THE EFFECT OF ADDED SURFACTANT ON THE PERFORMANCE OF SCRUBWEED HERBICIDES

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SUMMARY

The addition of polyalkyleneoxide modified dimethyl polysiloxane (pdp) to the tank mix improved the performance of glyphosate, metsulfuron-methyl, and 2,4,5-T plus picloram in controlling mature gorse (*Ulex euorphaeus*) and broom (*Cytisus scoparius*). It sometimes slightly improved the performance of hexazinone. There were indications that pdp improved the performance of 2,4,5-T plus picloram when applied in the autumn but had a negative effect during early summer applications. When pdp was added to glyphosate better control was achieved in the autumn than in the early or mid-summer application times.

INTRODUCTION

Leaf penetration/uptake studies on gorse using radio-labelled herbicides and commercial formulation have shown that uptake was usually enhanced when pdp (Pulse) was added to the spray mix (Zabkiewicz *et al* 1985). For example, glyphosate uptake into gorse could be increased from 7% to 70%.

This preliminary finding was sufficiently encouraging to test pdp with a range of other herbicides in field trials to see if it could enhance herbicide effectiveness of gorse and broom. Herbicides tested are shown in Table 1.

METHOD

Two trial sites were selected in Canterbury. The broom site was located on stony Lismore soils 9 km west of Rangiora. The broom had been burnt in 1976 and at the time of herbicide application (1981 and 1982) was 1.8-2.0 m tall, growing from closely spaced individual stems. Plots were 5 x 2 m in size, replicated four times in randomised blocks. Plots were sprayed in October 1981, February 1982, or April 1982. A second trial was laid out adjacent to the first in similar manner but with only one application time, December 1982.

The gorse site was at Mt Thomas, on heavy yellow-grey earths, at an elevation of 300 m. The gorse had been burnt 9 years previously and was up to 2 m tall, growing from closely spaced stems. Plots were 5 x 2 m replicated three times in randomised blocks. Treatments were applied in — November 1981, February 1982, or April 1982. The rates of herbicides and additive used in each trial are shown in Tables 1-3.

A CO₂ boom sprayer (770039 flat fan nozzles, 205 kPa) held 1 m above the canopy was used in a double pass to give the required applied volume (300 litres/ha). All spraying was carried out between 6.00 a.m. and 8.00 a.m. in calm weather, with the temperature below 16°C, and about 80% RH.

In each plot 60 individual broom or gorse stems were harvested at 5 cm intervals along a diagonal transect. Stems were cut into 20 cm lengths and categorised as "dead", if no green cambial tissue was evident. Results were evaluated statistically using chi squared analysis for each pair data summarised in Tables 1 and 3 and for each set of data in Table 2.

RESULTS AND DISCUSSION

Broom trials

Table 1 gives the treatment means 15 months after application of the herbicides. In the absence of pdp, 2,4,5-T plus picloram gave best results when applied in the spring.

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TABLE 1: Broom — Percent biomass dead 15 months following application of herbicides.

Treatment and date sprayed	Rate kg ai/ha	Percent biomass dead		Significance ¹
		– pdp	+ pdp (0.5% v/v)	
glyphosate 36% (Roundup)	2.2			
2.10.81		47	52	NS
3.2.82		31	27	NS
14.4.82		35	41	NS
glyphosate 36% ai	3.6			
2.10.81		61	78	NS
3.2.82		32	30	NS
14.4.82		33	48	NS
glyphosate 49% ai (Mon 0139)	2.2			
2.10.81		47	56	NS
3.2.82		47	44	NS
14.4.82		40	45	NS
glyphosate 49%	3.6			
2.10.81		53	42	NS
3.2.82		42	47	NS
14.4.82		24	57	**
hexazinone (Velpar)	2.7			
2.10.81		18	22	NS
3.2.82		16	30	*
14.4.82		27	30	NS
hexazinone	4.5			
2.10.81		17	21	NS
3.2.82		21	33	NS
14.4.82		21	36	*
2,4,5-T/picloram (Tordon 520 Brushkiller)	4.25			
2.10.81		80	80	NS
3.2.82		72	70	NS
14.4.82		64	74	NS
2,4,5-T/picloram	5.5			
2.10.81		84	76	NS
3.2.82		69	74	NS
14.4.82		59	80	*

