

## HERBICIDES FOR CONTROLLING WEEDS IN MERCURY BAY WEED

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### ABSTRACT

Although Mercury Bay weed (*Dichondra micrantha*) has been used as an alternative lawn species in New Zealand, it has not been a popular option as poor information on its herbicide tolerance makes weed control difficult. Three herbicide tolerance trials were conducted on potted Mercury Bay weed plants, two on established Mercury Bay weed and one on plants establishing from seed or transplanted stolon fragments. Established Mercury Bay weed tolerated clopyralid, tribenuron, chlorsulfuron, haloxyfop, oryzalin, oxadiazon and low rates of paraquat/diquat, glufosinate and glyphosate. Young seedlings tolerated none of the pre-emergence treatments used, but post-emergence applications of clopyralid, tribenuron and oryzalin were safe. Mercury Bay weed establishing from stolon lengths tolerated pre-emergence applications of linuron and methabenzthiazuron.

**Keywords:** Mercury Bay weed, *Dichondra micrantha*, turf, herbicide tolerance

### INTRODUCTION

Mercury Bay weed is a low-growing, perennial member of the Convolvulaceae family which originates from North America and has been used as an alternative lawn species (Webb *et al.* 1988). As Mercury Bay weed has C<sub>4</sub> physiology, it has a low rate of evapotranspiration, making it very suitable as a ground cover in summer dry areas (Fry and Butler 1989). A major reason for its lack of popularity is that weeds are difficult to control in Mercury Bay weed lawns due to a lack of information on what herbicides can be used safely on them. One of the few New Zealand recommendations for weed control in Mercury Bay weed came from Matthews (1975), who stated diuron and bensulide could be used. Diuron is still sold in some garden centres packaged specifically for weed control in Mercury Bay weed lawns, but bensulide is no longer available. Other herbicides recommended in USA for weed control in Mercury Bay weed are monuron, neburon and diphenamid (Williamson 1974), none of which are available in New Zealand.

Initial results from trials at Massey University have shown that Mercury Bay weed can provide a dense, low-growing ground cover in orchards, capable of preventing establishment of most weeds (unpublished data). Mowing has been used to control some weeds in these swards due to the low, creeping stature of Mercury Bay weed. However more herbicide information was required to assist with the establishment and maintenance of Mercury Bay weed swards. Three pot trials were conducted to obtain this information, and the results may be useful also for Mercury Bay weed lawns.

### METHODS

For Trial 1, Mercury Bay weed plants were established from seed in 600 ml polythene planter bags filled with Kiwitea loam soil (pH 5.0, organic carbon 4.5%) and kept for a year in a glasshouse on sub-irrigated felt mats. Herbicide treatments were applied to the pots on 7 January 1994 using a pendulum laboratory sprayer operating at 200 kPa and delivering 308 litres/ha. Treatments were allocated to pots using a randomised block design with five replicates. The average air temperature in the

glasshouse over the 7 weeks following application was 22.1°C. Plants were visually assessed and scored regularly in the weeks after application to quantify herbicide damage.

For Trial 2, the plants were established from plugs of Mercury Bay weed taken from a field plot and grown in 1.5 litre planter bags with Kiwitea loam soil. Plants were kept on sub-irrigated outdoor beds for 4 months before being sprayed with herbicide treatments as in Trial 1 on 19 February 1996. The water rate was equivalent to 250 litres/ha, and the mean air temperature over the following 7 weeks was 15.5°C. Otherwise, the procedure was similar to Trial 1.

Trial 3 assessed the effects of herbicide treatments on establishing Mercury Bay weed plants. Seeds were sown (15 per bag) into 600 ml planter bags of soil, while lengths of Mercury Bay weed stolons were shallowly buried in other planter bags. Some of these bags were treated with pre-emergence herbicides immediately after seed sowing or stolon burial on 4 July 1996. Several post-emergence treatments were applied to other bags on 6 September 1996, by which time most seedlings were at the 2-4 leaf stage and stolons had produced an average of 11.8 leaves per pot. Plants were kept in a glasshouse heated to 20°C and sub-irrigated. Each treatment was replicated four times, except for post-emergence treatments to stolon regrowth for which there were five replicates. A randomised block design was used, and in addition to regular scoring of visual damage symptoms after application, all plants were cut off at ground level 15 weeks after treatment and the fresh weight of foliage was recorded.

## RESULTS AND DISCUSSION

### Established Mercury Bay weed

For the control of established broad-leaved weeds in an established stand of Mercury Bay weed, clopyralid (Versatill), dicamba (Banvel), tribenuron (Granstar) and chlorsulfuron (Glean) all appear to be safe herbicides to use (Tables 1 and 2). Established grass weeds could be removed safely using haloxyfop (Gallant).

