HERBICIDE ADDITIVES TO 2,4,5-T FOR GORSE CONTROL

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SUMMARY

Trials were conducted near Palmerston North and in North Canterbury to test herbicide additives to 2,4,5-T for ground spraying of gorse (*Ulex europaeus*) at different times of the year. Additives gave no advantage to an adequate rate of 2,4,5-T in the late spring/summer. Picloram showed some benefit in autumn/winter but dicamba, 2,3,6-TBA, glyphosate, diquat and paraquat were either ineffective or reduced the activity of 2,4,5-T on mature gorse. Diesel oil was of benefit in autumn/winter. With the exception of diesel oil and picloram, herbicide additives to 2,4,5-T cannot be recommended.

INTRODUCTION

For over 30 years, 2,4,5-T has been the major herbicide used for gorse control in New Zealand. Much experimental work over that period and experience from practical usage has shown that 2,4,5-T needs to be applied between November and February to control actively growing gorse. As new herbicides have become available many have been added to 2,4,5-T in an attempt to improve effectiveness and to extend the spraying season.

Picloram is the most frequently used additive and generally increases activity of 2,4,5-T and extends the effective spray season (e.g. Upritchard 1973) though Patterson (1964) did not find the mixture any better than 2,4,5-T alone. Logan and McLaughlan (1974) claimed dicamba increased the activity of 2,4,5-T on gorse but other workers have expressed doubts. Williams and Palmer (1969) found paraquat and diquat accelerated the brown-off of gorse following winter treatment with 2,4,5-T but Thompson (1975) showed that addition of diquat reduced the translocation of 2,4,5-T within the plant. When the work reported here commenced glyphosate and 2,3,6-TBA were also being tested by their proprietors as additives to 2,4,5-T.

Unless the rate of 2,4,5-T can be reduced substantially by the addition of other herbicides or the effectiveness considerably enhanced, the economics of additives are doubtful. It was decided therefore, to conduct further trials with a number of additives to 2,4,5-T and compare their effectiveness in gorse control. Two trials were conducted near Palmerston North and four in North Canterbury.

METHOD AND RESULTS

Trial 1 Palmerston North. Mature gorse.

Individual gorse bushes, growing on a sloping site, were selected, numbered and graded for size. The size ranged between 0.5 and 2.5 m tall with bushes up to 7 years old. Each treatment was applied to 10 bushes equally representative of the size range. Each bush was sprayed all over to the point of run-off using a solid cone (TG5) nozzle from a knapsack sprayer at 550 kPa.

The herbicides used, dilution rates and times of application are given in Table 1. The higher rate of each herbicide applied was approximately the rate recommended by the manufacturer. The three treatment times included one within the recommended optimum period (Nov - Feb) and two later in the season. The effects of treatments were assessed visually by four or five independent observers without knowledge of treatment applied.

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TABLE 1: Percent control (reduction in vigour relative to untreated bushes) of mature gorse. (Trial 1. Palmerston North, 1979).

Herbicide	Dilution rate g ai/litre	Date of treatment		
		January	May	July
		assessed at 31 15 25 months after treatment		
2,4,5-T	0.7	100	70	8
(Weedone 2,4,5-T)	1.4	99	81	62
2,4,5-T + picloram	0.5 + 0.125	100	51	26
(Tordon 520)	1.0 + 0.25	100	73	44
2,4,5-T + dicamba	0.5 + 0.125	69	47	21
(Ban 750)	1.0 + 0.25	100	80	24
2,4,5-T + 2,3,6-TBA	0.5 + 0.165	52	47	25
(Weedone 2,4,5-T + Cooper's TBA)	1.0 + 0.33	100	51	52
2,4,5-T + glyphosate	0.5 + 0.25	45	41	24
(Weedone 2,4,5-T + Roundup)	1.0 + 0.5	95	40	47
2,4,5-T + 10% diesel	0.7	78	84	95
(Weedone 2,4,5-T)				

Such a high level of control was given by 2,4,5-T alone when applied in January that addition of other herbicides could not show any improvement in control. When the lower rates were applied in January, control was reduced by the addition of dicamba, 2,3,6-TBA, glyphosate and diesel oil. However, since these herbicides were added to a lower rate of 2,4,5-T than that used alone, it was unclear whether they provided no benefit or were antagonistic. Size of bush did not appear to affect the results.

