bulrush was 4 leaf, smallflower was 4 leaf, ducksalad was 3 leaf on June 6.
   Watergrass was 2 tiller, bulrush was 5 leaf, smallflower was 5 leaf, ducksalad was 6 inches, redstem was 8-10 leaf on June 27.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 28: Air temperature 76^{o} F, wind 10-22 MPH from the south, southeast.
   Weather conditions on June 2: Air temperature 80^{o} F, wind 15 MPH from the north, northwest.
   Weather conditions on June 6: Air temperature 59^{o} F, wind 10 MPH from the northwest.
   Weather conditions on June 27: Air temperature 64^{o} F, wind 2-5 MPH from the south, southeast.

Table 17. IR5878 Perm. Flood for Program

			Percent injury[1]						% Weed Control[2]												
Treatment	**Rate**	**Timing[3]**	7 DAT	14 DAT	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	Yield (lb/A)
	(g ai/ha)		1st trt		2nd trt		3rd trt		14-Jun				1-Jul					22-Jul				
Untreated									17	11	2	1	48	8	1	5	20	23	20	1	3	1796
Cerano+ IR5878 0,5GR fb SuperWHAM + COC	673 + 74.5 fb 6726 + 1.25%v/v	0.5 lsr fb 2-3 Till	4	0	0	0			63	55	93	100	76	83	100	79	91	73	99	100	94	6049
Cerano fb IR5878 0,5GR fb SuperWHAM + COC	673 fb 74.5 fb 6726 + 1.25%v/v	0.5 lsr fb 1-2 lsr fb 2-3 Till	4	0	13	9	0	0	50	74	75	100	74	95	100	98	91	78	88	100	75	5188
IR5878 0,5GR fb SuperWHAM + COC	74.5 fb 6726 + 1.25%v/v	0.5 lsr fb 2-3 Till	3	1	0	0			38	76	98	100	54	91	100	88	93	36	100	100	88	4038
IR5878 0,5GR fb SuperWHAM + COC	74.5 fb 6726 + 1.25%v/v	1-2 lsr fb 2-3 Till	3	4	0	0			69	90	75	100	63	100	100	100	99	58	100	100	100	4769
Cerano fb Granite GR fb Super WHAM + COC	673 fb 40.4 fb 6726 + 1.25%v/v	0.5 lsr fb 2-3 lsr fb 2-3 Till	8	6	13	6	0	0	98	98	100	100	96	100	100	100	100	98	98	100	100	5467
Granite GR fb SuperWHAM + COC	40.4 fb 6726 + 1.25%v/v	2-3 lsr fb 2-3 Till	3	5					61	94	100	109	95	100	100	100	100	86	96	100	100	5441
LSD (P=0.05)																						1584

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad), LEFFA (Sprangletop), BAORO (Waterhyssop) AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), lsr (leaf stage of rice), Til (tillers of rice), DPRE (pre emergent), EPE (early post emergent), PPF (post permanent flood).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a continuous flood.
3. Treatment dates: 0.5 lsr (May 28), 1-2 lsr (June 2), 2-3 lsr (June 6), 2-3 Till (June 29)
4. Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 28.
   Watergrass was 3 leaf, bulrush was 3 leaf, smallflower was 3 leaf, ducksalad was 2 leaf on June 2.
   Watergrass was 4 leaf, bulrush was 4 leaf, smallflower was 4 leaf, ducksalad was 3 leaf on June 6.
   Watergrass was 2 tiller, bulrush was 5 leaf, ducksalad was 6 inches, waterhyssop 3-4 inches on June 29.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 28: Air temperature 76^{o} F, wind 10-22 MPH from the south, southeast.
   Weather conditions on June 2: Air temperature 80^{o} F, wind 15 MPH from the north, northwest.
   Weather conditions on June 6: Air temperature 59^{o} F, wind 10 MPH from the northwest.
   Weather conditions on June 29: Air temperature 84^{o} F, wind 1-2 MPH from the southeast.

