EVALUATION OF HERBICIDES FOR CONTROL OF CALIFORNIAN THISTLE

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SUMMARY

Several herbicides, including MCPB, MCPA, 2,4-D, clopyralid, glyphosate, picloram and mixtures thereof, were applied by spray or ropewick boom to Californian thistle *(Cirsium arvense)* in pasture. All herbicides failed to give any useful reduction in thistle numbers, and only MCPB had no effect on clover incidence. Application by ropewick boom, or by spray to thistle regrowth following mowing, also failed to improve control.

INTRODUCTION

Californian thistle is one of the most troublesome weeds of intensively grazed pasture in Otago/Southland. It is well adapted to productive, well aerated soils in areas where temperatures are moderate (Hodgson 1968).

Hartley and James (1979) showed that there were measurable economic gains in sheep liveweight to be obtained from control of a thistle population of approximately 30% ground cover. The difficulty is to avoid clover damage from herbicides which may be used for thistle control.

Only MCPB is recommended for Californian thistle control without damage to white clover *(Trifolium repens)* (Allen and Meeklah 1972), but control is not always satisfactory. Thus there is interest in the addition of other herbicides to improve control and in mechanically selective devices such as ropewick applicators to apply herbicides such as picloram which is not selective towards clover, and glyphosate not selective towards grass.

This paper reports the results of field trials in South Otago comparing alternatives to MCPB for control of Californian thistle, some using both low volume spray boom and ropewick applicators. Two further trials were laid down on intensively grazed thistle-free pasture, to obtain data on clover tolerance.

MATERIALS AND METHODS

Six experiments were laid down in randomised block designs of four replicates each. Plot sizes were 2 x 10 m. Details of herbicides, dosages, and dates of application are shown in the appropriate tables. The rope wick applicator was held 15 cm above the pasture, and thistles wiped in a double pass in opposite directions at 2 kmph. Boom spraying was by modified Oxford Precision sprayer, using 250 litres/ha at 175 kPa with 8002 Teejet nozzles.

Thistle stem counts were taken pre-spraying and one year later. The effect on clover survival was estimated at No. hits/100 points/10m^2 taken at intervals throughout the year. Clover was 99% white clover (*Trifolium repens*) so no species differentiation was made.

Experiments A and B compared boom application to mown and un-mown thistles when about 80% were in the early flower bud stage. Regrowth from mown thistles was sprayed at a similar stage in autumn in trial B, but in trial A after grazing by sheep there was insufficient foliage remaining to retain herbicides. Experiments C and D compared herbicides applied by spray boom and rope wick, applied also when 80% of thistles were in early flower bud. Experiments E and F were similar to A and B in treatment allocation and experimental procedure except that no plots were mown.

All trials were on 'all grass' farms, and rotationally grazed by sheep according to feed demand.

TABLE 1: Expt A: Effect of herbicides and mowing on thistle numbers and clover cover, sprayed 21.12.82, mown 21.12.82

		Thistle No./ha ('000)		Clover % hits
Treatments	kg ai/ha	30.11.82	21.12.83	21.12.83
MCPB	1.5	49	71	10
MCPB/MCPA	1.0/0.33	57	56	17
MCPA	1.0	79	75	14
clopyralid/MCPB	0.021/0.75	64	55	16
	0.032/1.13	42	48	12
2,4-D/MCPA/MCPB	0.3/0.3/0.6	64	48	14
	0.4/0.4/0.8	55	34	15
untreated - mown		49	126	24
untreated - not mown		56	173	15
LSD 5%		23	42	10
LSD 1%		31	57	14

RESULTS

In Experiment A the thistle population in unsprayed plots increased about threefold in one year, and herbicides stopped this increase with minor differences between them (Table 1). The population in Experiment B was stable though much higher, and herbicides gave only moderate reduction in thistle numbers (Table 2). Mowing reduced thistle numbers judging by untreated controls one year later, but the addition of herbicides gave little improvement.

Clover incidence returned to normal within one year in Experiment A, but in experiment B the high rate of clopyralid/MCPB as well as 2,4-D/MCPA/MCPB significantly reduced an already very low clover population.

None of the treatments in Experiment C reduced thistle numbers, but in Experiment D MCPB and the wick-applied glyphosate and picloram/2,4-D reduced thistles (Table 3). Clover counts in the high rate of 2,4-D/MCPA/MCPB, clopyralid/MCPB and picloram/2,4-D were significantly lower than untreated one year later.

In the tolerance trials E and F, clover counts fluctuated but generally clopyralid/MCPB and the high rate of MCPA caused the most adverse effects (Table 4). At the final counts, 52 weeks after application, only the highest rate of clopyralid/MCPB showed clover numbers significantly lower than untreated clover.

DISCUSSION

In no experiment was there any useful reduction in thistle incidence. Applying herbicides by ropewick boom failed to improve kill consistently, and where in Experiment D picloram/2,4-D significantly reduced thistle numbers, this was accompanied by clover suppression.

Mowing has been suggested (Hartley, M.J. pers comm) as a means of increasing the shoot:root ratio in Californian thistles. In Experiment B pre-spraying stem counts were only increased by 10% through mowing, and at final counts in the following year no herbicides gave better control through mowing and spraying the regrowth. Mowing alone gave reductions similar to all other treatments.

