

Progress report for Chemical weed control in potted orchids.
Period 01/01/02 – 12/31/02
P.I. - Dr. Joe DeFrank Dept. of TPSS, UH-Manoa.

This progress report from Dr. DeFrank's USDA Floriculture Grant will describe progress for orchids only, progress on anthuriums and potted palms is available upon request.

Preemergence herbicides applied to 3 potted orchid cultivars:

An experiment to determine the response of 3 potted orchid cultivars to sequential preemergence herbicide applications was initiated at Newman's Nursery (NN) in Pahoia on the Big Island. The three cultivars selected for treatment were "Sharry Baby", "Silver Chalice" and "Hirota White". Herbicides were applied at two rates; the anticipated and two times the anticipated labeled use rate (1X and 2X, respectively). The herbicides evaluated in this experiment were Direx 4L (diuron), Gallery (isoxaben), Spartan (sulfentrazone) and Surflan (oryzalin). Herbicide applications were directed to the base of plants to avoid direct contact with leaves and flowers. The first herbicide application was applied on 12/02/99 with sequential applications made at 73, 69, 46 and 70 day intervals for a total of 5 sprays. The last herbicide application was made on 01/24/01 and the experiment was terminated on 03/07/01 (42 days after the last spray application) when crop samples were collected for dry weight determinations.

The data analysis of shoot dry weight accumulation (see **Table 1**) indicated that the response to herbicide applications was not the same across the three cultivars used in this experiment. Direx 4L or Surflan (high rate) did not reduce shoot dry weight of Sharry Baby but Gallery and Spartan did. The shoot dry weight reduction by Surflan at the low rate was not related to herbicide application but was caused by an unidentified disease factor. Silver Chalice and Hirota White shoot dry weight was not significantly reduced by any herbicide applications.

Table 1. Shoot dry weight accumulation of 3 orchid cultivars to 5 sequential applications of preemergence herbicides. Plant samples were collected 42 days after the last herbicide application. A significant Cultivar x Herbicide Treatment interaction means growth response to treatments was not the same for all cultivars.

Treatments	LB ai/a	Shoot dry wt.(g)		
		Sharry Baby	Silver Chalice	Hirota White
DIREX 1X	1.5	14.48 a	0.43 c	3.33 c
DIREX 2X	3.0	12.05 ab	0.50 c	5.30 c
GALLERY 1X	.75	4.50 c	0.45 c	4.47 c
GALLERY 2X	1.5	4.33 c	0.35 c	5.18 c
SPARTAN 1X	.25	6.83 bc	0.38 c	2.23 c
SPARTAN 2X	.50	5.93 c	0.40 c	3.08 c
SURFLAN 1X	2.0	3.60 c	0.50 c	5.90 c
SURFLAN 2X	4.0	14.80 a	0.55 c	4.30 c
UNTREATED		13.43 a	0.63 c	6.30 bc

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

The data analysis of root dry weight accumulation (see **Table 2**) was similar to the shoot data analysis. The root weight of Sharry Baby was not significantly affected by either level of Direx 4L application but all other treatments except the high rate of Surflan reduced root dry weight accumulation. Both Silver Chalice and Hirota White root dry weight was not significantly reduced by any herbicide applications, **Table 2**. These data support the use of both Direx 4L and Surflan on these three orchid cultivars. Gallery and Spartan were too inhibitory to be on Sharry Baby to be considered for further testing or pursuit of labeling.

Table 2. Root dry weight accumulation of 3 orchid cultivars to 5 sequential applications of preemergence herbicides. Dry weight samples were collected 42 days after the last herbicide application. A significant Cultivar x Herbicide Treatment interaction means growth response was not the same for all cultivars.

Treatments	LB ai/a	Root dry wt. (g)		
		Sharry Baby	Silver Chalice	Hirota White
DIREX 1X	1.5	4.85 a	0.30 c	1.03 c
DIREX 2X	3.0	3.88 ab	0.28 c	2.30 bc
GALLERY 1X	.75	1.08 c	0.25 c	1.53 c
GALLERY 2X	1.5	0.70 c	0.20 c	1.65 c
SPARTAN 1X	.25	2.15 bc	0.35 c	1.45 c
SPARTAN 2X	.50	2.20 bc	0.38 c	1.15 c
SURFLAN 1X	2	0.75 c	0.20 c	2.20 bc
SURFLAN 2X	4	4.85 a	0.20 c	1.30 c
UNTREATED		5.40 a	0.35 c	2.23 bc

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

Postemergence herbicides applied to 7 potted orchids of varying size:

