THE RESPONSE OF NATIVE HAWAIIAN GRASSES TO SEQUENTIAL APPLICATION OF PRE AND POSTEMERGENCE HERBICIDES.

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Introduction

Two experiments were conducted at the Natural Resources Plant Materials (NRCS) Center on Molokai in 2001 to determine the response of two native Hawaiian grasses and weeds to sequential applications of both pre and postemergence herbicides. The low rate of all herbicides was set at a level that is reported to provide commercially acceptable weed control on the produce label.

Materials and Methods

Seeds of emoloa (*Eragrostis variabilis*, NRCS accession # 9079729*)* and pili grass (*Heteropogon contortus*, NRCS accession # 9079683) were planted to 72-cell trays on 03/20/01 and 04/10/01, respectively. Grass seedlings were planted to experimental field plots on 07/17/01. A single row of each grass type was planted down the middle of experimental plots that were 6 ft. X 15 ft. in size. The rows of grass had the same orientation for all treatments within an experimental block. However, orientation of the grass rows was randomized between blocks.

Preemergence experiment:

Table 1 contains the description of the herbicide treatments that were applied to grass transplants. Herbicides were applied to transplanted grass on 07/18/01, 1 day after planting. Overhead irrigation was applied to plots on an as needed basis to allow for maximum growth of grasses and weeds. A second herbicide application was made on 08/21/01, 34 days after the initial spray application. On 09/04/01, weeds removed from herbicides treated plots as well as plots designated "weeded non-chemical". On 10/31/01 pili (2 clumps) and emoloa (3 clumps) grass clumps from 2 of 4 replications were cut at the soil surface, bagged and dried for determination of biomass accumulation. On 10/31/01, samples for the remaining 2 replications were collected from experimental plots, see Figure 1 for plot map.

Postemergence experiment

Table 4 contains the description of the herbicide treatments that were applied to grass transplants. Herbicides were applied to transplanted grass on 08/07/01; 21 days after grasses were planted, see Figure 2 for plot map. Overhead irrigation was applied to plots on an as needed basis to allow for maximum growth of grasses and weeds. A second herbicide application was made on 08/21/01, 14 days after the initial spray application. On 09/04/01, weeds removed from herbicide plots. On 10/17/01 (43 days after the second and 71 days after the first herbicide application) pili (2 clumps) and emoloa (3 clumps) grass clumps were cut at the soil surface, bagged and dried for determination of biomass accumulation.

Results

Preemergence experiment:

Data for mean dry weight accumulation of both pili grass and emoloa in response to two sequential preemergence herbicide applications are contained in **Table 2**. The analysis of the dry weight data indicated that there was not a significant interaction between the factors of herbicide treatment and grass type. The analysis indicates that both grasses responded in a similar way to herbicide application. **Table 3** contains the mean dry weight accumulation for both grasses. These means are provided to illustrate that the difference in dry weight in response to herbicide treatments was not significantly different between the two grasses.

Postemergence experiment

Data for mean dry weight accumulation of both pili grass and emoloa in response to two sequential herbicide applications are contained in **Table 5**. The analysis of the dry weight data indicated that there was not a significant interaction between the factors of herbicide treatment and grass type. The analysis indicates that both grasses responded in a similar way to herbicide application. **Table 6** contains the mean dry weight accumulation for both grasses. These means are provided to illustrate that the difference in dry weight in response to herbicide treatments was not significantly different between the two grasses.

Discussion

Preemergence experiment:

The data in **Table 2** indicate that both rates of Direx and Plateau reduced grass dry weight in comparison to untreated plants. Although means for Ronstar and Surflan at both rates were numerically lower than untreated plants they were not significantly lower. The data indicate that both Ronstar and Surflan can be safely used as "over the top" sprays for preemergence weed control in newly transplanted pili and emoloa seedlings.

Postemergence experiment

The data presented in **Table 5** indicate that all postemergence herbicide treatments except the low rate of Garlon 4 significantly reduced the dry weight accumulation of both grasses. It appears that the low rate of Garlon can be safely used on newly planted transplants of the native Hawaiian grasses used in this experiment. Since the herbicide treatments were applied as "over the top" sprays, it seems reasonable to assume that directed sprays on larger more mature plants would also be safe.