Table 18. Wilbur-Ellis WH 105

			Percent injury[1]				Weed Control[2]													
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	LEFFA	ECHPH	SCPMU	CYPDI	HETLI	Yield (lb/A)
	(g ai/ha)		1st trt		2nd trt		14-Jun				1-Jul						22-Jul				
Untreated[4]	--	--					18	29	3	6	39	29	0	24	1	8	48	48	0	6	559
W.H. 105	600	DOS-0.5 lsr	4	0			76	0	100	63	91	13	100	56	100	100	93	6	100	0	4532
W.H. 105	700	DOS-0.5 lsr	5	0			65	30	100	100	90	19	100	81	100	73	98	23	100	0	4903
W.H. 105	800	DOS-0.5 lsr	8	0			78	45	100	100	85	25	100	50	100	100	84	0	100	43	3306
W.H. 105 fb. Bolero	600 fb. 4480	DOS-0.5 lsr fb. 1-2 lsr	5	0	0	5	80	25	100	63	95	19	100	56	100	100	100	13	100	18	5211
W.H. 105 fb. Shark	600 fb. 224	DOS-0.5 lsr fb. 2-3 lsr	5	0	1	0	66	0	75	91	91	0	75	46	100	98	98	0	100	13	4374
W.H. 105 fb. Shark	400 fb. 150	DOS-0.5 lsr fb. 2-3 lsr	4	0	1	1	63	0	75	50	73	0	100	0	75	75	81	0	100	13	2713
W.H. 105 + Cerano	600 + 673	DOS- 0.5 lsr fb. 0.5 lsr	5	0	0	8	95	30	75	98	99	13	100	71	100	100	100	18	100	23	4720
Abolish fb. W.H. 105	4480 fb. 600	PFS fb. DOS-0.5 lsr	0	4	5	0	93	30	75	100	96	31	100	55	100	100	100	6	100	45	5496
Abolish fb. W.H. 105	3000 fb. 400	PFS fb. DOS-0.5 lsr	0	0	4	0	93	13	75	100	96	25	100	66	100	100	100	13	100	35	5154
Abolish fb. Cerano fb. W.H. 105	4480 fb. 673 fb. 600	PFS fb. 0.5 lsr fb. 0.5 lsr	0	4	0	3	99	36	75	100	99	58	100	56	100	98	100	64	100	13	6878
Abolish fb. Cerano fb. W.H. 105	4480 fb. 336 fb. 600	PFS fb. 0.5 lsr fb. 0.5 lsr	0	4	0	10	93	58	75	100	99	68	100	78	75	100	100	68	100	55	6824
W.H. 105 fb. SuperWham + COC	600 fb. 6726 + 1.24% v/v	DOS-0.5 lsr fb. 1-3 Till	5	0	0	0	65	0	75	63	96	53	100	66	75	100	96	83	100	45	6771
W.H. 105 + Cerano	600 + 673	0.5 lsr	0	9			88	35	75	75	96	44	100	13	100	98	96	64	75	0	5624
W.H. 405	600 + 673	0.5 lsr	3	0			56	0	75	13	83	0	75	25	100	50	93	0	100	0	2426
W.H. 305	--	--	19	4			64	20	75	13	88	8	100	15	75	25	98	0	100	0	3252
LSD (P=0.05)																					1501

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a continuous flood.
3. Treatment dates: PFS (May 23), DOS (May 23), 0.5 lsr (May 28-29), 1-2 lsr (June 2), 2-3 lsr (June 7), 1-3 Till (June 27)
4. No weeds visible on May 18.
   Watergrass was 1 leaf on May 23.
   Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 28.
   Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 29.
   Watergrass was 3 leaf, bulrush was 3 leaf, smallflower was 3 leaf, ducksalad was 2 leaf on June 2.
   Watergrass was 3-4 leaf, bulrush was 3-4 leaf, smallflower was 3-4 leaf, ducksalad was 3 leaf on June 7.
   Watergrass was 2 tiller, bulrush was 3-5 leaf, smallflower was 4-5 leaf, redstem was 8 leaf, ducksalad was 6 inches, waterhyssop was 6 inches on June 30.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 18: Air temperature 56^{o} F, wind 4-6 MPH from the southeast.
   Weather conditions on May 23: Air temperature 77^{o} F, wind 5 MPH from the west, northwest.
   Weather conditions on May 28: Air temperature 76^{o} F, wind 15 MPH from the south, southeast.
   Weather conditions on May 29: Air temperature 62^{o} F, wind 2-4 MPH from the southeast.
   Weather conditions on June 2: Air temperature 80^{o} F, wind 15 MPH from the north, northwest.
   Weather conditions on June 7: Air temperature 59^{o} F, wind 1-2 MPH from the west, southwest.
   Weather conditions on June 27: Air temperature 64^{o} F, wind 2-5 MPH from the south, southeast.

