HERBICIDE TOLERANCE OF TRANSPLANTED DALMATIAN SAGE AND OREGANO

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ABSTRACT

Herbicides were applied to Dalmatian sage and oregano at Invermay and Redbank in the week following transplanting and before weed emergence. Reduction in plant numbers in both crops was greater on the lighter soil at Redbank than on the heavier Invermay soil. Dalmatian sage plant numbers and dry matter yields were reduced by dichlobenil and dichlobenil/simazine with the highest yields being produced in the handweeded, pendimethalin and chlorthal/dimethal treatments. Oregano plant numbers were similar in all herbicide treated plots at Invermay but dry matter yield was severely reduced by oryzalin. At Redbank, diuron, metribuzin, simazine and aziprotrotryne reduced plant numbers and dry matter yields relative to the handweeded treatment which was similar to linuron and prometryn.

Keywords: Dalmatian sage, oregano, herbicides, plant survival, dry matter yield

INTRODUCTION

Oregano (*Origanum vulgare*) and Dalmatian sage (*Salvia officinalis*) are perennial culinary herbs of the Labiatae family originating from Europe. Dried and fresh leaves from both plants are widely used as food flavourings and their oils are used in the perfume industry. At establishment, Dalmatian sage and oregano suffer from weed competition and at transplanting or direct seeding, weeds need to be controlled to ensure plant survival and to lessen the effect of foreign leaf matter at harvest.

James *et al.* (1991) demonstrated herbicide tolerance of five herb crops including Dalmatian sage and oregano and Hartley (1993) reported on the tolerance of both crops to herbicides applied either before or after seedlings were planted. Preliminary trials on a Molyneux gravelly sand soil at Roxburgh East showed that 1 and 2 year old transplanted Dalmatian sage cuttings adequately tolerated combinations of simazine plus either dichlobenil, chlorthiamid or pendimethalin (B.Mitchell, unpublished). Maas (1989) lists a number of herbicides recommended for use in Dalmatian sage but most are not commercially available in New Zealand. Preliminary herbicide screening in transplanted oregano on the Taieri on a Wingatui recent silt loam soil type indicated varying degrees of plant tolerance to a small range of soil applied herbicides (B.Mitchell, unpublished). From the above literature, herbicides were selected to evaluate the tolerance of, and weed control in, seedling transplanted Dalmatian sage and oregano.

METHODS

Trials involving both Dalmatian sage and oregano were sited at Invermay Agricultural Centre on a Wingatui recent alluvial silt loam soil (pH 5.8, OC 2.9%) and at Crop and Food Research Institute's Redbank Station, Clyde, Central Otago on a Waenga loam silt soil (pH 6.5, OC 1.4%). Seeds of both species were grown in cell trays and planted into prepared soil in separate trials on 15 December 1994 at Redbank and on 20 December at Invermay.

Plants were spaced 30 cm apart in three rows in plots 3x1.5 m wide with 24 plants/plot at Redbank and in 2.7x1.5 m plots containing 21 plants at Invermay. At planting,

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oregano plants were 6-12 cm tall with both single and multiple stems, while the Dalmatian sage plants were 7-14 cm tall at the 6-10 true leaf stage. Gravimetric soil moisture levels at transplanting were 25% at Invermay and 17% at Redbank. Overhead watering was applied after planting at Redbank to maintain soil moisture but not at Invermay.

Herbicide treatments applied to Dalmatian sage and oregano are given in Tables 1 and 2 respectively. All herbicide treatments were applied to the trials at Redbank on 20 December 1994. At Invermay, trifluralin was applied on 19 December 1994 and the crops planted over the next 2 days. Trifluralin was incorporated into the soil by hand raking at both sites. The remaining treatments at Invermay were applied on 23 December 1994 with the exception of bentazone which was applied to oregano on 23 January 1995 when the crop was 10-18 cm tall. Treatments were replicated four times in a randomized block design. Handweeded plots were included as the untreated control in each trial, being weeded either two or three times before harvest. All sprayed treatments were applied using a modified Oxford Precision sprayer fitted with 8002 TeeJet nozzles at 190 kPa in 300 litres/ha. Dichlobenil granules were applied by hand, using pumice as the carrier.