Summary

The data reported here provides a solid foundation for chemical weed control in newly established plantings of pili grass and emoloa used for seed production. Newly transplanted grasses of both species can be treated with over the top sprays of both Ronstar and Surflan at rates of 2.0 and 2.0 pounds of active ingredient per acre, respectively. A tank mix of these two herbicides should also be safe, however this tank mix was not evaluated in these experiments. A postemergence application of Garlon 4 is safe on both grass species as an "over the top" application starting at 21 days after planting, at a rate of 2.0 pounds of active ingredient per acre. A second application can follow 14 days after the first. The combined use of pre and postemergence herbicides reported here can provide for a near weed free planting of both pili grass and emoloa when transplants are used. The herbicides and their rate of application cannot be assumed to be safe on plantings established from seed. Experiments on direct seeded plantings would need to be conducted to identify the timing and rates for safe and effective herbicide applications for pre and postemergence weed control. Although not discussed in this report, all rates of herbicide application were effective in controlling weeds.

Acknowledgements and Disclaimer

Trade names are used in this report for the convenience of readers and does not constitute and exclusive endorsement of the University of Hawaii, the Cooperative Extension Service, the USDA nor the Natural Resources Conservation Service. The information contained here is not a recommendation for use. It is a violation of state and federal law to use any pesticide in manner inconsistent with it's labeling.

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Figure 1. Plot map of preemergence study at the Plant Materials Center. Numbers in cells represent treatments described in Table 1 below. Replications are designated as IP-E, meaning replication I with grass row orientation of pili – emoloa. A single row of emoloa and pili grass transplants are spaced 2 ft. apart within the row and 2 ft. b/w rows

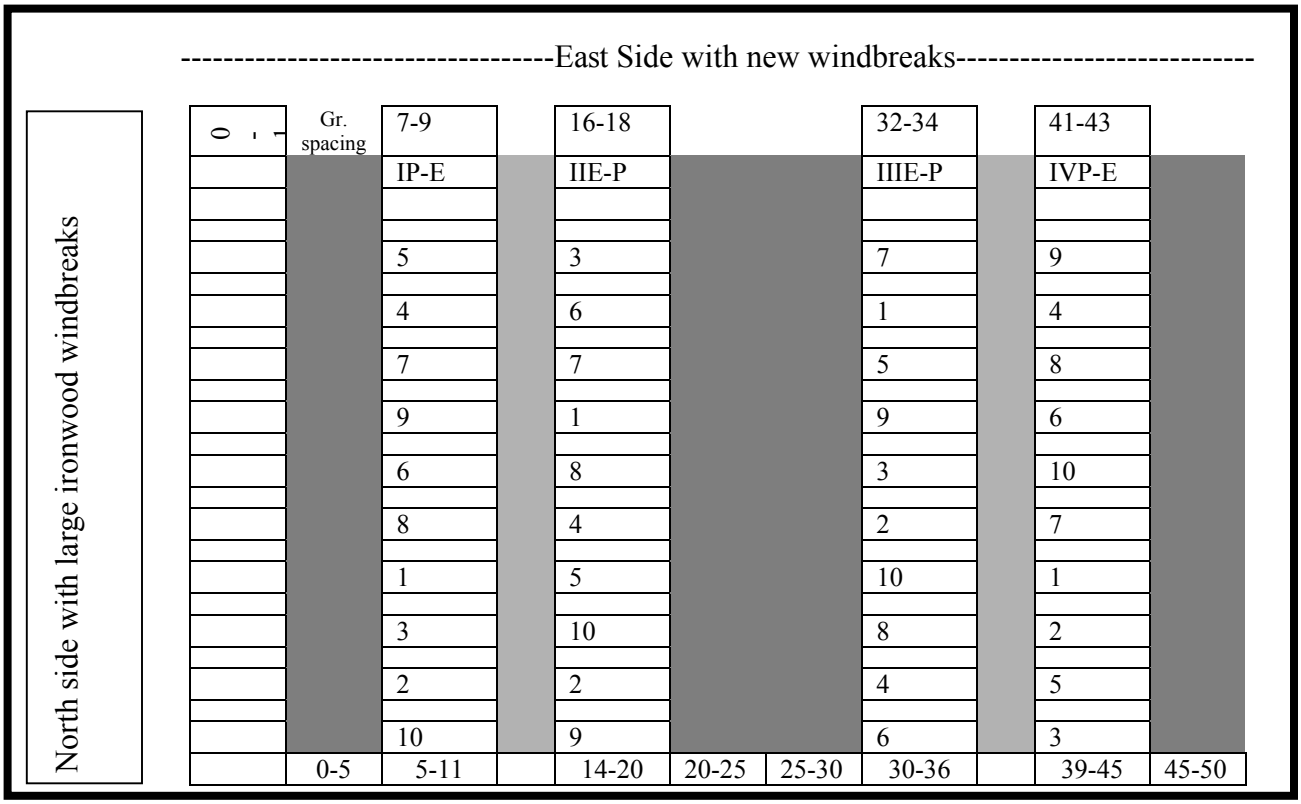

Figure 2. Plot map of postemergence study at the Plant Materials Center. Numbered cells correspond to treatment descriptions found in Table 4 below. The internal section of the experimental area was used to conduct a related but different experiment. A single row of emoloa and pili grass transplants are spaced 2 ft. apart within the row and 2 ft. b/w rows