Table 19. Gowan GWN-3040 Pinpoint

				% injury[1]		Weed Control[2]														
Treatment	Rate	Timing[3]	Date	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	Yield (lb/A)
	(g ai/ha)			1st trt		14-Jun				1-Jul					22-Jul					
Untreated[4]	--	--				19	10	6	2	34	1	1	9	4	21	10	5	4	5	1975
GWN-3040 + 0.25% v/v NIS	70 + 0.25% v/v	3-5 lsr	10-Jun	0	0	8	19	26	3	90	100	81	63	85	59	100	100	27	25	4605
GWN-3040 + SuperWham + 0.25% v/v NIS	70 + 4484 + 0.25% v/v	3-5 lsr	10-Jun	0	0	71	100	100	98	94	100	100	100	100	75	100	100	75	63	5225
GWN-3040 + SuperWham + 0.25% v/v NIS	70 + 6726 + 0.25% v/v	1-2 Til	23-Jun	8	0	3	30	40	35	60	100	100	100	100	71	100	100	75	25	3594
GWN-3040 + Grandstand + 0.25% v/v NIS	70 + 280 + 0.25% v/v	1-2 Til	23-Jun	0	0	6	25	34	8	69	100	100	94	100	16	100	70	70	44	2123
GWN-3040 + Regiment + 0.25% v/v NIS	70 + 30 + 0.25% v/v	1-2 Til	23-Jun	6	0	0	33	44	29	66	100	98	100	100	94	100	96	100	0	6353
LSD (P=0.05)																				1411

[1] % Injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a pinpoint flood with water drained June 5 and permanent flood beginning June 13.
3. Treatment dates: 3-5 lsr (June 10), 1-2 Till (june 23)
4. Watergrass was 1-2 tiller, bulrush was 3-4 leaf, smallflower was 3-4 leaf, ducksalad was 4 leaf, redstem was 3 leaf June 10. Watergrass was 2-3 tiller, bulrush was 4 leaf, smallflower was 4 leaf, ducksalad was 2-3 leaf on June 23.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on June 10: Air temperature 73^{o} F, wind 2 MPH from the west, southwest. Weather conditions on June 23: Air temperature 66^{o} F, wind 1-2 MPH from the southeast.

Table 20. Gowan GWN-3040 & GWN 3039

			Percent injury[1]				Weed Control[2]														
Treatment	Rate	Timing[3]	7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	BAORO	ECHPH	SCPMU	CYPDI	HETLI	LEFFA	Yield (lb/A) 14% moisture
	(g ai/ha)		1st trt		2nd trt		14-Jun				1-Jul						22-Jul					7-Oct
Untreated[4]	--	--					25	26	5	6	33	19	1	23	0	4	44	26	2	10	0	1511.47
GWN-3040	35	1-3 lsr	6	4			39	68	100	50	43	98	100	19	75	44	41	100	50	31	75	2566.71
GWN-3040	70	1-3 lsr	8	4			71	65	100	76	89	100	100	59	75	48	79	100	96	46	75	5396.67
GWN-3039	35 + 154	1-3 lsr	6	3			50	35	100	59	66	100	100	15	75	48	65	100	73	29	50	4440.28
Dicamba	154	1-3 lsr	1	0			53	0	100	78	25	0	100	44	100	0	44	0	94	53	100	2569.63
Dicamba	325	1-3 lsr	4	0			13	0	100	19	13	0	100	0	100	25	29	6	100	48	100	1717.39
Dicamba	650	1-3 lsr	4	1			46	0	100	71	19	0	100	25	100	52	33	0	88	24	100	3009.54
GWN-3040 + Dicamba	35 + 325	1-3 lsr	3	1			50	53	75	70	33	98	100	15	100	100	34	98	50	43	25	2280.88
GWN-3040 + Dicamba	35 + 650	1-3 lsr	4	1			80	75	100	51	63	100	100	19	100	75	69	100	63	30	100	4609.18
GWN-3040 + Shark + 0.25% v/v NIS	70 + 224 + 0.25% v/v	1-3 lsr	6	1			85	66	100	73	78	100	100	36	75	100	68	102	100	24	0	5153.01
GWN-3040 + Abolish + 0.25% v/v NIS	70 + 4480 + 0.25% v/v	1-3 lsr	8	0			86	75	100	93	88	100	100	76	100	100	85	100	100	64	100	6364.9
Cerano	673	0.5 - 1 lsr	10	6			90	0	100	69	74	25	100	25	100	25	93	0	69	28	100	4439.54
Cerano + GWN-3040	673 + 35	0.5 - 1 lsr	12	8			81	86	100	90	69	100	100	60	100	98	74	96	0	66	75	5205.81
Cerano fb. GWN-3040	673 fb. 70	0-1 lsr fb. 1-3 lsr	8	13	13	6	89	46	100	76	78	100	100	38	100	100	85	100	38	35	100	5875.79
GWN-3040	70	0.5 - 1 lsr	4	5			83	43	100	91	59	100	100	70	100	73	69	100	100	81	75	4351.97
GWN-3040	35	0.5 - 1 lsr	4	3			80	50	100	95	59	98	100	53	100	75	71	98	63	44	75	4650.83
LSD (P=0.05)																						1928.7

