CHEMICAL CONTROL OF MOUSE-EAR HAWKWEED

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SUMMARY

The chemical control of mouse-ear hawkweed (*Hieracium pilosella*) was studied in Otago. Both 2,4-D and a mixture of mecoprop/MCPA/dicamba were shown to give acceptable control. 2,4-D ester gave better control than 2,4-D amine but caused more clover (*Trifolium repens*) damage; these two effects were greater if application was in November rather than in September. Volunteer grasses increased as mouse-ear hawkweed was reduced.

INTRODUCTION

There has been growing concern in recent years among South Island run holders (Anon 1976) over the increase in mouse-ear hawkweed, subsequently referred to in this report as hawkweed.

The ecology and biology of this weed have been studied by Makepeace (1976) and Scott (unpublished). It is a weed of depleted tussock grassland and appears to be an indicator of shallow soils subject to summer droughts, where it survives as a drought tolerant perennial.

A shift from hawkweed dominance to that of useful agronomic species is likely to be achieved in the long run by the introduction of clover plus the fertilisers, phosphate, sulphur and molybdenum, needed for good clover growth, coupled with a change in grazing management.

Chemical control of hawkweed may not be economical over large areas of low producing tussock grassland, but its reaction to herbicides should be known for use in specific situations where control by management is for any reason impracticable or ineffective.

METHODS

The main area chosen for experimental work was a 200 ha block at Mt. Stoker near Middlemarch, set-stocked with approximately 500 hoggets from September to May and occasionally grazed with a few cattle. It had never been topdressed to the owners knowledge. Three further experiments were laid down in 1978 at Little Valley, Alexandra, in conjunction with investigations into the control of hawkweed by over-drilling or oversowing with white clover and the use of fertiliser. Herbicides were applied (21.9.78) as sub-plots to one part of the main 2 x 20 m plots sown or drilled (3.10.78) into an area of hawkweed similar to that at Mt. Stoker.

The experimental sites used lie within the semi-arid and sub-humid climate zones of Central Otago and the South Island of New Zealand. Rainfall for the former averages 400 mm pa with a soil moisture deficit of 290 mm; for the latter rainfall averages 520 mm pa. Mean annual screen temperature is 10.8°C (range 3.0 to 17.7° C) with 178 days of ground frost. Soils on experimental sites were silt loams, with organic matter levels of 2 to 5%.

Experimental areas were chosen for evenness of hawkweed and thus we were working on plots of at least 60% hawkweed cover. Associated species were browntop (*Agrostis tenuis*), sweet vernal (*Anthoxanthum odoratum*), suckling clover (*Trifolium dubium*), moss and remnants of small tussocks. Some trial areas were oversown and topdressed, and in others grazing effects were also estimated by placing frame

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enclosures (1 m²); except at Little Valley where the trial area was fenced to protect over-drilled and oversown species, in all other cases the remainder of the trial area was open to grazing.

Details of herbicides, rates and timing are given in the tables. Materials were applied in 220 litres/ha by a modified Oxford Precision sprayer. Plot sizes were 1.5 x 10 m at Mt. Stoker and 4 x 2 m at Little Valley. Treatments were replicated 3 to 6 times in randomised blocks.

Assessments of clover were made by two or more independent observers, or by point analysis.

RESULTS

1975: Two pilot trials were laid down 30.12.75 in hot dry conditions. Bentazone had no effect on hawkweed, but 2,4-D (both amine and ester), MCPA and a commerical mixture of mecoprop/MCPA/dicamba, appeared similar in activity, giving good control with no apparent improvements in results between 1.0 and 1.5 kg/ha of 2,4-D or MCPA.

1976: In a further comparison of a range of herbicides applied 28.9.76, good control was obtained with mecoprop/MCPA/dicamba especially at the higher rate (Table 1). Hawkweed control was not improved where a small amount of 2,4-D was substituted with dicamba, while asulam was without effect. The addition of ammonium sulphate (at 10x herbicide active ingredient) did not enhance activity of herbicides in this experiment. An increase in ground cover by volunteer grasses such as sweet vernal and browntop followed the reduction in cover by hawkweed.

TABLE 1: Comparison of herbicides for control of hawkweed applied 28.9.76.

	% cover at 18.2.77	
Treatment kg/ha	hawkweed	grass
2,4-D amine 0.5	33 b B	50 d C
2,4-D amine 1.0	19 cd D	58 bcd BC
2,4-D 0.4 + dicamba 0.1	30 bc BC	52 cd C
2,3-D 0.8 + 0.2	12 de DE	69 ab AB
mecoprop 1.2 + MCPA 0.3 + dicamba 0.05	15 d CD	61 bc ABC
mecoprop 2.3 + MCPA 0.6 + dicamba 0.1	3 e E	75 a A
asulam 1	63 a A	27 e D
asulam 2	69 a A	22 e D
untreated	71 a A	21 e D
CV%	22	17

When 2,4-D ester was examined at three rates, significant control was obtained at 1.0 and 1.5 kg/ha (Table 2) together with an increase in associated grasses. Cessation of grazing for one year gave slightly better contro but the application of Mo superphosphate (250 kg/ha) was without effect through lack of clover to respond and compete.