Plant numbers were recorded and crop plant vigour visually assessed between spraying and harvest. Weed cover in all plots was assessed 2 or 3 times until all weeds were removed from all plots in late January (Redbank) and early February (Invermay).

TABLE 1: Percent survival, plant vigour and dry matter yield of Dalmatian sage at two sites after herbicide application

Treatment	Rates (kg ai/ha)	Plant vigour ¹		% survival		DM yields ³	
		Jan ²	Feb ²	Jan ²	Feb ²	kg/ha	g/plant
Invermay							
trifluralin	1.2	6.9	6.4	98	94	237	4.8
simazine	1.0	6.6	6.1	96	96	197	3.9
dichlobenil	3.0	6.6	4.1	94	54	76	1.9
dichlobenil	6.0	4.8	2.0	80	24	10	0.4
dichlobenil	3.0						
+ simazine	0.75	5.2	3.8	88	23	19	0.9
pendimethalin	1.5	7.0	6.1	99	99	230	4.5
linuron	1.0	6.0	5.8	100	100	215	4.2
chlorthal-dimethyl	10.0	7.5	6.9	96	96	279	5.5
aziprotryne	2.0	7.1	6.4	100	100	269	5.2
handweeded		8.4	7.5	100	100	373	7.2
effective LSD (P<0.05)		2.21	1.99	9.4	15.8	106	2.01
Redbank							
trifluralin	0.8	7.0	7.6	99	99	517	9.8
simazine	0.75	3.0	4.5	76	23	45	3.5
dichlobenil	3.0	4.6	3.0	94	16	26	1.6
dichlobenil	6.0	4.5	2.8	97	8	16	1.0
dichlobenil	3.0						
+ simazine	0.75	4.2	3.2	78	23	28	1.3
pendimethalin	1.5	7.9	8.8	100	99	744	14.0
linuron	0.75	7.0	7.6	99	92	570	11.5
chlorthal-dimethyl	7.5	8.1	8.0	100	97	684	12.9
aziprotryne	2.0	4.8	5.5	87	65	166	4.6
handweeded		8.6	8.2	100	99	715	13.4
effective LSD (P<0.05)		1.16	1.74	11.3	10.5	140	2.7

¹ Vigour ratings, 0 = dead, 10 = excellent

² Invermay, 9 Jan 1995, 14 Feb 1995. Redbank, 12 Jan 1995, 21 Feb 1995.

³ Yields 23 Feb 1995

At harvest on 23 February 1995 all surviving plants in each plot were cut to 3-5 cm above the ground surface using secateurs and samples were then oven dried to determine dry matter (DM) yield. Both vigour and yield data were subjected to analysis of variance while the data for plant survival were analysed using binomial regression analysis. The effective LSD is for comparison between treatments where plant survival is less than 100%.

RESULTS

Dalmatian sage

At both Invermay and Redbank, dichlobenil used either alone or in combination with simazine significantly ($P < 0.05$) reduced plant numbers and DM yields relative to all other treatments (Table 1). At Redbank, simazine and aziprotryne also reduced plant numbers and DM yields. Dry matter yields in the handweeded treatment were not significantly different from aziprotryne and chlorthal-dimethyl at Invermay or from pendimethalin and chlorthal-dimethyl at Redbank. At Invermay the handweeded treatment had the highest yield, while DM yields were similar for all herbicide treatments except dichlobenil.

TABLE 2: Percent survival, plant vigour and dry matter yields of oregano at two sites after herbicide application.

Treatment	Rates (kg ai/ha)	Plant vigour ¹		% survival		Yields ³	
		Jan ²	Feb ²	Jan ²	Feb ²	kg/ha	g/plant
Invermay							
trifluralin	1.2	7.6	7.0	100	100	234	4.5
linuron	1.0	6.6	6.5	96	96	198	4.0
prometryn	1.0	6.8	6.9	100	99	207	4.0
oryzalin	5.0	6.9	3.4	100	99	34	0.7
aziprotryne	2.0	6.4	6.2	100	98	195	3.9
chlorthal-dimethyl	10.0	7.6	6.8	100	100	186	3.6
methabenzthiazuron	1.0	6.6	6.6	99	100	203	3.9
pendimethalin	1.5	7.5	6.4	100	100	200	3.9
bentazone	1.2	7.9	6.5	100	100	207	4.0
handweeded		7.1	7.5	99	99	274	5.4
effective LSD (P<0.05)		0.81	1.58	4.1	4.1	66	1.3
Redbank							
trifluralin	0.8	7.2	7.9	98	98	632	12.0
linuron	0.75	7.0	7.9	96	97	788	15.1
prometryn	1.0	7.1	7.9	94	95	737	14.5
terbacil	0.75	6.2	6.4	100	100	428	8.0
diuron	1.0	1.9	4.1	8	6	18	4.4
pendimethalin	1.5	6.9	7.1	99	99	593	11.2
aziprotryne	1.5	4.8	7.1	69	73	348	9.0
simazine	1.0	2.8	4.0	24	24	96	6.1
metribuzin	0.5	0.5	2.0	6	8	4	2.0
handweeded		8.2	8.2	100	100	946	17.7
effective LSD (P<0.05)		1.39	2.56	10.5	10.5	218	4.2