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded May 22, 2005 with 150 lbs per acre of M205
2. Trial managed as a continuous flood.
3. Treatment dates: 0.5 lsr (May 28-29), 1-3 lsr (June 7)
4. Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 28.
   Watergrass was 2-3 leaf, bulrush was 1 leaf, smallflower was 1 leaf on May 29.
   Watergrass was 3 leaf, bulrush was 3 leaf, smallflower was 4 leaf, california arrowhead was 4 leaf, waterhyssop was 3 leaf on June 7.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 28: Air temperature 76^{o} F, wind 22 MPH from the south, southeast.
   Weather conditions on May 29: Air temperature 62^{o} F, wind 7 MPH from the southeast.
   Weather conditions on June 7: Air temperature 72^{o} F, wind 2-3 MPH from the south.

Table 21. Shark H2O Early seeding

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]								Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	HETLI	ECHPH	SCPMU	CYPDI	SAGMO	BAORO	
	(g ai/ha)		1st trt		2nd trt		8-Jun			27-Jun					
Untreated[4]	--	--					100	1	1	70	1	1	27	10	NA
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	PFS fb. 1-3 Til	0	0	0	0	21	0	100	9	50	3	66	9	NA
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	PFS fb. 1-3 Til	0	0	0	0	21	0	100	4	25	6	56	15	NA
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	PWE fb. 1-3 Til	0	0	0	0	20	50	75	10	50	28	100	0	NA
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	PWE fb. 1-3 Til	0	0	0	0	40	50	100	20	100	100	75	85	NA
Shark 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	1-2 Til fb. 1-3 Til	0	0	0	0	25	100	100	10	28	25	45	43	NA
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	28	75	100	13	98	100	98	88	NA
Shark 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	3-4 lsr fb. 1-3 Til	0	0	0	0	23	50	100	4	75	100	96	84	NA
Shark 40 DF (repackaged) F4826 (RP) 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	3-4 lsr fb. 1-3 Til	0	0	0	0	19	25	100	5	69	75	64	85	NA
Shark 0.6mm granule F8426 (RD) 40 DF fb. Clincher + COC	112 fb. 315 + 1.25% v/v	1-2 Til fb. 1-3 Til	0	0	0	0	20	100	100	11	75	70	25	29	NA
Shark 0.6mm granule F8426 (RD) 40 DF fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	28	100	100	6	100	100	100	100	NA
Shark 2% Clay granule F8426 (ASC) 2G fb. Clincher + COC	224 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	23	100	100	9	100	100	95	96	NA
Londax fb. Clincher + COC	71 fb. 315 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	0	0	40	75	50	9	100	100	6	73	NA
Untreated	--	--	0	0	0	0	100	1	1	73	1	2	1	11	NA