An experiment to determine the response of 7 orchid cultivars to sequential postemergence herbicide applications was conducted at Polynesian Orchids and Anthuriums Inc. (PO&A, owner Leland Anderson) located in Kurtistown on the Big Island. The orchid cultivars selected for treatment in this experiment ranged in size from seedlings in 72-cell trays ("UH 306", "UH 800" and "Sharry Baby") to mid-sized flowering plants in 4 inch pots ("Gower Ramsey" and "Hiang Beauty") to mature plants grown in 6 inch pots for cut flowers ("Houserman White" and "Barbara Mull x Midas Touch", both Phalanopsis). The herbicides evaluated in this experiment were Direx 4L, Lontrel (clopyralid) and Aim (carfentrazone). The herbicides were applied at two rates; the anticipated and two times the anticipated labeled use rate (1X and 2X, respectively). Spray applications were made directly to crop foliage using a spray to wet application that was calculated to be 100 gallons per acre. The first application was applied on 11/11/99 with sequential applications made at 20, 208, 73 and 69 day intervals for a total of 5 sprays. Visual injury ratings were made during the course of the experiment and on 12/04/00 the experiment was terminated and all orchids except Phalanopsis were collected for dry weight accumulation.

The first spray injury rating indicated that Aim was too phytotoxic to be useful on orchids and no additional applications were made. Thus, all data reported for Aim represent the result of a single application followed by 12 months of recovery. The dry weight accumulation of the orchid cultivars (see **Table 3**) responded in a similar to the sequential spray applications. The analysis of the combined dry weight of 5 orchid cultivars indicated that all treatments significantly reduced growth of both roots and shoots.

Table 3. The response of the combined dry weight accumulation of 5 orchid cultivars to 5 sequential herbicide spray applications made directly to crop foliage. Cultivar response to treatments was not significantly different, thus weight of 5 cultivars were combined. A nonsignificant Cultivar x Herbicide Treatment interaction means growth response was the same for all cultivars.

Treatments	LB or g ai/a	Combined dry wt. of 5 cultivars (g)	
		Shoots	Roots
DIREX 4L	.5 LB	12.35 b	2.81 b
DIREX 4L	1.0 LB	12.18 b	3.19 b
LONTREL 3EC	.28 LB	11.69 b	2.59 b
LONTREL 3EC	.56 LB	13.17 b	2.63 b
AIM ^z	3.7 g	15.52 ab	3.15 b
AIM	7.4 g	12.94 b	3.56 ab
UNTREATED	-	22.92 a	4.76 a

^z Data reported for Aim represent the result of a single application followed by 12 months of recovery.

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

The analysis of the data collected in this experiment indicates that all herbicide applications reduced dry weight accumulation by nearly 35-45%. These results indicate that foliar exposure to herbicides like Direx 4L are more detrimental than applications directed to the base of plants that minimizing foliar contact (see **Tables 1&2**). However, the actual data varied widely and conclusions must be made with caution. The data in **Table 4** contains the whole plant dry weight for the individual cultivars. The means in this table cannot be declared significantly different because of a high level of variation not attributable to herbicide treatments. However, the data can be useful in determining where additional research may be required. A tentative conclusion appears to be that UH 306, UH 308 and Hiang Beauty are much more sensitive to Direx 4L and Lontrel than Sharry Baby and Gower Ramsey.

Table 4. The response of 5 orchid cultivars to 5 sequential herbicide spray applications made directly to crop foliage. Cultivar response to treatments was not significantly different. Data for all Aim treatments represents the response to a single application followed by 12 months of recovery. The data analysis from this experiment was affected by the high level of variation in plant dry weight that could not be attributed to herbicide treatments.

Treatments	LB or g ai/a	Whole plant dry wt. of 5 cultivars (g)				
		UH 306	UH 800	Sharry Baby	Gower Ramsey	Hiang Beauty
DIREX 4L	.5 LB	17.8	17.1	26.0	2.2	12.7
DIREX 4L	1.0 LB	11.6	15.6	35.8	7.0	6.9
LONTREL 3EC	.28 LB	15.4	9.6	22.4	5.3	18.7
LONTREL 3EC	.56 LB	12.3	13.5	22.6	2.0	30.2
AIM ^z	3.7 g	20.2	22.8	25.1	1.5	24.1
AIM	7.4 g	16.2	18.5	25.0	7.3	20.9
UNTREATED	-	32.0	36.6	25.0	4.2	40.9

^z Data reported for Aim represent the result of a single application followed by 12 months of recovery. The interaction between orchid cultivars and herbicide treatments was not significant, therefore statistical comparison of means in this table are not appropriate.

