A COMPARISON OF 2,4-D AND MCPA, ALONE AND IN COMBINATION, FOR THE CONTROL OF RAGWORT

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SUMMARY

In five trials the butyl ester of 2,4-D and the potassium salt of MCPA were compared, separately and in a 1:1 combination, at three rates for the control of ragwort (*Senecio jacobaea*) in pasture. At all rates MCPA was inferior to 2,4-D in ragwort control and tended to be more damaging to white clover (*Trifolium repens*). When the herbicides were combined the mixture gave less effective control of ragwort than 2,4-D alone and was at least as severe on clover. All herbicides reduced the number of ragwort rosettes carried forward to the following season.

INTRODUCTION

The economic importance of ragwort as a pasture weed is well demonstrated by the readiness with which any treatment promising improved control is promoted and adopted. For many years the ester formulations of 2,4-D have been the standard recommendation for the overall spraying of ragwort in pastures. Early work in New Zealand (Ward 1949, Lynch 1949) established that, at equal rates, 2,4-D was superior to MCPA for the control of ragwort. This has been confirmed by overseas research (Holly *et al* 1952, Forbes 1974). White clover is an important component of New Zealand pastures which MacLean (1957) and Meeklah (1958) have shown to be more tolerant of 2,4-D ester than of the potassium salt of MCPA.

It is well known that 2,4-D, while very effective for the treatment of small immature ragwort rosettes, often fails to give satisfactory control of large regrowth plants which usually form a significant proportion of established infestations. Consequently, a demand constantly exists for a treatment able to give better results than 2,4-D in these more resistant populations without causing increased clover damage. Recently a tank mixture of approximately equal parts (by active ingredient) of the butyl ester of 2,4-D and the potassium salt of MCPA has been reported (Morgan 1982, Garrity 1983) as superior, both in terms of ragwort control and clover tolerance, to the standard 2,4-D treatment. The mixture has been widely promoted by many Noxious Plants Officers and appears to have gained considerable acceptance by farmers and spraying contractors.

As a result of the reported user endorsement of the 2,4-D/MCPA mixture, field trials were commenced in May 1983, to compare 2,4-D and MCPA, separately and combined, for the control of ragwort in pasture.

METHODS AND MATERIALS

Table 1 gives site details and treatment dates for the five trials reported here. The main pasture species present at all sites were ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). All sites were cattle grazed except for Trial 4 which was grazed by farmed deer. One to two weeks after grazing the treatments shown in Table 2 were applied at all sites. Herbicides were applied in 250 litres/ha water through a CO₂ pressure sprayer and hand boom at 210 kPa. In all trials treatments were replicated four times in randomised blocks. Plot size throughout was 20 m x 3 m. Trial 3 received 8 mm of rain between 3 and 12 hours after treatment.

Treatment effects on pastures were determined by point analyses (100 cover points/plot) during the spring and early summer of 1983. Effects on ragwort were assessed in February-March 1984, by counting surviving flowering plants and non-flowering rosettes.

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TABLE 1: Site details at laying down of trials.

Trial No.	Location	Treatment date	Ragwort infestation No/m ² *	Growth stage
1	Karakariki	24.5.83	1.3	Small regrowths and rosettes
2	Karakariki	25.8.83	0.9	Medium regrowths and rosettes
3	Te Kauwhata	13.9.83	2.1	Small-med. regrowths, some small rosettes
4	Waimiha	20.9.83	3.1	Large-med. regrowths and small rosettes
5	Te Kauwhata	9.11.83	1.5	Bolting stage regrowth plants, some rosettes

* very small plants not counted

TABLE 2: Herbicide treatments used in terms of active ingredient and ratio of 2,4-D (butyl ester) and MCPA (potassium salt).

Total ai (kg/ha)	0.9			1.4			1.8			
2,4-D/MCPA ratio	1:0	1:1	0:1	1:0	1:1	0:1	1:0	1:1	0:1	Untreated
2,4-D (ethone DS)	0.9	0.45	-	1.35	0.68	-	1.80	0.90	-	-
MCPA (IWD Weedar)	-	0.47	0.94	-	0.70	1.40	-	0.94	1.87	-

For statistical purposes total active ingredient (Total ai) and mixture were considered as quantitative factors. Total ai was analysed as active ingredient/ha (0.9, 1.4 and 1.8) and the mixture as proportion of 2,4-D (100%, 50% and 0). Analyses of variance to determine linear and quadratic trends for both total ai and mixture were carried out.