NA

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), PWE (prior to weed emergence), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded April 29, 2005 with 150 lbs per acre of M 104
2. Trial managed as a continuous flood with 3-4 inches.
3. Treatment dates: PFS (April 27), PWE (May 6), 1-2 lsr (May 13), 3-4 lsr (May 23), 1-3 Till (May 24)
4. No weeds visible on April 27 prior to flood.
   Watergrass was 1 leaf on May 6.
   Watergrass was 2 leaf on May 13.
   Watergrass was 4 leaf, ricefield bulrush was 3 leaf and california arrowhead was 3 leaf on May 23.
   Watergrass was 4-5 leaf, ricefield bulrush was 3 leaf, california arrowhead was 4 leaf and waterhyssop was 1.5 inches on May 24.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches on June 4.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on April 27: Air temperature 69^{o} F, wind 5-6 MPH from the north northwest.
   Weather conditions on May 6: Air temperature 64^{o} F, wind 5-6 MPH from the southwest.
   Weather conditions on May 13: Air temperature 75^{o} F, wind 0-1 MPH from the west.
   Weather conditions on May 23: Air temperature90^{o} F, wind 1-2 MPH from the southwest.
   Weather conditions on May 24: Air temperature 84^{o} F, wind 3-5 MPH from the northwest.
   Weather conditions on June 4: Air temperature 85^{o} F, wind 2-3 MPH from the south
7. No harvest due to poor watergrass control.

Table 22. Continuous flood Red soil

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]									Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	BAORO	HETLI	ECHPH	SCPMU	CYPDI	HETLI	
	(g ai/ha)		1st trt		2nd trt		8-Jun					27-Jun				
Untreated[4]	--	--					59	2	1	2	20	90	1	1	1	0
Cerano fb. Shark	673 fb. 224	DOS fb. 2-3 lsr	0	0	3	0	93	100	100	100	100	94	75	100	100	4819
Cerano fb. Shark	336 fb. 224	DOS fb. 2-3 lsr	0	0	0	0	71	100	100	98	100	43	100	100	100	3877
Bolero fb. Superwham + COC	4480 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	3	0	54	100	100	48	99	70	100	100	100	3947
Bolero fb. Superwham + COC	2240 fb. 6726 + 1.25% v/v	1-2 lsr fb. 1-3 Til	0	0	6	0	45	100	100	23	99	65	100	100	100	4502
Abolish fb. Superwham + COC	4480 fb. 6726 + 1.25% v/v	PFS bf. 1-3 til	0	0	5	0	45	100	75	0	94	71	100	100	100	4076
Abolish fb. Superwham + COC	2240 fb. 6726 + 1.25% v/v	PFS bf. 1-3 til	0	0	5	0	64	100	100	50	89	76	100	100	100	4435
Granite GR fb. SuperWham + Whip + COC	40 fb. 6726 + 32 + 1.25% v/v	2-3 lsr fb. 1Till	0	5	4	0	91	100	100	100	100	99	100	100	100	5148
Granite GR fb. SuperWham + Whip + COC	20 fb. 6726 + 32 + 1.25% v/v	2-3 lsr fb. 1Till	0	0	3	0	74	75	75	38	66	81	100	100	100	4506
LSD (P=0.05)																1074

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), PWE (prior to weed emergence), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded April 29, 2005 with 150 lbs per acre of M 104
2. Trial managed as a continuous flood with 3-4 inches.
3. Treatment dates: PFS (April 27), DOS (April 29), 1-2 lsr (May13), 2-3 lsr (May 16), 1-3 Till (June 4)
4. No weeds visible on April 27 prior to flood.
   No weeds visible on April 29
   Watergrass was 2 leaf on May 13.
   Watergrass was 0.5 leaf, smallflower umbrellasedge was 2 leaf, ducksalad was 2 leaf, waterhyssop was 2 leaf on May 16.
   Watergrass was 1-2 tiller, ricefield bulrush was 5 inches on June 4.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on April 27: Air temperature 69^{o} F, wind 5-6 MPH from the north northwest.
   Weather conditions on May 6: Air temperature 64^{o} F, wind 5-6 MPH from the southwest.
   Weather conditions on May 13: Air temperature 75^{o} F, wind 0-1 MPH from the west.
   Weather conditions on May 23: Air temperature90^{o} F, wind 1-2 MPH from the southwest.
   Weather conditions on May 24: Air temperature 84^{o} F, wind 3-5 MPH from the northwest.
   Weather conditions on June 4: Air temperature ^{o} F, wind MPH from the west, northwest.