Postemergence herbicides applied to 4 potted orchids:

An experiment to determine the response of 4 orchid cultivars to sequential postemergence herbicide applications was conducted at Newman's Nursery (NN) in Pahoia on the Big Island. The orchid cultivars selected for treatment in this experiment were grown in 4 inch pots used to finish the crop for sale. The cultivars used were: "Emma White" (Dendrobium), Wildcat "Blood Ruby", "Volcano Queen" (both Oncidiums) and "SuFun Beauty" (Vanda). The herbicides evaluated in this experiment were Direx 4L and Lontrel. The herbicides were applied at 3 rates, one, two and four time the anticipated labeled use rate (1X, 2X and 4X, respectively). Spray applications were made directly to crop foliage using a spray to wet application that was calculated to be 100 gallons per acre. The first application was applied on 11/11/99 with sequential applications made at 20, 208, 73 and 69 day intervals for a total of 5 sprays. Visual injury ratings were made during the course of the experiment and on 12/04/00 the experiment was terminated and all plants were collected for dry weight accumulation.

The data in **Table 5** indicates that herbicide sprays did not significantly reduce dry weights and that all cultivars responded in a similar way. Data for shoot and root weights of individual cultivars is provided in **Table 6 and Table 7**, respectively. The orchid cultivars at NN responded in a similar way to herbicide applications and neither shoot nor root dry weight accumulation was adversely affected. The only orchid cultivar to show abnormal growth to Lontrel was "Emma White", expressed as J-shaped flower spikes and deformed flowers. The other three cultivars did not show any noticeable injury in response to any of the spray applications.

The data from NN and PO&A indicate that orchid cultivars can vary widely in their response to herbicide applications. Potential users need to be careful **NOT** to assume that herbicide applications that appear safe on one cultivar predict safe use on all. It is clear that additional experiments need to be conducted simultaneously with the same cultivars, at similar stages of development and potting media, at different locations to accurately establish the impact of sequential herbicide spray applications on orchid growth and yield attributes.

Table 5. The response of combined dry weight accumulation of 4 orchid cultivars to 5 sequential herbicide spray applications made directly to crop foliage. A nonsignificant Cultivar x Herbicide Treatment interaction means growth response to treatments was the same for all cultivars.

Treatments	lb. ai/a	Combined wt. of 4 cultivars	
		Shoot Dry Wt. (g)	Root Dry Wt. (g)
DIREX 4L	.5	12.34	6.39
DIREX 4L	1.0	11.56	6.03
DIREX 4L	2.0	12.04	5.72
LONTREL 3EC	.28	11.29	5.68
LONTREL 3EC	.56	11.22	5.13
LONTREL 3EC	1.2	11.09	5.07
UNTREATED		11.74	5.51

Means for shoot and root dry for 4 orchid cultivar wt. were not significantly different in response to chemical treatments.

Table 6. Shoot dry weight accumulation of 4 orchid cultivars to 5 sequential herbicide spray applications made directly to crop foliage.

Treatments	lb. ai/a	Shoot Dry Wt. (g)			
		Volcano Queen	Emma White	Blood Ruby	SuFun Beauty
DIREX 4L	.5	12.0	17.4	14.0	6.0
DIREX 4L	1.0	11.1	14.4	15.0	5.7
DIREX 4L	2.0	11.4	18.0	13.0	5.9
LONTREL 3EC	.28	9.1	21.7	8.8	5.5
LONTREL 3EC	.56	11.2	18.0	9.8	5.9
LONTREL 3EC	1.2	11.2	17.0	10.2	6.0
UNTREATED		11.4	18.6	11.1	5.8

The interaction between orchid cultivars and herbicide treatments was not significant, therefore statistical comparison of means in this table are not appropriate.

Table 7. Root dry weight accumulation of 4 orchid cultivars to 5 sequential herbicide spray applications made directly to crop foliage. Cultivar response to treatments was not significantly different; thus all cultivars responded to the herbicide treatments in a similar way.

Treatments	lb. ai/a	Root Dry Wt. (g)			
		Volcano Queen	Emma White	Blood Ruby	SuFun Beauty
DIREX 4L	.5	3.6	7.9	8.5	5.5
DIREX 4L	1.0	4.7	5.6	8.5	5.2
DIREX 4L	2.0	5.1	5.6	7.2	5.0
LONTREL 3EC	.28	3.4	8.8	5.3	5.3
LONTREL 3EC	.56	3.4	6.0	5.4	5.8
LONTREL 3EC	1.2	3.7	5.5	5.2	6.0
UNTREATED		4.0	7.6	4.6	5.8

The interaction between orchid cultivars and herbicide treatments was not significant, therefore statistical comparison of means in this table are not appropriate.