Except for MCPB, all herbicides had some effect on clover incidence, but only the higher rates of clopyralid/MCPA and ropewick applied picloram/2,4-D gave prolonged and severe reductions. It was also noted that glyphosate applied by ropewick damaged grasses in the sward, especially where thistles were dense, and this also would temporarily reduce pasture production. Hartley (1983) although working with Scotch thistles, again demonstrated the importance of clover tolerance to herbicides if maximum sheep liveweight gains were to be achieved.

TABLE 2: Expt. B: Effect of herbicides and mowing on thistle number and clover cover. Thistles sprayed or mown 14.12.82 and mown regrowth sprayed 7.3.83.

Treatments kg ai/ha	Thistle No./ha (000) Unmown 10.12.82	Unmown 1.12.83	Mown 10.12.82	Mown 7.3.83	Mown 1.12.83	Clover % hits Unmown 20.10.83	Clover % hits Mown 20.10.83
MCPB 1.5	269	181	296	301	200	3.2	3.8
MCPB/MCPA 1.0/0.33	263	211	271	305	169	3.2	1.2
MCPA 1.0	261	180	220	260	143	1.5	0.8
clopyralid 0.021/0.75	235	190	258	281	196	2.0	1.0
0.032/1.13	276	224	291	306	155	0.5	1.0
2,4-D/MCPA/MCPB 0.3/0.3/0.6	228	149	266	312	177	2.5	2.0
0.4/0.4/0.8	236	176	230	323	161	0.5	0.8
Untreated	306	286	261	284	180	3.5	3.5
LSD 5%	76	73	76	82	73	2.1	2.1
LSD 1%	101	97	101	111	97	2.8	2.8

TABLE 3: Expt. C and D: Effect of herbicides on thistle numbers and clover cover following application of various herbicides by spray boom or ropewick on 14.1.83.

Treatments kg ai/ha	Thistle No./ha ('000) Expt C 14.1.83	Expt C 13.12.83	Expt D 14.1.83	Expt D 13.12.83	Clover % hits Expt C 13.12.83	Clover % hits Expt D 13.12.83
MCPB 1.5	159	163	106	81	14	20
MCPB/MCPA 1.0/0.33	130	159	95	131	12	16
MCPA 1.0	122	140	112	106	13	18
clopyralid/MCPB 0.021/0.75	110	125	97	105	5	6
2,4-D/MCPA/MCPB 0.4/0.4/0.8	158	152	119	134	10	11
0.6/0.6/1.2	119	129	123	138	8	9
glyphosate*	142	172	132	81	13	12
picloram/2,4-D*	129	130	113	60	TR	2
untreated	118	147	150	205	11	18
LSD 5%	35	49	36	57	4.4	7.0
LSD 1%	48	67	49	77	5.9	9.5

*herbicides applied by ropewick, diluted at 1:2 water.

Results from the herbicides selected for test in these trials thus failed to indicate that any were more effective than MCPB; and while clover incidence is not a measure of clover productivity, clover counts are a useful measure of tolerance, pointing to probable effects on stock production.

TABLE 4: Expt. E (Invermay) and F (Milton): Effect on white clover % cover, following herbicide application to thistle-free rotationally grazed pasture.

Treatments kg ai/ha	Expt. E applied 21.1.83 pre-spray	Weeks after tr. 6	12	40	Expt. F applied 27.1.83 pre-spray	Weeks after tr. 7	14	33
MCPB 1.5	34	32	25	10	82	80	26	30
MCPA/MCPB 0.33/1.0	34	32	11	8	86	81	43	32
MCPA 1.0	34	40	17	12	80	70	31	26
MCPA 1.5	32	23	8	4	84	48	19	23
clopyralid/MCPB								
0.021/0.75	30	6	6	3	82	64	25	21
0.028/1.0	34	8	4	5	84	58	18	18
0.042/1.5	36	2	1	2	88	19	6	8
2,4-D/MCPA/MCPB								
0.4/0.4/0.8	34	19	14	6	82	51	31	23
0.6/0.6/1.2	34	27	17	10	82	51	11	24
Untreated	32	35	16	11	86	75	26	33
LSD 5%	7.4	9.4	9.4	6.7	7.4	11.4	10.8	5.8
LDS 1%		12.7	12.7	9.0		15.4	14.5	7.8

Insufficient evidence is available to show why there was such poor Californian thistle control with herbicides in the 1982/83 growing season. We suggest that Californian thistle populations need to be under stress through grazing, trampling, and soil compaction to reduce production of aerial shoots from the many dormant buds along the rhizomes. There was abundant pasture growth during this season (Withell, Q.B. pers comm). Thus relatively low grazing pressure was applied to thistle populations.

We suggest that Californian thistle populations need pressure from heavy stocking before herbicides can accelerate any decline in numbers.

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REFERENCES

Allen, F.C. and Meeklah, F.A., 1972. Weeds of high fertility pasture. *Proc. N.Z. Grassland Assoc. 34*: 99-106.

Hartley, M.J., 1983. Effect of Scotch thistles on sheep growth rates. *Proc. 36th N.Z. Weed and Pest Control Conf.*: 86-88.

Hartley, M.J. and James, T.K., 1979. Cost benefit of Californian thistle control in pasture. *Proc. 32nd N.Z. Weed and Pest Control Conf.*: 245-249.

Hodgson, J.M., 1968. The nature, ecology and control of Canada thistle. USDA Bulletin. USDA, Washington D.C.