Table 23. Pinpoint Trial Red soil

Treatment	Rate	Timing[3]	Percent injury[1]				Weed Control[2]				Yield (lb/A)
			7 DAT	14 DAT	7 DAT	14 DAT	ECHPH	SCPMU	CYPDI	HETLI	
	(g ai/ha)		1st trt		2nd trt		27-Jun				
Untreated[4]							91	1	1	1	0
Regiment + NIS fb. SuperWham + Whip + COC	44.5 + .125% v/v fb. 6726 + 42 + 1.25% v/v	4-5 lsr fb. 1-3 Til	0	0	5	4	89	100	100	100	4343
Regiment + NIS fb. SuperWham + Whip + COC	30 + .125% v/v fb. 6726 + 42 + 1.25% v/v	4-5 lsr fb. 1-3 Til	0	0	5	4	84	100	100	100	3748
Prowl H20 + Super Wham + COC	1120 + 4484 + 1.25% v/v	4-5 lsr	0	0			33	100	100	100	945
Prowl H20 + Super Wham + COC	560 + 4484 + 1.25% v/v	4-5 lsr	0	0			13	100	100	100	1548
Regiment + Abolish	37 + 3360	4-5 lsr	0	0			24	100	75	100	2053
Regiment + Abolish	30 + 2240	4-5 lsr	0	0			25	100	75	100	2210
LSD (P=0.05)											1278

[1] Percent injury (percent injury to rice)

[2] ECHPH (Late watergrass), SCPMU (Rice field bulrush), CYPDI (Small flower Umbrellaplant), HETLI (Duck salad) LEFFA (Sprangletop), BAORO (Waterhyssop), AMMCO (Redstem), SAGMO (California arrowhead)

[3] fb. (followed by), PFS (pre-flood surface), PWE (prior to weed emergence), lsr (leaf stage of rice), Til (tillers of rice).

[4] Untreated weed control values represent % cover by the respective weed species

Trial Information

1. Trial seeded April 29, 2005 with 150 lbs per acre of M 104
2. Trial managed as a pinpoint flood.
3. Treatment dates: 4-5 lsr (May 24), 1-3 Till (June 4)
4. Watergrass was 4-5 leaf, bulrush was 3 leaf, california arrowhead was 4 leaf, and waterhyssom was 1.2 inches on May 24. Watergrass was 1-2 tiller, ricefield bulrush was 5 inches on June 4.
5. Spray applications made with 20 gallons/acre using 8003 nozzles.
6. Weather conditions on May 24: Air temperature 84^{o} F, wind 3-5 MPH from the northwest.
   Weather conditions on June 4: Air temperature ^{o} F, wind MPH from the west, northwest.

Table 24. Dates of water management procedures and planting in 2004 and 2005.

	Weed emergence flush		Plant		Permanent flood	
Treatment	2004	2005	2004	2005	2004	2005
1	-	-	May 15	May 30	May 14	May 28
2	-	-	May 15	May 30	June 5	June 28
3	May 14 & 26	May 5-11	June 4	May 30	June 2	May 28
4	May 14 & 26	May 5-11	June 4	May 30	June 2	May 28
5	May 14 & 26	May 5-11	June 4	May 30	June 23	June 28

Table 25. Rice and weed densities (plants m^{-2}) associated with each rice establishment system in 2004 and 2005. Weed densities were measured in areas that did not receive herbicide treatments after rice emergence, but the stale-seedbed treatments (3-5) were exposed to glyphosate prior to rice planting. Locations of these weedy check areas were similar each year.

	Treatment									
	1		2		3		4		5	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Rice	278	208	225	223	209	241	225	224	230	241
Echinochloa	0	0	41	79	0	0	0	0	<1	10
Sprangletop	0	0	3	5	1	0	0	0	<1	25
Smallflower	198	1,480	3	4	8	645	7	70	6	1
Bulrush	1	<1	0	0	0	<1	0	2	0	0
Redstem	32	70	0	0	1	70	0	70	0	0