EFFECT OF PLANT TYPE ON THE RESPONSE OF RAGWORT TO RATES AND TIMES OF 2,4-D APPLICATION

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SUMMARY

Field trials were conducted on two soil types in the Waikato to evaluate the effects of rate, time of application and type of ragwort (*Senecio jacobaea*) plant treated, on the efficacy of 2,4-D ester. Increasing the rate of an overall spray of 2,4-D ester from 1.0 to 2.0 to 3.5 kg ai/ha increased the level of control of a ragwort population. One kg ai/ha gave adequate control of seedlings at all times of application. Spring application gave better control than early or late winter applications. Plants described as large single rosettes or regrowth types were not adequately controlled by overall boom spraying.

INTRODUCTION

Control of ragwort has long been a subject for research. Chemical control trials were reported in the 1930's (Thompson 1938; Deem 1933), yet ragwort is still a significant weed problem. A recent survey conducted on 'prime producing' pasture, as defined by Hunter and Blaschke (1984), estimated an average plant density of 487 plants/ha over the Waikato region, and 2347 in Manawatu. Ragwort was present on 20 and 26% of sampled sites respectively (Bourdote and Kelly 1986).

Earlier research on the chemical control of ragwort has reported the level of control on a population basis, taking little account of the fate of individual plants. The proportion of plants in different growth stages within the population could have a significant influence on the results achieved. The fate of individual plants needs to be investigated in order to assess the influence of plant size and stage of growth on the control of ragwort.

Trials were conducted at two sites in the Waikato region during 1985/86 to investigate the effect of rates and times of application of 2,4-D ester on ragwort plants of various sizes and stages of growth.

MATERIALS AND METHODS

Site 1 at Patetonga was on a Clevedon silt loam, while Site 2 at Karakariki was on a Hamilton clay loam. At Site 1 plants were either large or small single rosettes or multi-rosette/regrowth plants, while at Site 2 plants were categorized as true seedlings (complete with cotyledons), single rosettes (small or large) or multi-rosette/regrowths (small or large).

Representative plants within plots were selected and marked with a 20 cm venetian blind strip, held by a nail placed adjacent to the plant. The number of plants marked per plot were 25 and 42 at Sites 1 and 2 respectively. Plant height, diameter, leaf number, crown diameter and number of rosettes were measured.

Both trials were randomised block designs with four replicates at Site 1 and three replicates at Site 2.

Butyl ester of 2,4-D (Ethone DS 2,4-D) at rates of 1.0, 2.0 or 3.5 kg ai/ha in 300 litres/ha water, was applied on 28.8.85 at Site 1, and on 11.6.85, 8.8.85 and 10.10.85 at Site 2. Unsprayed control plants were included at both sites. Applications were made using a hand held CO₂ operated 3 m boom. Assessments of marked plants were made approximately 3 and 6 months after treatment, and finally in summer 1986. Analysis of

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variance is based on the 6 month assessment adjusted for any later regrowth. Data from untreated plots were not included in the analysis.

Recovered plants were spot treated after the November (6 month) assessment at Site 1 and after the December assessment at Site 2, to prevent mass flowering on the trial area.

Fig. 1: a. Effect of rate of 2,4-D on ragwort control.
b. Effect of time of 2,4-D application on ragwort control.
c. Effect of stage of growth control of ragwort by 2,4-D.

RESULTS

Summaries of the main effects of treatments are shown in Figures 1a, 1b and 1c. Figure 1a shows that all increases in the rate of herbicide gave a significantly improved kill of ragwort at both sites. Figure 1b gives mean percentage kills achieved at the various times of application. Data from the May application at Site 1 are not statistically comparable with data from Site 2. At Site 2, October treatments controlled, on average, 76% of plants, significantly more than August or May applications. There were some significant differences in the level of control of the various plant categories. Figure 1c shows that at Site 2, control of seedlings was better than that of other plant categories. At both sites there was better control of small rosettes than of larger rosettes and at Site 2 single rosette plants were better controlled than multi-rosette/regrowth plants ($P < 0.001$). There was no difference in the level of control between large rosettes and regrowth plants at Site 1. No significant difference was found between small and large multi-rosette/regrowth plants.