When treatments were applied in May or July, control was poor and there appeared to be little, if any, advantage in adding other herbicides. The addition of diesel oil, however, resulted in greatly increased control.

Trial 2 Palmerston North. Mature gorse

The method used in this trial was similar to that used in Trial 1 except that a "gorse gun" (No. 4 tip at 700 kPa) was used for spraying. The trial was designed in the light of results from the previous trial. Consequently lower rates of 2,4,5-T were used for the January treatments, and although rates were increased for the later applications, all treatments at different times had one rate of 2,4,5-T in common (see Table 2 for details).

Results from this trial (Table 2) indicate that with the January application, picloram and diesel improved control of gorse but that dicamba, 2,3,6-TBA, glyphosate, diquat and surfactant alone all reduced the effectiveness of the 2,4,5-T. Results from the later applications show that the addition of diesel was beneficial and that there may have been some benefit in adding picloram. Early assessment (4-5 months after treatment) of April and May treatments showed 2,4,5-T and diquat to give the best visual control (90%), but this was followed by a rapid recovery of treated bushes.

TABLE 2: Percent control (reduced vigour) of mature gorse. (Trial 2. Palmerston North, 1980)

		Date of treatment			4
		January	April	May	
Herbicide	Dilution rate g ai/litre †	22	19	18	
		assessed at			
		months after treatment			
2,4,5-T	0.25	13			
	0.5	59	2		
	0.75	53	46	0	
	1.0		51	22	
	1.5			26	
2,4,5-T + picloram (4:1)*		73	68	56	
2,4,5-T + dicamba (4:1)*		33	23	16	
2,4,5-T + 2,3,6-TBA (3:1)		26	35	20	
2,4,5-T + glyphosate (2:1)		41	35	33	
2,4,5-T + diquat (diquat 0.24)		44	38	48	
2,4,5-T + surfactant (surfactant 1.2)		36	56	38	
2,4,5-T + diesel (diesel 10%)		82	78	92	

† in mixtures 2,4,5-T used at mid rate for that date with additive in ratio shown

* Proprietary products Tordon 520 and Ban 750; remaining treatments Weedone Hi-Ester-T plus Coopers TBA, Roundup, Reglone and Shellostrol. Diesel emulsified with Triton X-45

Trial 3 North Canterbury. Mature gorse

Trials were conducted on a flat site on heavy soil (winter wet, summer dry) where a permanent pasture sward was reverting to a dense gorse overstory. A series of 10 x 4 m plots was established in the gorse areas, each plot containing 15 clumps of gorse 1.4 m tall. Each plot was sprayed with a herbicide treatment (Table 3), two passes giving a total of 300 litres water/ha using a CO₂ powered boom spray unit at 205 kPa. A late summer application was made in February 1976 when the gorse had hardened and flower buds were beginning to form. A further application on another series of plots was made in November 1976 to plants with 5-10 cm of new growth. There were 5 replicates of each treatment. Treatments were assessed by digging and cutting up 45 stems/plot for examination.

Results of this trial indicated that picloram improved control particularly when assessed for regrowth suppression (Table 3). There was little benefit in using dicamba and a detrimental effect from diquat. Diesel oil was of value in February but less advantage in November.

TABLE 3: Results of treatments of mature gorse in February or November 1976. Death and moisture content (MC) assessed pre-burn March 1977, regrowth (RG) assessed March 1978 (Trial 3. North Canterbury)

Treatment*	Rate kg ai/ha	February 1976			November 1976		
		%Dead	%MC	%RG	%Dead	%MC	%RG
2,4,5-T	7.2	85	30	13	93	18	15
2,4,5-T + picloram	4.0 + 1.0	91	18	3	100	15	4
2,4,5-T + dicamba	6.0 + 1.5	64	30	8	87	29	12
2,4,5-T + diquat	7.2 + 1.0	61	38	20	73	26	23
2,4,5-T + diesel	7.2 + 30 litres	92	16	5	82	27	9

* Formulations as Table 1

Trial 4 North Canterbury. Seedling gorse

An area adjacent to Trial 3 was desiccated and burnt. Several 10 x 4 m plots were established and regrowth was sprayed with 2,4,5-T or 2,4,5-T with various additives. Techniques for spraying were as described for Trial 3 above. Herbicides were applied in November 1975 to three replicates of 30 plants 20-25 cm tall, identified as seedlings and tagged. Treatments were evaluated by digging and examining the roots of all plants 16 months later.