**TABLE 1: Scores (0 = healthy, 10 = dead) for 12-month-old potted Mercury Bay weed plants grown in a glasshouse following treatment by herbicides.**

Treatment	Rate (kg ai/ha)	Weeks After Treatment			
		0.7	3.5	7	14
2,4-D amine	1.1	2.6	7.2	8.2	3.0
amitrole	2.4	1.8	8.6	10.0	9.0
asulam	1.6	1.2	5.2	8.0	4.6
clopyralid	0.22	1.6	1.6	2.0	0.6
dalapon	5.1	6.2	7.6	5.0	3.0
diuron	2.4	1.6	5.4	4.4	2.8
diuron + linuron	0.74 + 1.1	1.4	6.4	3.2	2.2
glufosinate	0.6	6.0	5.0	1.4	1.4
glyphosate	0.54	4.4	5.8	2.2	0.2
haloxyfop	0.25	1.6	1.2	1.6	1.2
MCPA	1.1	3.2	7.4	5.8	1.2
norflurazon	2.4	2.2	6.4	4.8	2.0
oryzalin	3.5	2.2	1.6	1.4	0.8
oxadiazon	1.6	1.4	3.0	2.2	2.0
oxyfluorfen	0.72	7.0	6.8	2.0	0.8
paraquat + diquat	0.24 + 0.12	9.2	2.8	1.6	0.4
simazine	1.5	1.0	5.6	4.8	2.6
tribenuron	0.015	0.6	1.0	1.0	0.8
untreated	-	0.2	0.2	0.8	0.0
LSD 5%		1.5	1.6	2.4	3.0

**TABLE 2: Scores (0 = healthy, 10 = dead) for 4-month-old potted Mercury Bay**

## weed plants grown outdoors following treatment by herbicides.

Treatment	Rate (kg ai/ha)	Weeks After Treatment			
		1	3	5	18
chlorsulfuron	0.015	2.8	2.8	2.4	2.4
chlorsulfuron	0.03	2.8	3.2	2.8	2.6
clopyralid	0.22	2.6	2.8	3.0	2.4
clopyralid	0.45	3.4	2.8	3.0	2.8
dicamba	0.2	2.6	2.0	2.8	2.4
diuron	2.4	3.2	3.0	2.4	2.6
diuron	1.2	1.6	2.8	3.2	2.2
glyphosate	0.54	3.6	2.8	3.0	2.6
mecoprop-P	0.9	2.8	4.2	5.2	4.8
oryzalin	3.5	2.8	2.8	3.0	2.4
oryzalin + oxadiazon	3.5 + 1.5	3.0	3.4	3.8	3.2
oxadiazon	1.5	2.8	3.0	3.2	2.8
paraquat + diquat	0.25 + 0.15	6.8	5.6	3.0	2.0
paraquat + diquat	0.50 + 0.30	7.6	5.2	3.0	2.6
pendimethalin	1.6	2.0	2.2	3.0	3.4
tribenuron	0.03	2.6	2.4	2.4	2.6
tribenuron	0.015	2.8	2.4	2.8	3.2
triclopyr	1.2	5.6	7.8	8.2	9.2
untreated	-	2.4	2.4	2.8	3.0
LSD 5%		1.5	1.4	1.0	1.2

Mercury Bay weed grows in waste areas and lawns as a minor weed species, and it is often observed to regrow following weed control attempts with broad-spectrum herbicides. This tolerance was observed in Trials 1 and 2 where Mercury Bay weed quickly regrew following initial damage from low rates of a paraquat/diquat mixture (Preeglone), glyphosate (Roundup) and glufosinate (Buster). Thus weeds not controlled by the selective herbicides listed above could be sprayed with one of these more broad-spectrum herbicides.

Diuron (Dichondra Clean) is a residual herbicide already used to prevent new weeds from establishing in Mercury Bay weed swards for several months, and which offers some knock-down activity on existing weeds. Other residual herbicides that appear to be safe in this role for established Mercury Bay weed are oxadiazon (Foresite), oryzalin (Surflan Flo) and pendimethalin (Stomp 330E). Note that diuron (Karmex) caused significant damage initially in Trial 1, though this did not occur in Trial 2. Likewise, we have found diuron to have variable selectivity in our field plots, so oxadiazon, oryzalin and pendimethalin may offer more reliable selectivity.

Herbicides which appeared to be too damaging at the rates used in Trials 1 and 2 were triclopyr (Grazon), amitrole (Amitrole ATA), asulam (Asulox), dalapon (Icapon), 2,4-D (2,4-D Amine), MCPA (IWD MCPA), mecoprop-P (Duplosan KV), oxyfluorfen (Goal), the diuron/linuron mixture (Cohort), norflurazon (Solicam) and simazine (Gesatop). Note however, that amitrole and triclopyr were the only two treatments from which the Mercury Bay weed did not recover well, and even with amitrole there were plants in Trial 1 which were fully necrotic after 7 weeks which then began recovering. Therefore some of the harmful herbicides may be useful at lower rates or if initial damage is acceptable.