TABLE 1: Site 1 — Percent kill of ragwort following an overall spraying of 2,4-D.

2,4-D (kg ai/ha)	Plant type		
	Small rosette (< 25 cm)	Large rosette (> 25 cm)	Multi-rosette regrowth
0	27	0	5
1.0	90	25	35
2.0	90	71	75
3.5	100	91	84
Total No. of plants recorded	92	109	170

LSD ($P < 0.05$) = 13. Final assessment 29/1/86

The data on percentage kill of ragwort at Site 1 are presented in Table 1. For smaller rosettes, no significant differences across rates of herbicide were observed. Large rosette plants showed a significant response to both increases in the rate of herbicide used, with only the 3.5 kg ai/ha rate achieving a level of control similar to that of the smaller rosettes. Regrowth plants gave a significant response only to the rate increase from 1 kg ai/ha to 2 kg ai/ha. The 3.5 kg ai/ha rate achieved similar control to that of smaller rosettes.

TABLE 2: Site 2 — Percent kill of ragwort following an overall spray with 2,4-D.

Time of spraying	2,4-D (kg ai/ha)	Rosette			Regrowth	
		Seedling 5	Small 13	Large mean diam. (cm) 25	Small 22	Large 38
11/6/85	1.0	89	62	26	28	11
	2.0	100	77	44	30	33
	3.5	100	92	77	50	34
8/8/85	1.0	92	63	16	39	41
	2.0	94	74	77	44	44
	3.5	94	77	78	67	72
10/8/85	1.0	100	75	54	44	11
	2.0	97	93	86	72	63
	3.5	100	96	76	82	94
Untreated	0	25	30	7	6	6
No. of plants/plot		12	9	9	6	6

LSD ($P < 0.05$) = 27. Final assessment 7/3/86

The effect of rate and time of application over the various plant categories at Site 2 is shown in Table 2. For seedlings, no significant difference in control was shown between rates or times of application.

Increasing the rate of herbicide from 2.0 kg ai/ha to 3.5 kg ai/ha did not significantly increase control of single rosette plants. October treatments gave the best control. Regrowth plants were generally harder to kill than single rosettes (Fig 1a). Control of smaller regrowth plants gave a response only to the rate increase of 2.0 kg ai/ha to 3.5 kg ai/ha while that of large regrowth plants gave a response to all rate increases used. Later times generally gave the best control of regrowth plants.

Analysis within a plant type using the parameters of diameter, height, leaf number, crown size and number of rosettes, showed no apparent trends. Survival appeared to be random with respect to these parameters.

DISCUSSION AND CONCLUSIONS

The main conclusions to be drawn from this work are that rate and time of 2,4-D application, ragwort plant size and stage of growth all influence the level of ragwort control achieved by an overall spraying of 2,4-D. Higher rates and later times gave best control. Earlier work has shown that damage to pasture, especially clovers, is more severe as the rate is increased (Thompson and Saunders 1984) and during periods of active clover growth (Maclean 1957). Any recommendations must take this into account. Later timing can to some extent substitute for higher rates. For example, compare the control of large rosettes by 3.5 kg ai/ha in June with the control by either 1 kg ai/ha or 2 kg ai/ha in October (Table 2).

Earlier stages of growth and smaller plants, except within the regrowth category, were controlled more effectively. Earlier work confirms this (Thompson 1980; Brewster *et al* 1978), suggesting spring application prior to bolting gives the best control. Thompson (1980) found that seedlings treated in October were better controlled than those treated in May. Some indication of this occurred at Site 2 at the lowest rate but differences were not significant. Brewster *et al* (1978) found that rosettes within a plant diameter range of 15-30 cm were better controlled than either larger or smaller rosettes. Analysis of Site 2 data (not tabulated) showed no difference between the smaller and medium size rosettes and that control of the largest size range was significantly poorer.

Generally for larger plants and regrowth plants, unless rates substantially greater than current label recommendation are applied, control is poor and spot treatment is required. For seedlings, 1 kg ai/ha at any time gives good control.

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