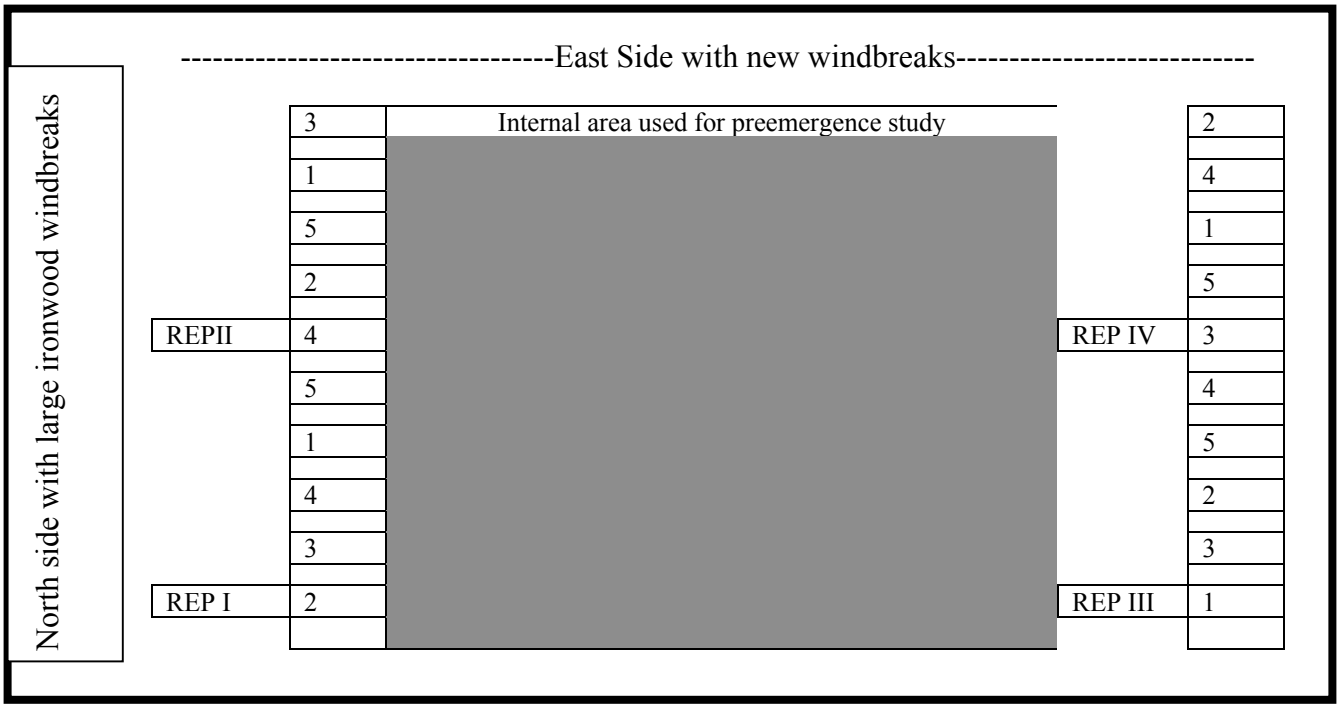

Table 1, preemergence herbicide treatments applied to grass transplants. Finished spray solutions were applied from 3-liter containers. Herbicides were applied with a backpack sprayer mounted with a 12-volt electric pump. Herbicides were applied at 22 PSI with a carrier volume of 40 gallons per acre, using a 3 nozzle boom containing 8004 LP TeeJet spray tips. Treatments were replicated 4 times.

Herbicides	Amount per acre	lb. ai/a	Amount ml or grams/3liter
1Direx 4L (diuron)	.8 qt.	.8	15 ml
2 Direx (diuron)	1.6 qt.	1.6	30 ml
3Ronstar (oxadiazon) 50WP	4.0 lb	2.0	36 grams
4 Ronstar (oxadiazon) 50WP	8.0 lb	4.0	72 grams
5 Plateau 70% DG	1.44 oz	0.063	.8 grams
6 Plateau 70% DG	2.88 oz	0.126	1.6 grams
7 Surflan 4AS	2.0 qt.	2.0	32.5 ml
8 Surflan 4 AS	4.0 qt.	4.0	75.0 ml
9 Un-weeded non chemical.	-		
10 Weeded non chemical	-		

Table 2. Dry weight accumulation in response to 2 sequential applications of preemergence herbicides. Two pili grass and 3 emoloa clumps were selected from each plot and dried to determine biomass accumulation in response to herbicide application. Samples were collect 91 days after the first spray and 57 days after the second spray application. Means of both grasses were pooled, there was not a significant interaction between grass type and herbicide treatments