Postemergence herbicides on 10 orchid cultivars in the seedling stage:

An experiment to determine the response of 10 orchid cultivars in the seedling stage to sequential postemergence herbicide applications was conducted at the Waianae location of Hawaii Rainbow Orchids (HRO, owner Creighton Mow). The orchids selected for this experiment included 9 Dendrobium and 1 Vanda. At the beginning of the experiment, seedling age from culture flasks ranged from 54 to 117 days. The Dendrobium orchids (cultivar designations and numbered codes provided by C. Mow) used in this experiment were: “D. Bangsaen Beauty Udomsri” (#2716), “D. Vipa Mary MR x D. Udom Flare X D. Kanokporn” (#2701), “D. Burana Jade”, “D. Jacky mutation” (WRM 303), “D. Sakura Pink”, “D. Bertha Chung X Imelda Romualdez `Blue” (224), “D. Thoung `Pink”, “D. Kannayao Red” (392), “D. Woor Leng X D. Pathum Thani”. The only Vanda selected for this experiment was Vanda “D.K. Hybrid”. Direx 4L was the only herbicide used in this experiment and was applied at 1 and 4 times the anticipated labeled use rate (1X and 4X, respectively). Spray applications were made directly to plant foliage using a 100 gallon per acre application rate. The first application was made on 04/27/00 with sequential applications made at 50, 21, 70, and 66 day intervals for a total of 5 sprays. Visual injury ratings were made during the course of the experiment and on 12/20/00 the experiment was terminated and all plants were collected for dry weight accumulation.

Whole plant dry weight accumulation of the 10 cultivars in this experiment responded in a similar way to herbicide applications. Since cultivar response was not significantly different, orchid response to the treatments can be described by pooling the mean dry weight accumulation of all cultivars. In **Table 8**, the pooled response of all cultivars indicates that no herbicide treatment reduced orchid dry weight accumulation in comparison to untreated plants.

Table 8. Whole plant dry weight accumulation of 10 orchid cultivars, in the seedling stage, to 5 sequential applications of Direx 4L. Cultivars responded in a similar way to herbicide treatments, thus the mean of 10 cultivars can be used to describe effects of herbicide spray applications on orchid growth.

Treatments	LB ai/a	Mean of whole plant dry wt. of 10 cultivars(g)
1 DIREX 4L	.5	4.25 a
2 DIREX 4L	2.0	2.98 b
3 Untreated	-	3.75 ab

Means in columns followed by the same letter are not significantly different according to Duncan’s Multiple Range Test at the 1% level.

The data in **Table 9** contains individual cultivar response to Direx 4L spray applications. Note that for most cultivars (except #4), the 4X level of Direx 4L appears to be suppressing dry weight accumulation. The suppression in growth was not significantly less than untreated plants but was significantly different than plants treated with the 1X level of Direx 4L (see **Table 8**).

Table 9. Whole plant dry weight response of 10 orchid cultivars to direct foliar application of Direx 4L spray applications.

Treatments	LB ai/a	Whole Plant dry wt. of 10 cultivars (g) ^x									
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10
DIREX 4L 1X	.5	1.50	3.90	4.83	3.43	3.73	5.00	5.63	4.47	4.63	5.33
DIREX 4L 4X	2.0	1.57	3.17	3.63	2.17	3.10	3.07	2.97	1.60	3.07	5.46
Untreated	-	2.27	4.00	4.57	1.30	3.83	3.67	5.30	2.20	4.33	6.10

The interaction between orchid cultivars and herbicide treatments was not significant, therefore statistical comparison of means in this table are not appropriate.

^x The list below provides the cultivar coding for the means reported in **Table 9**.

Cultivar Code	Cultivar Name	Days out of culture flask prior to spraying
1	D. Bangsaen Beauty Udomsri, #2716	85
2	D. Vipa Mary MR x D. Udom Flare X D. Kanokporn, #2701	85
3	D. Burana Jade	117
4	D. Jacky mutation, WRM 303	117
5	D. Sakura Pink	117
6	D. Bertha Chung X Imelda Romualdez `Blue, 224	85
7	D. Thoung `Pink	54
8	D. Kannayao Red, 392	54
9	D. Woor Leng X D. Pathum Thani	85
10	Vanda D.K. Hybrid	117

These data indicate a high level of safety when using Direx 4L on these cultivars in the seedling stage. However, crop response to herbicides can change or stay the same as physiological age increases. Therefore, Direx 4L safety on seedlings cannot automatically be assigned to older plants with emerging flower spikes. These results will be useful in requesting herbicide labeling for these cultivars at the seedling stage. Additional research on older plants with emerging flower spikes is strongly recommended.

