RAGWORT CONTROL USING A ROPE WICK APPLICATOR

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SUMMARY

Glyphosate and 2,4-D/picloram were compared for the control of ragwort *(Senecio jacobaea)* using a rope wick applicator. Best control was achieved with 2,4-D/picloram 100/25 g/litre (achieved by a 1:1 dilution of product with water) at the bolting stage and with glyphosate 120 g/litre (1:2 dilution) at the flowering stage. 2,4-D/picloram gave slightly more persistent control than glyphosate. Treatment at mid-flowering with either herbicide prevented viable seed production. 2,4-D/picloram reduced the clover content of the sward whereas glyphosate tended to increase the proportion of clover.

INTRODUCTION

Ragwort control by chemical methods is normally achieved through overall spraying during spring with 2,4-D followed by spot treatment of survivors with picloram or dicamba usually in combination with 2,4-D. The former phase entails a compromise between effectiveness versus the amount of clover damage that is acceptable. The latter phase is labour intensive and often results in severe pasture weakening in the zone immediately around the treated plant promoting new germination and establishment of ragwort seedlings.

The capability of precisely targeting the more effective, non-selective, systemic herbicides for improved weed control without undesirable pasture effects is claimed for the recently developed rope wick applicator. The background and advantages of rope wick applicators have been described (Cooper *et al* 1981; Dale 1978, 1979a, 1979b). This study evaluated the level of ragwort control in pasture and other effects produced by this type of application equipment.

MATERIALS AND METHODS

Three trials were conducted during 1981-82 in cattle grazed pasture with ragwort populations of 1.2 - 2.6 plants/m^2 at Motumaoho, Karakariki Valley and Rangitoto in Waikato and King Country districts, North Island. Three dilutions of glyphosate were compared with three dilutions of 2,4-D/picloram of similar viscosity. Herbicides were applied 1-2 days after grazing in a double pass in opposite directions using a 2 m wide, non-commercial wick applicator fitted with Feltex 14 mm polypropylene rope fixed by Rubbercraft No. 8 grommets and operated 10 cm above the pasture at a speed of 3 km/h. A separate applicator was used for each herbicide and dilution to ensure freedom from cross-dilution or contamination. The reference treatment was 2,4-D/picloram (0.2/0.05 g/litre) applied as a spot spray using an Oxford Precision sprayer equipped with a No. 0 fan nozzle. Plot size was 2 x 30 m and the time taken by both types of treatment was recorded for each trial. The application times coincided with the cabbage, bolting and flowering stages of ragwort at the following dates: Motumaoho 1.10.81, 18.11.81, 23.12.81; Karakariki Valley 7.10.81, 27.11.82, 5.1.82; Rangitoto 4.11.81, 23.11.81, 17.12.81. No rain fell within 24 h of application except at Rangitoto on 17.12.81 when a light shower occurred 1 h after the last treatment. The trial was laid out as a randomised block design with four replicates.

Assessments were made by means of 0-10 visual scoring of above ground flowered or surviving biomass, counting the number of inflorescences and plants, germination testing of seed viability, and point analyses of vegetation at appropriate times.

For statistical analysis, visual scores and seed germination raw data were transformed by $\sin^{-1}\sqrt{p}$ where p = a proportion between 0 and 1, and inflorescence, plant counts and clover/grass ratios were transformed by $\log_e (x + 50)$, $\log_e (x + 1)$ and $\log_e$ respectively. Back transformed means are reported in the tables.

The effect of rope type and herbicide dilution was examined in the laboratory by comparing relative transfer rates between two containers using a saturated wick to siphon the solution from a 7 cm head.

RESULTS AND DISCUSSION

Ragwort control

Both herbicides tested gave adequate control at some of the lower dilutions when applied at the bolting and flowering stages (Table 1). 2,4-D/picloram was better than glyphosate at the bolting stage but *vice versa* at the flowering stage. The lowest dilutions were required for best results at other times except at the cabbage stage when none of the rope wick treatments was effective. Rope wick treatments were inferior to spot treatments until the flowering stage application.

TABLE 1: Effect of type of herbicide, dilution and stage of application on ragwort (mean of 3 trials).

Treatment	Rate g/litre	Surviving shoot biomass score † 19-26.2.82	Inflorescences /m² 9-11.2.82	Post-flowering plants/10m²‡ 15-19.4.82
untreated		10.0	3846	1.7
Cabbage stage				
glyphosate 1:2	120	6.3	462	6.7
glyphosate 1:4	72	5.8	538	8.0
glyphosate 1:8	40	7.0	776	7.1
2,4-D/picloram 1:1	100/25	5.2	316	6.9
2,4-D/picloram 1:2	67/17	5.5	420	7.6
2,4-D/picloram 1:4	40/10	6.1	407	5.1
2,4-D/picloram 1:100 spot	0.2/0.05	2.0	19	6.8
Bolting stage				
glyphosate 1:2	120	4.5	187	7.3
glyphosate 1:4	72	3.4	121	6.7
glyphosate 1:8	40	5.9	530	5.0
2,4-D/picloram 1:1	100/25	2.7	58	3.6
2,4-D/picloram 1:2	67/17	3.2	90	4.2
2,4-D/picloram 1:4	40/10	4.2	186	5.3
2,4-D/picloram 1:100 spot	0.2/0.05	0.7	7	3.1
Flowering stage				
glyphosate 1:2	120	1.4	17	3.4
glyphosate 1:4	72	1.8	13	3.8
glyphosate 1:8	40	4.0	69	3.6
2,4-D/picloram 1:1	100/25	3.0	28	2.4
2,4-D/picloram 1:2	67/17	4.2	51	1.5
2,4-D/picloram 1:4	40/10	7.2	210	2.0
2,4-D/picloram 1:100 spot	0.2/0.05	3.8	14	0.7
Least significant ratio (5%)		1.3	2.1	1.5
CV%		35	87	52

† visual estimate on a scale where 0 = no plants > 10 cm diameter surviving or flowered, 10 = maximum flowered and surviving.