¹NS = Non-significant, * = $X^2.05$, ** = $X^2.01$ **TABLE 2: Second broom trial — percent biomass dead following application of four herbicide treatments with and without surfactant (sprayed 12.12.82; harvested February 1984).**

Treatment	Rate kg ai/ha	No additive	pdp 0.2% v/v	Ulvapron 2% v/v	pdp and Ulvapron	Significance ¹
glyphosate	5.4	72	89	83	82	NS
hexazinone	7.2	72	51	83	55	**
2,4,5-T/picloram	5.5	90	99	99	100	NS
metasulfuron-methyl	0.75	51	91	68	83	**

¹NS = Non-significant, ** = $X^2.01$

TABLE 3: Gorse — Percent biomass dead 15 months following application of herbicides.

Treatment and date sprayed	Rate kg ai/ha	Percent biomass dead		Significance ¹
		– pdp	+ pdp (0.5% v/v)	
glyphosate 36%	2.2			
25.11.81		12	16	NS
4.2.82		8	6	NS
15.4.82		17	18	NS
glyphosate 36% ai	3.6			
25.11.81		14	24	NS
4.2.82		1	22	**
15.4.82		6	25	**
glyphosate 49% ai	2.2			
25.11.81		13	14	NS
4.2.82		9	12	NS
15.4.82		2	31	**
glyphosate 49%	3.6			
25.11.81		22	24	NS
4.2.82		13	21	NS
15.4.82		19	36	*
hexazinone	2.7			
25.11.81		10	13	NS
4.2.82		5	6	NS
15.4.82		2	7	NS
hexazinone	4.5			
25.11.81		11	17	NS
4.2.82		5	8	NS
15.4.82		5	17	*
2,4,5-T/picloram	4.25			
25.11.81		89	86	NS
4.2.82		35	64	**
15.4.82		37	56	*
2,4,5-T/picloram	5.5			
25.11.81		88	82	NS
4.2.82		52	67	NS
15.4.82		47	67	*

¹NS = Non-significant, * = $X^2_{.05}$, ** = $X^2_{.01}$

However, with added pdp, equally good results were obtained from the autumn spraying (at least at the higher rate) indicating that the additive had enhanced herbicide activity (80% vs 59% kill). With glyphosate little, if any, benefits were gained by the addition of pdp. There was some slight evidence that spraying in the spring or autumn was more effective than spraying in the mid-summer period. Results from the application of hexazinone were very disappointing but did show some increased mortality when pdp was added to the tank mix.

In the case of glyphosate and hexazinone, insufficient herbicide may have been used. M. Willocks (pers comm) suggested that the rate of pdp (0.5% v/v) was too high and should be reduced to 0.2% v/v to prevent run-off problems with this plant.

Results of the second trial are given in Table 2. The effectiveness of glyphosate was improved when pdp was added to the spray mix. Improved effectiveness was not so marked when Ulvapon was included in the tank mix with glyphosate.

Ulvapron alone at 2% v/v improved the effectiveness of hexazinone while pdp reduced the herbicide effectiveness. Differences were small when pdp or Ulvapron were added to the tank mix with 2,4,5-T plus picloram. This was not unexpected as the earlier trials (Table 1) showed that any marked benefit would occur in the late summer or autumn applications when 2,4,5-T plus picloram is least effective.

The addition of pdp to the tank mix with metsulfuron-methyl resulted in an improvement in effectiveness while Ulvapron alone did little to improve herbicide efficacy. There was no advantage in including both additives in the spray mix.

Gorse trial

Results are shown in Table 3. The addition of pdp to the spray mix generally resulted in a higher percentage of dead gorse material, particularly in the summer/autumn application times.

It seems that not enough glyphosate or hexazinone was used to ensure a high kill of plant material. Nevertheless the results have been sufficiently encouraging to persevere with trial work and more recent studies, still in progress, show that glyphosate at 4.32 kg - 5.40 kg ai/ha seems likely to give good desiccation of gorse if applied in the late autumn.

The additive pdp aided the effectiveness of the herbicide metsulfuron-methyl, confirming earlier work (Balneaves and Cosslett 1983; Balneaves 1985). This product together with pdp offers the forest manager a further useful tool for dealing with weed problems on both new land and cut-over forest land, for future afforestation.

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