Potting media components impregnated with preemergence herbicides on 3 orchid cultivars.

In this experiment, a cement mixer was used to treat growth media with preemergence herbicides prior to their use in pots. Cubed coconut fiber was the media component impregnated with various herbicides and is commercially marketed as coir. Cubed coir was treated at two rates with Direx 4L, Surflan and Gallery as a mixture and Ronstar WP (a wettable powder). Treated coir was used in two ways, as a top dressing after orchids were planted and as a growth medium component in a 50% mixture with volcanic cinder. Herbicides used to treat coir were also applied as directed sprays to the surface of potted orchids with a growth media composed of a 50% mixture of coir and cinder. This treatment design allowed for the comparison of orchid growth in response to a herbicide dose introduced 3 different ways, i.e. treated coir as a surface topdress, treated coir as a potting component in the growth medium and as a conventional directed spray application to the surface of the growth medium. Ronstar G (a granular formulation) was also included in the treatment set. All chemical treatments were applied at two rates, 1 and 4 times the anticipated labeled use rate (1X and 4X, respectively). Seedling orchids were removed from common trays and planted into 4 inch pots and grown in a commercial production environment on 05/04/00. Both spray and granular herbicide applications were applied only once, immediately after planting. The experiment was located at Newman's Nursery and each pot included 3 orchid cultivars, "Ocelot", "D. Roi ET – D. Doctor Poyck" (325) and "D. Burana Green".

The only problem in this experiment was the lack of regular fertilization to maintain commercially acceptable vigor of the orchids. The experiment was terminated on May 05, 2001 and orchid cultivars were sampled for whole plant dry weight accumulation. Weed control ratings and weed counts were also taken to determine the efficacy of the three methods of introducing herbicides into pots.

The orchid response to the herbicide treatments was similar for all cultivars. The data for orchid dry weight accumulation in response to herbicide treatments in **Table 10** includes the pooled data for the three orchid cultivars. The data indicate that none of the herbicide treatments significantly reduced orchid dry weight accumulation. The numerically lower dry weights were recorded when herbicide treated coir (4X level) was used as part of the growth media.

Moss was introduced on seedlings removed from infested common trays. The best control of moss was recorded in Ronstar WP treatments. Moss control with Ronstar G was not significantly different than untreated pots. Even though the amount of active ingredient in Ronstar G and WP treatments were the same, the granular formulation was unable to control moss. These results show how important the formulation and placement of Ronstar are to be effective on certain weeds, like moss. Moss was almost nonexistent in treatments containing Ronstar WP treated coir as part of the growing media.

The two other weeds present in this experiment were Artillery Fern and Bitter Cress. These weeds were not as consistently distributed across all treatment like moss. The lack of even distribution explains why untreated pots had little to no counts for these species while pots treated with Direx 4L had high levels of bitter cress. Conclusions, based on weed counts, suggest that Direx 4L applied as a single preemergence application lacked good control of Bitter Cress after 12 months. Artillery Fern was present in treatments containing the Gallery/Surflan mixture.

The method of herbicide application appears to have little impact on the response of orchid growth and weed control in pots. However, orchid growth does not support continued study of treated coir (at the 4X level) as a media component. It makes more sense to compare conventional spray applications to a fortified top dress of coir or volcanic cinders. Also, granular formulations appear to be less effective for control of moss than spray applications on coarse media used to grow orchids.

Table 10. The response of 3 orchid cultivars (Ocelot, D. Roi ET – D. Doctor Poyck (325) and D. Burana Green) and weeds to herbicides introduced to pots in three ways: herbicide treated coir as a top dress (TD) above a growth media mixture of 50% coir and 50% volcanic cinder, herbicide treated coir as a growth media component in 50% mixture of coir and volcanic cinder and as a conventional directed spray application. Ronstar was the only herbicide applied as a granular formulation to the top of the 50% mixture of coir and volcanic cinder.