TABLE 2: The effect of 2,4-D ester on control of hawkweed applied 13.9.76.

	% cover at 18.2.77	
Treatment kg/ha	hawkweed	grass
2,4-D ester 0.5	51 ab AB	33 bc AB
2,4-D ester 1.0	39 bc B	44 ab AB
2,4-D ester 1.5	36 c B	49 a A
untreated	61 a A	27 c B
CV%	24	28

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Pasture Weeds

1977: In an attempt to establish a dicamba dose/response relationship six rates of dicamba were tested together with two standards, mecoprop/MCPA/dicamba and 2,4-D ester. Although generally significantly better than untreated ($P < 0.05$), hawkweed control by dicamba was not as effective as with the mecoprop mixture, and 2,4-D ester both 3 and 10 months after application (Table 3).

1978: A further attempt using higher rates was made to establish a dicamba dose/response curve, but with similar results to the 1977 experiment (Table 3).

TABLE 3: Effect of dicamba on hawkweed (% cover and hits/100 points) in two experiments applied 3.10.77 and 5.10.78.

Applied 3.10.77 kg/ha	Assessed 23.1.78 % cover hawkweed	Assessed 15.8.78 hits/100 points	Applied 5.10.78 kg/ha	Assessed 21.2.79 % cover hawkweed
dicamba 0.05	62 ab A	22 ab A	dicamba 0.1	44 b
dicamba 0.1	50 cd AB	24 ab AB	dicamba 0.2	24 bc
dicamba 0.15	60 abc AB	18 b BC	dicamba 0.4	58 a
dicamba 0.2	52 bcd AB	20 b B	dicamba 0.6	43 b
dicamba 0.25	45 d B	26 ab AB	dicamba 0.8	36 bc
dicamba 0.3	52 bcd AB	24 ab AB	dicamba 1.0	30 c
mecoprop 1.2 + MCPA 0.3 + dicamba 0.05	18 e C	6 c C	mecoprop 1.2 + MCPA 0.3 + dicamba 0.05	16 d
2,4-D ester 1.0	10 e C	5 c C	2,4-D ester 1.5	6 d
untreated	65 a A	34 a A	untreated	69 a
CV%	17	32		23

The effects of 2,4-D formulations, dose rate and time of application were studied in 1978 and this was repeated in 1979. Results from both years are shown in Fig. 1. Application in October gave better hawkweed control than application in September, while November was best. 2,4-D ester benefited more than the amine formulation from later application, although 0.5 kg/ha generally failed to give acceptable control. White clover had been established from oversowing the previous psrig, and response of both hawkweed and white clover were observed within a small pasture cage on each plot (Fig. 2). Hawkweed responses to formulation, dose and time of applciation of 2,4-D were similar to those in the main plots, except that September application fared better through elimination of grazing. Clover cover tended to increase both at the lower rates (0.5 to 1.5 kg/ha) and at the earlier applications. November application however, severely reduced clover cover except at 2 kg/ha which presumably caused leaf scorch, reduced translocation and thus aided recovery.

To indicate the effect of 2,4-D on established white clover at this time in this environment, an identical trial was laid down on vigorous clover dominant pasture, the site being within 1 km of the hawkweed infestations and on the same soil type. An assessment 2 months after application showed that 0.5 and 1.0 kg/ha caused little reduction in clover cover, while 1.5 to 2.0 kg/ha reduced clover cover from 70% to 50% except in October and November when it fell to 40%. At rates greater than 0.5 kg/ha the ester was always more damaging than the amine formulation. Total yields were not, however reduced because of increased production from grasses. By autumn clover had fully recovered.

A comparison of 2,4-D amine 1.5 kg/ha and 2,4-D ester 1.0 and 1.5 kg/ha (applied 21.9.78) was made at Little Valley, Alexandra. No satisfactory reduction in hawkweed cover was achieved.

Also at Little Valley, sub-plots of 2,4-D and mecoprop/MCPA/dicamba were laid down (21.9.78) 12 days prior to the establishment of an over-drilled by nutrients trial and an oversowing by nutrients trial. The trial design did not permit statistical comparison of untreated with herbicide sub-plots. However, the most marked effect came from applied phosphate rather than herbicides, thus results from untreated and 2,4-D sub-plots are shown in Table 4 with a separate statistical analysis for each.