RESULTS AND DISCUSSION

The five trials in this project covered the part of the year over which boom sprayed ragwort treatments are normally applied and spanned the range of herbicide rates most likely to be used in practice. Ragwort growth stage at treatment ranged from relatively small and susceptible plants in May to bolting plants in November (Table 1). Three of the trials were commenced in the late winter-early spring period recommended by Morgan (1982) as the optimum time to apply the 2,4-D/MCPA mixture.

Table 3 shows the effect of treatments in reducing the numbers of ragwort plants which survived to flower in the summer following herbicide application. The superiority of 2,4-D over MCPA for the control of ragwort, reported by Ward 1949, Lynch 1949, Holly *et al* 1952 and Forbes 1974, was confirmed. Only in Trial 1 where the small plants were vulnerable to all treatments did control by MCPA approach that achieved by 2,4-D. Table 3 also shows it was only in Trial 1 that the 2,4-D/MCPA mixture gave control approximately equal to that by 2,4-D. In all other trials control by the mixture was less effective than that by 2,4-D, indicating that the herbicidal effect of combining 2,4-D and MCPA was simply additive, with no evidence of synergistic effect resulting from the combination. This is supported by analyses of variance which show linear trends for total ai and mixture as significant in all trials and quadratic effects as significant in Trial 4. These results are in agreement with European experience (Anon 1968).

TABLE 3: Percent reduction in the number of flowering ragwort plants.

Total a.i.(kg/ha)†		0.9			1.4			1.8			S.E.M Untreated††	
2,4-D/MCPA ratio		1:0	1:1	0:1	1:0	1:1	0:1	1:0	1:1	0:1		
Trial	1	90	90	67	92	94	89	97	92	91	3.5	2.0
	2	86	69	62	90	87	77	91	82	84	5.3	1.6
	3	70	51	42	86	75	57	92	88	67	3.4	3.1
	4	57	46	15	77	71	30	83	79	56	4.8	3.0
	5	69	61	61	77	74	72	88	81	65	4.5	1.7

† total active ingredient

†† number of plants/m² on untreated plots

Pasture point analysis data from all five trials (Table 4) confirmed the findings of MacLean (1957) and Meeklah (1958) that white clover was less severely affected and recovered more quickly following treatment with 2,4-D than with MCPA. Morgan (1982) has stated that he found the mixture of 2,4-D and MCPA to be noticeably less harmful to clover than the standard 2,4-D treatment. Our results (Table 4) do not support this conclusion and again suggest an additive effect from the combination. Analyses of the pasture pointing data indicate a significant linear trend in trials 2, 3 and 5 for the mixture to cause greater clover suppression than 2,4-D, further confirming the findings of MacLean (1957) and Meeklah (1958).

In all trials carry over populations of rosette stage ragwort plants were present in February-March 1984. Except in Trial 4 all herbicides significantly reduced the number of these plants compared to untreated controls. Differences between herbicide treatments were apparent in only two trials (trials 2 and 3); therefore no data from counts of carryover rosettes are presented. At the sites where treatment differences occurred analysis of variance showed a significant linear decline in the rosette numbers as the proportion of 2,4-D increased.

TABLE 4: Clover cover as a percent of untreated areas.

Total a.i.(kg/ha)† 0.9				1.4			1.8			S.E.M Untreated††		
2,4-D/MCPA ratio				1:0	1:1	0:1	1:0	1:1	0:1	1:0	1:1	0:1
Trial	1	80	70	75	57	53	50	45	45	39	5.4	51
	2	81	65	56	63	62	33	69	64	34	7.7	50
	3	87	68	84	72	73	57	67	58	58	5.5	67
	4	49	56	49	39	25	48	44	26	30	7.6	61
	5	72	53	54	60	47	45	48	40	34	7.2	60

† total active ingredient

†† percent clover cover on untreated plots

CONCLUSIONS

1. The potassium salt of MCPA was inferior to the butyl ester of 2,4-D for the control of ragwort.
2. When 2,4-D and MCPA were combined the effect was additive, not synergistic, so that a 1:1 tank mix of the two gave less effective ragwort control than 2,4-D alone.
3. MCPA was more severe on white clover than 2,4-D.
4. A 1:1 mixture of the two herbicides was at least as severe on clover as 2,4-D.

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