¹ Vigour ratings, 0 = dead, 10 = excellent

² Invermay, 9 Jan 1995, 14 Feb 1995. Redbank, 12 Jan 1995, 21 Feb 1995

³ Yields, 23 Feb 1995

Oregano

Vigour ratings at Invermay (Table 2) showed only oryzalin at the February assessment to be significantly ($P < 0.05$) lower than the handweeded treatment but plant vigour at Redbank was significantly reduced in comparison with the handweeded

treatment in the metribuzin, simazine, diuron, aziprotryne and terbacil plots and these treatments, with the exception of terbacil, also reduced plant numbers. Dry matter yield at Invermay was highest from the trifluralin and handweeded treatments, but yields were similar from all herbicide treated plots with the exception of oryzalin. Linuron and prometryn plots produced DM yields similar to the handweeded treatment at Redbank but were not significantly better than the yields from trifluralin and pendimethalin treated plots.

Weeds

At Invermay, dominant weeds in both trials were spurrey (*Spergula arvensis*), groundsel (*Senecio vulgaris*), shepherds purse (*Capsella bursa pastoris*) and red dead nettle (*Lamium purpureum*). On 26 January 1995 (35 days after spraying) weeds totalled less than 10% ground cover in any treatment. Shepherds purse was the main weed in trifluralin treated plots along with groundsel which was also present in pendimethalin plots. Bentazone was applied to oregano at this time (weeds were at the 2-6 true leaf stage) and 14 days later weeds in these plots had been reduced to less than 1% total cover. At Redbank, 35 days after spraying, mallow (*Malva parviflora*) had emerged in chlorthal-dimethyl (8% cover), aziprotryne (4% cover) and handweeded plots (18% cover). Only traces of weeds were recorded in the other treatments.

DISCUSSION

At Redbank, Dalmatian sage and oregano plants appeared more sensitive to some soil applied herbicides but, where plant tolerance was adequate, DM production was considerably higher than in the corresponding treatments at Invermay. Yields from the handweeded plots were also higher at Redbank than at Invermay. Trifluralin, pendimethalin, linuron and chlorthal-dimethyl were well tolerated by Dalmatian sage at both sites with simazine and aziprotryne appearing safe only at Invermay. Oregano grew successfully and produced similar dry matter yields in all treatments except oryzalin at Invermay. Plants in oryzalin plots gradually lost their vigour as leaves turned purplish/bronze with no new basal leaf growth being produced. Hartley (1993) reported that seedling oregano transplants tolerated oryzalin applied 12 days after planting but fresh yield was severely suppressed when the same herbicide was applied a few days before planting. Hartley also recorded reduced oregano yields where bentazone was used after weed emergence but had failed to control weeds. The use of diuron, simazine, aziprotryne and metribuzin on these culinary herbs could not be recommended on light soils. Weeds were adequately controlled for the 9 weeks between herbicide application and harvest.

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APPENDIX OF HERBICIDES USED

Aziprotryne (Brasoran 50WP), bentazone (Basagran), chlorthal/dimethyl (Dacthal 75W), dichlobenil (Prefix D), diuron (Karmex), linuron (Linuron 50), methabenzthiazuron (Tribunil), metribuzin (Sencor DF), oryzalin (Surflan Flo), pendimethalin (Stomp330E), prometryn (Gesagard 50WP), simazine (Gesatop), terbacil (Sinbar), trifluralin (Treflan).