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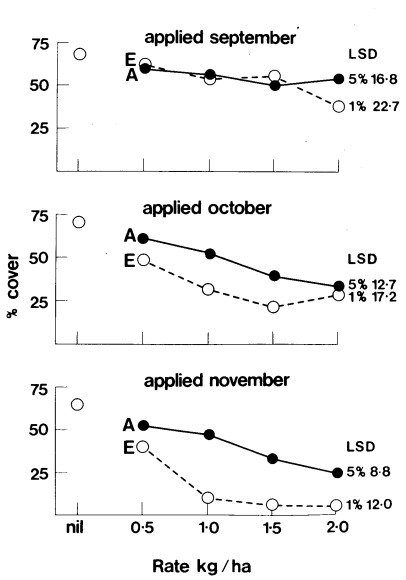

Fig. 1: The effect of 2,4-D formulation, dose rate, and time of application on percentage cover of hawkweed. (Mean data from two experiments, 1978 and 1979. Assessed 4 months after final application). A = amine, E = ester.

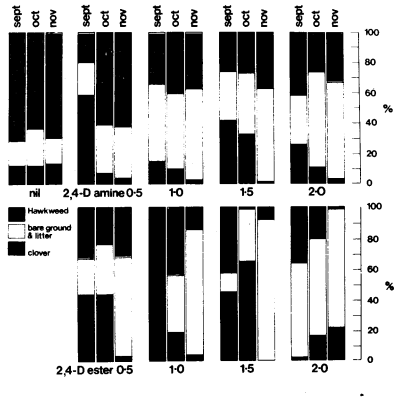

Fig. 2: The effect of 2,4-D formulation, dose rate and time of application in 1978, on species percentage ground cover in pasture frames (Assessed 4 months after final application).

TABLE 4: The effect of 1 kg/ha 2,4-D ester, applied 12 days before oversowing or drilling white clover plus nutrients, on % cover by hawkweed and clover (assessed 6 months after treatment).

	% hawkweed		% clover	
nutrient	untreated	2,4-D	untreated	2,4-D
Oversown trial				
nil	77 a A	72 a A	8 c C	15 c C
Mo	78 a A	68 a A	9 c C	13 c C
Mo + P	38 b B	27 b B	53 a A	63 a A
Mo + N	75 a A	72 a A	6 c C	12 c C
Mo + P + N	45 b B	29 b B	43 b B	47 b B
CV%	12	12	20	17
Over-drilled trial				
nil	73 a A	56 a A	10 d C	18 d D
Mo	60 b AB	42 ab Ab	23 c B	36 bc BC
Mo + P	34 c C	20 c C	54 a A	38 a A
Mo + N	56 b B	48 a AB	24 c B	25 cd CD
Mo + P + N	36 c C	29 bc BC	44 b A	46 ab AB
CV%	15	24	15	22

Mo = 200 g/ha sodium molybdate, P = 500 kg/ha reverted super-phosphate, N = 250 kg/ha nitro-lime.

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DISCUSSION

These results indicate that 2,4-D amine or ester at 1 to 1.5 kg/ha and mecoprop/MCPA/dicamba at 1.5 to 3 kg total ai/ha gave the best control The other chemicals tested were not effective. A detailed examination of dicamba, expected to be the most active component of the above mixture, failed to produce acceptable control.

Results were variable, particularly with 2,4-D, only mecoprop/MCPA/dicamba giving consistently good results in the first 3 years work. We would have expected December 1975 applications under drought conditions to be a failure, yet acceptable results were obtained. In subsequent years applications were made in September in the hope that a successful kill could be followed if necessary by over-drilling about 4 weeks after spraying by which time, herbicide residues should be considerably reduced.

The Little Valley results indicate that 2,4-D had no effect on white clover establishment when applied 12 days before over-drilling or over-sowing. Where clover was already established, observations on its tolerance to 2,4-D suggest that less damage is caused by application in September rather than in October or particularly November, by using amine rather than the ester formulation, and by restricting grazing for the first year.

The factors involved in 2,4-D variability were defined in the 1978 Mt. Stoker experiments (see Fig. 1).

(a) The threshold dose for acceptable reduction in hawkweed cover probably lies between 0.5 and 1 kg/ha.

(b) The ester is more active than the amine.

(c) There is a time, temperature or stage of growth effect, with better control from later application in September. Yet early application is desirable not only to facilitate oversowing before accumulated winter moisture evaporates, but also to reduce clover kill where that legume is established before spraying (see Fig.2).

Herbicides are probably unnecessary for hawkweed control. The oversowing and over-drilling experiments showed that phosphate reduced hawkweed cover almost as much as did 2,4-D, probably through the competitive effect of the resulting clover.

CONCLUSIONS

1. Ground cover by hawkweed (*Hieracium pilosella*) can be roughly halved by spraying with 2,4-D 1 to 1.5 kg ai/ha or mecoprop/MCPA/dicamba 1.5 kg ai/ha.
2. The ester form of 2,4-D is more active than the amine, but may cause more clover damage.
3. 2,4-D is more active in late rather than in early spring.
4. Volunteer grasses increase as hawkweed is reduced.
5. Grazing needs to be eliminated for most of the first grazing season in a control programme where topdressing and oversowing plus herbicides are used.

REFERENCES

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