Herbicide treatment	Application method	Mean dry wt. of 3 cultivars (g)	Moss ^w cover (%)	BICR ^v counts (#)	AFER ^u counts (#)
Surflan/Gallery 1X	TD	2.72 a	99.5 a	0.4 e	1.8 ab
Surflan/Gallery 4X	TD	2.41 ab	90.5 abc	0.1 e	2.2 a
Surflan./Gallery 1X	MIX	2.37 abc	94.5 a	2.2 e	0.5 bc
Surflan /Gallery 4X	MIX	1.74 bc	78.5 cd	0.3 e	1.8 ab
Surflan/Gallery 1X	SPRAY ^z	2.10 abc	79.5 bcd	2.8 e	0.5 bc
Surflan/Gallery 4X	SPRAY	1.56 bc	54.0 e	3.6 e	1.1 abc
Direx 4L 1X	TD	1.98 abc	100.0 a	17.6 a	0.1 bc
Direx 4L 4X	TD	1.65 bc	99.5 a	12.2 b	0.1 c
Direx 4L 1X	MIX	2.06 abc	100.0 a	8.3 c	0.0 c
Direx 4L 4X	MIX	1.49 c	91.5 ab	15.8 a	0.0 c
Direx 4L 1X	SPRAY	2.34 abc	91.0 abc	3.6 de	0.1 c
Direx 4L 4X	SPRAY	2.02 abc	95.0 a	7.1 cd	0.9 abc
RONSTAR 50 WP 1X	TD	2.18 abc	6.6 g	0.3 e	0.0 c
RONSTAR 50 WP 4X	TD	2.18 abc	33.5 f	0.9 e	0.0 c
RONSTAR 50 WP 1X	MIX	1.55 bc	1.4 g	0.0 e	0.0 c
RONSTAR 50 WP 4X	MIX	1.69 bc	0.5 g	0.0 e	0.0 c
RONSTAR 50 WP 1X	SPRAY	2.03 abc	32.5 f	0.0 e	0.0 c
RONSTAR 50 WP 4X	SPRAY	2.42 ab	.4 g	0.0 e	0.0 c
RONSTAR 2%G 1X	GRANULAR	2.07 abc	89.5 abc	0.0 e	0.0 c
RONSTAR 2%G 4X	GRANULAR	2.09 abc	68.0 d	0.0 e	0.0 c
UNTREATED-TD ^y	-	2.23 abc	100.0 a	0.0 e	1.0 abc
UNTREATED-MIX ^x	-	2.14 abc	95.0 a	0.5 e	0.6 abc

^z SPRAY indicates that herbicides were applied to the top of growth media in a directed spray application.

^y TD indicates that herbicide treated coir potting component was applied as a topdress to orchids rooted in a growth media mix of 50 volcanic cinder and 50% untreated coir.

^x MIX indicates that herbicide treated coir was present as a growth media component with 50% of volcanic cinders.

^w Moss: unidentified species

^v BICR: Bitter Cress, *Cardamine hirsuta* L.

^u AFERN, Artillery Fern, *Nephrolepis spp.*

Table 11. The response of 3 orchid cultivars (Ocelot, D. Roi ET – D. Doctor Poyck (325) and D. Burana Green) and weeds to herbicides introduced to pots in three ways: herbicide treated coir as a top dress (TD) above a growth media mixture of 50% coir and 50% volcanic cinder, herbicide treated coir as a growth media component in 50% mixture of coir and volcanic cinder and as a conventional directed spray application. Ronstar was the only herbicide applied as a granular formulation to the top of the 50% mixture of coir and volcanic cinder. The interaction between orchid cultivars and herbicide treatments was not significant, therefore statistical comparison of means in this table are not appropriate.

Herbicide treatment	Application method	Mean whole plant dry wt. (g)		
		D. Burana Green	Ocelot	D.Roi Et x D. Dr. Poyck (325)
Surflan/Gallery 1X	TD	4.3	2.1	1.7
Surflan/Gallery 4X	TD	3.9	1.0	2.3
Surflan./Gallery 1X	MIX	3.3	1.9	2.0
Surflan /Gallery 4X	MIX	3.2	0.9	1.1
Surflan/Gallery 1X	SPRAY ^z	3.0	1.1	2.2
Surflan/Gallery 4X	SPRAY	2.5	0.6	1.6
Direx 4L 1X	TD	2.6	1.4	2.0
Direx 4L 4X	TD	2.3	1.4	1.2
Direx 4L 1X	MIX	3.2	1.6	1.4
Direx 4L 4X	MIX	2.6	1.1	0.8
Direx 4L 1X	SPRAY	3.4	2.4	1.3
Direx 4L 4X	SPRAY	3.5	1.1	1.4
RONSTAR 50 WP 1X	TD	2.7	1.9	2.0
RONSTAR 50 WP 4X	TD	3.5	1.3	1.7
RONSTAR 50 WP 1X	MIX	2.6	1.2	1.0
RONSTAR 50 WP 4X	MIX	3.2	1.1	0.8
RONSTAR 50 WP 1X	SPRAY	2.8	1.6	1.7
RONSTAR 50 WP 4X	SPRAY	3.6	2.1	1.6
RONSTAR 2%G 1X	GRANULAR	3.8	1.1	1.3
RONSTAR 2%G 4X	GRANULAR	2.8	1.8	1.7
UNTREATED-TD ^y	-	3.0	1.5	2.1
UNTREATED-MIX ^x	-	2.8	1.8	1.8

^z SPRAY indicates that herbicides were applied to the top of growth media in a directed spray application.