Herbicides	Amount per acre	Dry weight of grasses (g)
1Direx 4L (diuron)	.8 qt.	290 bc
2 Direx (diuron)	1.6 qt.	245 bc
3Ronstar (oxadiazon) 50WP	4.0 lb	462 a
4 Ronstar (oxadiazon) 50WP	8.0 lb	390 ab
5 Plateau 70% DG	1.44 oz	280 bc
6 Plateau 70% DG	2.88 oz	202 c
7 Surflan 4AS	2.0 qt.	492 a
8 Surflan 4 AS	4.0 qt.	525 a
9 Un-weeded non chemical.	-	505 a
10 Weeded non chemical	-	556 a

Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test at the 1% level.

Table 3. Dry weight accumulation in response to 2 sequential applications of preemergence herbicides. Two pili grass and 3 emoloa clumps were selected from each plot and dried to determine biomass accumulation in response to herbicide application. Samples were collect 91 days after the first spray and 57 days after the second spray application. Mean separation for these data is not supported by statistical analysis (i.e. the interaction between herbicide treatment and grass type was not significant at the 5% level)

Herbicides	Amount per acre	Dry weight of grasses	
		pili Grass (g/2-plants)	emoloa (g/3-plants)
1Direx 4L (diuron)	.8 qt.	456	125
2 Direx (diuron)	1.6 qt.	380	109
3Ronstar (oxadiazon) 50WP	4.0 lb	522	401
4 Ronstar (oxadiazon) 50WP	8.0 lb	486	294
5 Plateau 70% DG	1.44 oz	361	199
6 Plateau 70% DG	2.88 oz	252	152
7 Surflan 4AS	2.0 qt.	600	384
8 Surflan 4 AS	4.0 qt.	621	430
9 Un-weeded non chemical.	-	667	342
10 Weeded non chemical	-	664	448

See Table 2 for separation of pooled means of both grasses in response to herbicide applications.

Table 4, postemergence herbicide treatments applied to grass transplants. Finished spray solutions were applied from 3 liter containers. Herbicides were applied with a back pack sprayer mounted with a 12-volt electric pump. Herbicides were applied at 22 PSI with a carrier volume of 40 gallons per acre, using a 3 nozzle boom containing 8004 LP TeeJet spray tips. Treatments were replicated 4 times.

Herbicides	Amount per acre	lb. ai/a	Amount ml or grams/3liter
1 Garlon 4	2 qt.	2 lb	37.5 ml
2 Garlon 4	4 qt	4 lb	75.0 ml
3 Garlon 4 + Plateau 70% DG	2 qt.+ 1.44 oz	2.0 lb. + 0.063	37.5 ml + .8 grams
4 Garlon 4+ Plateau 70% DG	4 qt. + 4.32 oz	4.0 lb + 0.189	70.0 ml + 2.4 grams
5 Untreated	-		

Table 5, Dry weight accumulation in response to 2 sequential applications of postemergence herbicides. Two pili grass and 3 emoloa clumps were selected from each plot and dried to determine biomass accumulation in response to herbicide application. Samples were collected 71 days after the first spray and 43 days after the second spray application. Means of both grasses were pooled, there was not a significant interaction between grass type and herbicide treatments

Herbicides	Amount per acre	Dry weight of grasses (g)
1 Garlon 4	2 qt.	308 ab
2 Garlon 4	4 qt	277 b
3 Garlon 4 + Plateau 70% DG	2 qt.+ 1.44 oz	242 b
4 Garlon 4+ Plateau 70% DG	4 qt. + 4.32 oz	153 b
5 Untreated	-	495 a

Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test at the 1% level.

Table 6. Dry weight accumulation in response to 2 sequential applications of postemergence herbicides. Two pili grass and 3 emoloa clumps were selected from each plot and dried to determine biomass accumulation in response to herbicide application. Samples were collect 71 days after the first spray and 43 days after the second spray application. Mean separation for these data is not supported by statistical analysis (i.e. the interaction between herbicide treatment and grass type was not significant at the 5% level)

		Dry weight of grasses	
Herbicides	Amount per acre	pili Grass (g/2-plants)	emoloa (g/3-plants)
1 Garlon 4	2 qt.	434	182
2 Garlon 4	4 qt	419	135
3 Garlon 4 + Plateau 70% DG	2 qt.+ 1.44 oz	316	167
4 Garlon 4+ Plateau 70% DG	4 qt. + 4.32 oz	204	103
5 Untreated	-	625	364

See **Table 5** for separation of pooled means of both grasses in response to herbicide applications.