#### Establishing Mercury Bay weed

The usual recommendation for home gardeners wishing to establish Mercury Bay weed lawns is to transplant plugs of established Mercury Bay weed (Williamson 1974). The herbicides discussed above could probably be used in such situations. However, establishment of Mercury Bay weed over larger areas may be more feasible by sowing seed or perhaps transplanting stolon fragments. Herbicides that could be applied as pre-emergence treatments or as early post-emergence applications would assist with

establishment of such swards, especially since sowing rates of seeds would need to be low because of the high cost of seed.

There was poor establishment of seedlings in Trial 3, possibly caused by poor seed vigour, irrigation problems or because day-length requirements for germination of this C<sub>4</sub> species were not met in mid-winter. Some seedlings germinated after the 11 week scoring, giving fresh weight data at 15 weeks after treatment for pots devoid of seedlings earlier. Thus scores for untreated pots were fairly high to reflect poor establishment, but not as high as with treated pots where chlorosis and stunting caused by herbicides was clearly evident. Despite these problems, results strongly suggested that none of the pre-emergence treatments were satisfactory for use with germinating Mercury Bay weed seedlings (Table 3). However the Mercury Bay weed establishing from stolon lengths appeared less affected by the pre-emergence treatments, with linuron (Linuron 50) and methabenzthiazuron (Tribunil) being particularly safe despite initial slight damage.

**TABLE 3: Scores (0 = healthy, 10 = dead) and fresh weight (FW) of foliage (g/plant) of Mercury Bay weed seedlings and stolon regrowth following pre-emergence herbicide treatments.**

Treatment	Rate (kg ai/ha)	Seedlings			Stolon fragments		
		Score 6 WAT <sup>1</sup>	Score 11 WAT	FW 15 WAT	Score 6 WAT	Score 11WAT	FW 15 WAT
chlorpropham	2.4	6.4	9.6	0.00	6.2	8.8	0.57
linuron	1.0	10.0	10.0	0.03	4.4	2.4	3.80
methabenz- thiazuron	1.1	9.4	7.8	0.3	4.6	3.2	3.16
oryzalin	1.5	8.6	7.6	0.66	5.8	4.8	1.47
oxadiazon	1.6	8.2	8.2	0.24	9.0	9.0	0.39
pendimethalin	1.0	7.2	7.8	0.17	8.0	7.0	1.54
untreated	-	5.0	4.4	1.97	2.2	1.2	3.51
LSD 5%		3.3	4.1	1.21	3.5	3.8	2.07

<sup>1</sup> WAT = weeks after treatment

**TABLE 4: Scores (0 = healthy, 10 = dead) and fresh weight (FW) of foliage (g/plant) of Mercury Bay weed seedlings and stolon regrowth following post-emergence herbicide treatments applied 2 months after planting.**

Treatment	Rate (kg ai/ha)	Seedlings			Stolon regrowth		
		Score 5 WAT	Score 10 WAT	FW 15 WAT	Score 5 WAT	Score 10 WAT	FW 15 WAT
chlorpropham	2.4	5.3	2.0	5.30	4.6	1.6	5.06
clopyralid	0.15	0.8	0.3	8.04	1.4	1.0	6.28
clopyralid	0.3	0.5	0.0	6.86	1.4	1.6	5.67
linuron	1.0	8.3	6.0	3.07	6.8	3.6	4.45
methabenz- thiazuron	1.1	8.3	5.3	3.40	6.2	1.0	6.37
oryzalin	1.5	1.0	0.3	7.01	1.8	1.6	7.05
oxadiazon	1.6	6.5	5.0	4.70	5.2	3.6	4.59
pendimethalin	1.0	5.0	2.8	5.34	4.2	2.2	5.28
tribenuron	0.011	1.8	0.8	6.56	1.8	1.4	6.41
tribenuron	0.022	2.5	1.0	7.69	2.2	1.4	4.80
untreated	-	0.8	0.5	8.53	2.0	1.6	6.46
LSD 5%		2.1	3.4	3.31	1.4	1.8	2.03

The establishing Mercury Bay weed was more tolerant of the post-emergence treatments applied 2 months after planting the seeds or stolon fragments (Table 4).

Although both seedlings and stolon fragments were still initially damaged by methabenzthiazuron, linuron, oxadiazon, pendimethalin and chlorpropham (Chloro-IPC), most plants were recovering from the effects 15 weeks after application. Recovery occurred more rapidly from chlorpropham and pendimethalin. However, the safest treatments were clopyralid, tribenuron and oryzalin.

Results from these trials have provided sufficient information to allow weed-free swards of Mercury Bay weed to be grown in the field at Massey University.

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