^y TD indicates that herbicide treated coir potting component was applied as a topdress to orchids rooted in a growth media mix of 50 volcanic cinder and 50% untreated coir.

^x MIX indicates that herbicide treated coir was present as a growth media component with 50% of volcanic cinders.

Summary

The experimental results in this report describe the response of orchids to both preemergence and postemergence herbicides. Three cultivars were exposed to preemergence herbicides applied to avoid foliar contact and three were exposed to herbicides introduced to the plants with 3 different methods. Twenty one cultivars were exposed to various postemergence sprays applied directly to foliage. These results will be supplied to the chemical companies manufacturing these herbicides to support the addition of specific cultivars to product labels. However, all experiments were conducted only once with stage of growth, potting media and cultural conditions varying widely. It may be difficult to convince companies to add an orchid use pattern to their product label based on these data alone.

Direx 4L appears to be a safe and effective herbicide for most of the orchid cultivars evaluated in this report. The only orchid cultivars demonstrating sensitivity to Direx 4L are UH 306, UH 800 and Hiang Beauty. Direx 4L provides good postemergence control of serious weeds like Bitter Cress and Artillery Fern, but is not effective in controlling moss. Ronstar provided excellent control of moss, but the company manufacturing it was not interested in spray applications to control weeds in potted orchids. The only reason the company (Aventis, makers of Ronstar) approved of their product's inclusion in this research effort was due to my description of impregnating media components with herbicides, thus avoiding spray applications. Foliar contact with Ronstar WP often results in leaf spotting and death of succulent growing points, such as apical meristem and emerging flower spikes.

Future research efforts should be initiated to determine the response of a wide variety of orchid cultivars to sprays and impregnated potting media containing both Direx 4L and Ronstar WP. To get a more accurate measurement of crop safety, the age, cultivar and potting mix of orchids need to be standardized with experiments conducted at various locations simultaneously. If consistent results can be obtained under various production conditions, using the same cultivars of similar age, then the data collected from these experiments will be very useful in supporting new label additions.

DERIVATION OF HERBICIDE APPLICATIONS TO ORCHIDS BASED ON RESEARCH CONDUCTED AND REPORTED BY

Dr. Joe DeFrank, Dept. of Tropical Plant and Soil Science, UH-Manoa

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The following information is provided as a service to growers and pesticide consultants that have a State of Hawaii Certification for Commercial Application of Restricted Pesticide in category 10 Demonstration and Research Pest Control. None of the pesticide applications described in this report can be legally applied in the state of Hawaii as of the date of this report (01/09/03). It is a violation of Hawaii State and Federal laws to use any pesticide in a manner inconsistent with its labeling. The information in **Table 12** is provided for the convenience of those legally able to make test applications in the state of Hawaii.

This chart is in no way intended as a recommendation by the author Dr. Joe DeFrank, The University of Hawaii or the Cooperative Extension Service. Trade names are used as a convenience to research professional and are not intended as an exclusive endorsement of trade name products.

The preceding research on orchids with pre and post emergence herbicides can be distilled down to two herbicides of interest for use on potted orchids, Direx 4L and Ronstar WP. Direx 4L used primarily as a postemergence spray applied directly to the foliage of weeds and orchids and Ronstar WP used as a preemergence, applied as a directed spray to top of weed-free potting media.

Useful Conversions for Derivation of Herbicide Rates.

1 Pound = 453.59 grams = 16 oz. 1 dry oz = 28.35 grams
1 acre = 43,560 ft² 2.470 acre = 1 hectare Ft.² * (.092903) = meter²
1 gallon = 3785 ml = 128 oz. 1 oz = 29.57 ml 1 teaspoon = 7 ml.

Table 1. Test herbicide solutions for Hawaii Orchid growers. Amounts per gallon are based on 100 gallons per acre (GPA) for post applications and 418 GPA for preemergence applications.

	A	B	C	D	E
Herbicide	Liquid oz. per gallon	Dry Oz per gallon	ml or grams per gallon	Teaspoon per gallon	G.H. Flats (10" x 20") treated with 1 gallon
Direx 4L post to weeds	.16 oz.-liq.	NA	4.7 ml	.7	311
Ronstar 50WP pre to media surface.	NA	.3 oz-dry	8.5 g	NA	74

DERIVATION OF DIREX 4L POSTEMERGENCE ON ORCHID FOLIAGE.