This trial demonstrated that all additives improved gorse control (Table 4), with picloram, dicamba and diquat giving the best results. Paraquat and diesel additives also improved control when compared to 2,4,5-T alone.

TABLE 4: Control of 6-month-old gorse seedlings treated in November 1975. (Trial 4. North Canterbury)

Herbicide*	Rate kg ai/ha	% Dead
2,4,5-T	3.6	62 c
2,4,5-T + picloram	2.0 + 0.5	100 a
2,4,5-T + dicamba	3.0 + 0.75	100 a
2,4,5-T + paraquat	3.6 + 1.0	85 b
2,4,5-T + diquat	3.6 + 1.0	100 a
2,4,5-T + diesel	3.6 + 30 litres	84 b

* Formulations as in Table 1

Trial 5 North Canterbury. Coppice regrowth

A coppice regrowth trial was sprayed, as described in Trial 3, in April 1975 following a burn in February 1975, and assessed one year later. A range of rates of 2,4,5-T was used with or without additives. There were 5 replicates with 15 stumps examined per replicate.

This trial showed that the effectiveness of additives was affected by the rate of 2,4,5-T used (Fig. 1). At the low rates of 2,4,5-T (1-2 kg ai/ha) picloram and dicamba were beneficial but at intermediate rates (3-5 kg/ha) dicamba and diquat reduced effectiveness of 2,4,5-T. Paraquat reduced gorse kill at all rates of 2,4,5-T.

Fig. 1: Effect of increasing rate of 2,4,5-T plus additives on coppice gorse regrowth (Trial 5 North Canterbury). Diquat and paraquat constant 1 kg ai/ha; diesel oil constant 30 litres/ha; picloram and dicamba 1:4 ratio with 2,4,5-T.

Trial 6 North Canterbury. Mature gorse

Mature gorse (as described for Trial 3 above) was sprayed with 2,4,5-T containing varying amounts of diesel (v/v) plus 0.33% X-45 emulsifier. Herbicide was applied in February 1976.

Increasing the amount of diesel in the mixture led to higher mortality of gorse bushes (Table 5).

TABLE 5: Mortality of mature gorse treated with 2,4,5-T iso-octyl ester (6 kg ai/300 litres/ha) with diesel additive. Assessment 15 months after application. (Trial 6 North Canterbury)

Diesel (%)	% of dead bushes
0	62
10	84
20	93
30	100

DISCUSSION

Several trends are apparent in these trials. Used at an adequate rate, within the optimum season, 2,4,5-T was a very effective herbicide for gorse control. Little benefit was gained from the addition of other herbicides for the control of mature gorse, nor was there any improvement in out of season control except from picloram and diesel oil. There was some improvement in the control of 6-month-old seedling gorse from all additives used but these were tested with only one fairly low rate of 2,4,5-T. The data from the coppice regrowth suggested that some additives were beneficial with low rates of 2,4,5-T, other data indicated many were detrimental with higher rates of 2,4,5-T.

Diesel oil showed an interesting seasonal effect. It consistently improved control from late season treatment but did little or even acted negatively when used in the late spring/early summer. Diquat greatly accelerated the brown-off effect but not the final kill and this may be why it is frequently used by contractors, especially late in the season. Thompson (1975) showed that addition of diquat reduced the movement of the effect of 2,4,5-T to protected parts of the plant. Possibly the rapid desiccation caused by diquat restricts uptake of 2,4,5-T. Paraquat probably behaves in a similar way and neither material should be added to 2,4,5-T for gorse control. The poorer control of gorse in the second Palmerston North trial compared to the first when using the same dilution rate was not expected. The difference might be due to different season or different application technique.

Other factors must be considered. These are cost (most additives are considerably more expensive than additional 2,4,5-T) and clover damage. Picloram, dicamba and 2,3,6-TBA all severely damage clover and have residual activity. The use of picloram for gorse control can inhibit clover establishment for up to 2 years (MacDiarmid 1975) and trials in North Canterbury indicated that dicamba suppressed clover to a similar extent (Balneaves unpublished).

CONCLUSION

There is little justification for the use of any of the additives tested, other than diesel oil and possibly picloram to 2,4,5-T for control of gorse. When spraying in the late summer, autumn and winter the addition of diesel oil increases the effectiveness of 2,4,5-T.

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