‡ total excludes plants < 10 cm diameter. Originally 1.8 plants/m² on 1.10.81.

The type of herbicide and growth stage at application had a significant effect on the amount of ragwort present in autumn. The best rope wick result was obtained from treatment at the flowering stage. 2,4-D/picloram was superior to glyphosate. This finding has been reported elsewhere (Peters and McKelvey 1981) and appears to be related to better translocation of picloram. The low number of plants in the control treatment is consistent with ragwort population flux and has been used as a prelude to control (Matthews and Thompson 1977; Thompson 1980).

With correct timing, rope wick treatments were found to reduce the amount of viable seed produced to very low levels (Table 2). Excellent results were obtained from mid-flowering treatments (Motumaoho site), and even mid- to late-flowering treatments (Karakariki Valley) achieved very good results. However, treatment at the very early flowering stage (Rangitoto site) gave highly unsatisfactory results, probably due in part to rain in the 24 h post treatment period.

TABLE 2: Effect of herbicide applied to ragwort at flowering on % viable seed production.

Treatment	Rate g/litre	Motumaoho (mid-flowering)	Karakariki (mid-to late flowering)	Rangitoto (very early flowering)
untreated		59.5	49.5	57
glyphosate 1:2	120	0.0	0.6	26
glyphosate 1:4	72	0.0	0.8	44
glyphosate 1:8	40	0.3	5.4	49
2,4-D/picloram 1:1	100/25	0.0	2.4	44
2,4-D/picloram 1:2	67/17	0.0	2.4	23
2,4-D/picloram 1:4	40/10	1.5	10.0	32
2,4-D/picloram 1:100 spot	0.2/0.05	0.0	3.0	15
Least significant ratio (5%)		-	3.5	-
CV%		-	60	-

Higher rates of solution transfer occurred with increased herbicide dilution thereby reducing chemical economy (Table 3). At a 1:4 dilution of glyphosate or 1:2 dilution of 2,4-D/picloram, the highest dilutions which gave acceptable control (Table 1), only a 20% chemical saving was obtained. However, timing became more critical and loss from the ropes by dripping was increased causing greater pasture damage. It is therefore questionable whether any worthwile saving was gained.

Hayasaka and Wu (1981) have shown that glyphosate at a 1:10 dilution gave control proportional to the volume of solution applied whereas at a 1:2.5 dilution control was uniformly high above the critical threshold volume. Thus it is probably equipment design rather than the herbicide which is the limiting factor at the moment. Although the Winstone "Wickboom" rope appears markedly less conductive than the Feltex type used in these trials, the current Winstone rope which we have not tested is claimed to be 100% more conductive (R. Moore pers comm).

TABLE 3: Relative flow rates and transfer of glyphosate in rope wicks.

Dilution	Rope	Flow rate	a.i. Transfer
1:2	Winstone rope	1.0	1.0
1:4	Winstone rope	1.3	0.8
1:8	Winstone rope	1.6	0.5
1:2	Feltex rope	2.5	2.5

TABLE 4: Effect of rope wick application at ragwort cabbage stage on pasture composition

Treatment	Rate g/litre	Clover/grass ratio Months after treatment 2	5
untreated		2.7	1.2
glyphosate 1:2	120	3.2	1.5
2,4-D/picloram 1:1	100/25	0.9	0.9
2,4-D/picloram 1:100	spot 0.2/0.05	-	0.5
Least significant ratio (5%)		1.4	
CV%		46	

Pasture effects

Although claimed to be physically selective, rope wick treatments caused a definite shift in pasture composition (Table 4). Glyphosate tended to increase the ratio of clover to grass while 2,4-D/picloram reduced the ratio. These effects had receded by 5 months after treatment. It is difficult to see how these changes can be avoided. Some dripping is inevitable with all the current wick applicators. Clover and grass become rank among ragwort foliage and are treated with the weed. Additionally it was noted that even with close grazing before the bolting stage glyphosate treatment, considerable grass damage occurred at one site because the ungrazed grass flowers were contacted by the wick boom. Heavier grazing could possibly overcome this problem. Wheel marking did not occur in these trials since narrow tyres were used on the application device. Normally a double pass with a heavy four wheel vehicle leaves a definite series of damage strips when treated foliage is rolled onto pasture. This can be minimised by using wider booms which need fewer passes to cover an area or by using a motorcycle and sulky arrangement.

General comparison

Over the three trials rope wick application took approximately one-tenth the time required to spot spray an equivalent area. This result was also confirmed on a larger scale by the farmer at the Rangitoto site. Thus even though the level of control at the bolting stage may be inferior to spot treatment, a considerable saving in time can be obtained even if re-treatment is necessary. Other benefits include reduced pasture injury and absence of herbicide drift.

Rope wick applicators are a useful adjunct to the overall control strategy for ragwort. They will not replace the need for overall spraying since rope wick applicators miss all seedlings and small regrowths. Best results will probably be obtained by applications at both the bolting and flowering stages to ensure that grazing is not lost and viable seed production by plants not controlled by the bolting stage treatment is prevented.

Although rope wick applications are currently recommended only for glyphosate, this work has demonstrated that 2,4-D/picloram is at least as effective and indicates the need to examine other potentially useful chemicals such as dicamba.

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