All postemergence herbicide applications on orchids were made with a carrier volume of 100 gallons per acre. Visually this is a spray to wet application that does not result in runoff from leaves. The label recommendation for Direx 4L postemergence in corn with 3 inch tall weeds is .5 quarts Direx 4L/a, no surfactant used. Direx 4L at .5 quarts per acre is the 1X rate in all orchid experiments.

A. To get liquid oz of Direx 4L per gallon: $4 \text{ qt}/128 \text{ oz} = .5 \text{ qt}/x$, $x = 16 \text{ oz}$.
Add $16 \text{ oz}/100 \text{ gal} = x \text{ oz}/1 \text{ gal}$, $x = .16 \text{ oz}$.

C. To get ml of Direx 4L per gallon: $4 \text{ qt}/3785 \text{ ml} = .5 \text{ qt}/x$, $x = 473.1 \text{ ml}$.
To get ml per gallon: $473.1 \text{ ml}/100 \text{ gal} = x \text{ ml}/1 \text{ gal}$, $x = 4.7 \text{ ml}$.

D. To get teaspoon per gallon: DeFrank measures 1 teaspoon as 7 ml. Then $7 \text{ ml}/1 \text{ tsp} = 4.7 \text{ ml}/x \text{ tsp}$, $x = .67 \text{ tsp}$.

E. To get number of greenhouse trays treated with 1 gallon using a 100 GPA.
For post applications: $100 \text{ gallons}/43,560 \text{ ft}^2 = 1 \text{ gal}/X \text{ ft}^2$, $x = 435.6 \text{ ft}^2$
1 greenhouse tray is 10 inch x 20 inch or 200 in^2 , $1 \text{ ft}^2 /144 \text{ in}^2 = x \text{ ft}^2/200 \text{ in}^2$, $x = 1.4 \text{ ft}^2$.
 $1 \text{ GH tray}/1.4 \text{ ft}^2 = X \text{ GH tray}/435.6 \text{ ft}^2$, $x = 311 \text{ G.H. trays}$.

DERIVATION OF PREEMERGENCE APPLICATIONS WITH RONSTAR WP TO SURFACE OF POTTING MEDIA:

The only experiment that reported the response of orchids to Ronstar WP applications was the Hot Cinder experiment at NN. In that experiment pot size was $.11 \text{ ft}^2$ and 4 ml were used to cover this surface area. To get the GPA of this treatment: $4 \text{ ml}/.11 \text{ ft}^2 = x \text{ ml}/43,560 \text{ ft}^2$, $x = 1,584,000 \text{ ml per acre}$. $1 \text{ gal}/3785 \text{ ml} = x \text{ gal}/1,584,000 \text{ ml}$, $x = 418 \text{ gal per acre}$. The spray was applied to the top of the potting media, avoiding foliar contact as much as possible. The 1X Ronstar WP rate is 8.0 LB/a, this is the rate for "Woody ornamental shrubs and conifer nursery" and is also the maximum label rate for any use pattern.

B. To get the dry oz of Ronstar WP per gallon: $1 \text{ lb}/16 \text{ dry oz} = 8 \text{ LB}/x \text{ dry oz}$, $x = 128 \text{ dry oz}$.
To get the amount of Ronstar WP per gallon: $128 \text{ dr. oz}/418 \text{ gal} = x \text{ dr. oz}/1 \text{ gal}$, $x = .3 \text{ dry oz}$.

C. To get grams of Ronstar WP per gallon: $454 \text{ grams}/16 \text{ dry oz} = x \text{ grams}/.3 \text{ dry oz}$, $x = 8.5 \text{ grams}$.

E. To get G.H. trays treated with 1 gallon: 4 ml per pot ($.11 \text{ ft}^2$) amounts to 418 gallons per acre. Thus if 418 gallons covers 43,560 ft^2 , then 1 gallon covers: $418 \text{ gal.}/43,560 \text{ ft}^2 = 1 \text{ gal.}/x \text{ ft}^2$, $x = 103.9 \text{ ft}^2$.
To get number of trays treated with 1 gallon: 1 greenhouse tray is 10 inch x 20 inch or 200 in^2 or $200/144 = 1.4 \text{ ft}^2$. $1.4 \text{ ft}^2/1 \text{ GH flat} = 103.9 \text{ ft}^2/x \text{ GH flat}$, $X = 74 \text{ G.H trays}$.