COST BENEFIT OF SELECTIVE CONTROL OF CALIFORNIAN THISTLE IN PASTURE

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Summary

Techniques of controlling Californian thistles *(Cirsium arvense)* were evaluated via sheep growth rates and pasture dry matter production. Under grazing, both repeat spraying with MCPB and repeat topping, before the thistles impeded grazing, gave increases in stock production to greater value than the cost of treatment. Delayed treatment did not give response sufficient to cover costs. Repeat spraying over two years gave good control of Californian thistles. Californian thistles appeared to affect pasture production indirectly via impaired pasture utilization which in turn affected production rather than by direct competition. Utilization by sheep was affected more than that by cattle.

INTRODUCTION

Much work has been done, throughout the world, on the physiology and control of Californian thistles. However, little of the work done has been in relation to pasture or to the economics of control of Californian thistles in pastures.

There is at present no selective herbicide that can reliably eliminate Californian thistles in pastures in a single application. As repeat treatments are necessary, information is required on the effect of Californian thistles on pasture production on which to base valid cost benefit decisions.

A trial was conducted at Rukuhia, Hamilton, to measure the effect Californian thistles had on pasture production under sheep grazing. A supplementary trial was conducted at Flock House, Bulls, where pasture dry matter production and utilization was measured under Californian thistles and in an area where these had been controlled.

METHOD

Grazing trial

A site, previously used for grazing trials following chemical control of barley grass (*Hordeum* spp), had become overrun by Californian thistles to about 30% ground cover. The area consisted of fifteen 0.18 ha paddocks which had been under uniform management for two years.

Each paddock was given a score based on the density of Californian thistles the previous summer as measured from aerial photographs, and on the current pasture production (May to September 1976). The 15 paddocks were arranged in five sets of three so that all the sets were as equal as possible, based on the above criteria. Sets were then allocated to treatments at random except that the highest and lowest producing paddocks and those with very high and low thistle scores were included in the untreated controls of which there were two sets.

Californian thistles were controlled by three methods -

Cutting frequently without removing mown thistles (cut whenever thistles impeded grazing - see Table 2).

Spraying frequently with MCPB at 1.5 kg/ha (sprayed whenever thistles impeded grazing - see Table 2).

Cutting and removing thistles at flowering and spraying regrowth with MCPB at 1.5 kg/ha.

Grazing commenced 6.1.77 and continued until 13.2.78 apart from 6 weeks during March/April 1977 when pasture growth was negligible following drought. The paddocks were grazed by dry sheep. Initially the paddocks were set-stocked at 5 sheep per paddock. Later a rotational system was used with one flock on each treatment, grazing each paddock for one week in three. Stocking rates varied between 17 and 25 sheep/ha according to season, with slight variation between treatments according to feed available. The sheep were weighed every three weeks and drenched at intervals for internal parasite control.

Thistle populations were measured by counting stems on a 1 m x 30 m transect of each paddock during the trial and by visual assessment the following year.

Mowing trial

A supplementary trial was conducted at Flock House, Bulls, where pasture dry matter production was measured in the presence and absence of Californian thistles. In the latter case, Californian thistles were controlled by one of three methods designed to control thistle with minimum effect on the pasture. The methods were spraying with MCPB at 1.0 kg/ha, painting individual thistles with a 1 to 50 dilution of glyphosate or cutting individual thistles below ground level. Treatments were repeated as necessary to keep pasture free from thistles. Plots were exposed to grazing except when caged for production measurements. After each cut the cages (1.3 x 3 m) were replaced on a grazed part of the plot so that production was measured from "grazed" pasture. Plots were cut to grazed pasture height.

Pasture production in the presence of Californian thistles was measured from a new plot at each cut since cutting affects thistle growth. Plots were caged to protect thistles and pasture from grazing and at the same time "matched" plots were chosen (matched on thistle density). The thistles and grass were cut separately (thistles cut by hand, remainder cut by rotary mower) from both the caged plots and the matched plots. The cages were then replaced on plots similar to the previous "matched" plots and the process repeated. This technique gave a measure of standing thistle DM at any one time, pasture production under thistles and utilization of the pasture. There were three "thistly" plots in each block (patch of thistles) covering the range of thistle densities within that block. These, together with one plot of each control treatment, constituted a replicate of which there were seven. The trial commenced September 1977 and continued until March 1979.

RESULTS

Grazing trial

The liveweight gains (LWG) of the sheep are shown in Table 1. Though the sheep were weighed every 3 weeks weight gains are shown over longer periods. As sheep were changed during the trial, total LWGs were not analysed statistically. However, the treatments gave significantly increased weight gains over most periods so that the 24-41% increases in total LWGs following thistle control are probably significant.

Table 1. Mean liveweight gains of sheep as affected by Californian thistle control.

Period	6.1.77-21.3.77	21.3.77-20.6.77	20.6.77-22.8.77	22.8.77-10.10.77	10.10.77-21.11.77	21.1.77-13.2.78	Total
Treatment							
Cut frequently	0.1	3.4	2.3	12.3	8.0	2.4	28.5
Spray frequently	4.1	2.9	2.0	11.2	9.7	1.0	30.9
Cut/spray	1.4	0.7	3.0	12.4	9.3	0.4	27.2
Untreated	-1.3	1.2	0.8	10.6	9.2	1.4	21.9
LSD 5%	3.4	1.8	1.4	1.5	2.4	2.0	

Table 2 shows the dates of treatments, the cost of treatments, the value of increased sheep production and consequently the cost benefit of treatment. The densities of thistles during and after the trial are also shown. Both the frequently cut and frequently sprayed treatments resulted in increased production that would have more than covered the cost of treatment at ruling costs and prices. The cut/spray treatment did not give sufficient production increase to pay for the treatment.

Table 2. Treatment dates, cost benefit and Californian thistle control.

Treatments and dates applied	Cost of treatment $/ha	Total LWG/ha	Increased returns $/ha	Cost/ benefit $/ha	No. thistle stems/ha 24.2.77 ('000)	% thistle cover 13.11.78
Cut frequently 5.1.77 17.2.77 21.3.77 8.12.77	32	587	63	31	95	6
Spray frequently 15.12.76 20.4.77 17.1.78	60	657	94	34	36	trace*
Cut/spray cut 17.2.77 spray 20.4.77 cut 8.12.77 spray 21.2.78	70	514	31	-39	123	16
Untreated		442			129	29

* less than 50 stems/ha

Treatment costs estimated from farm contract price statistics. Returns calculated by pricing extra LWG at 87c/kg at 50% killing out.

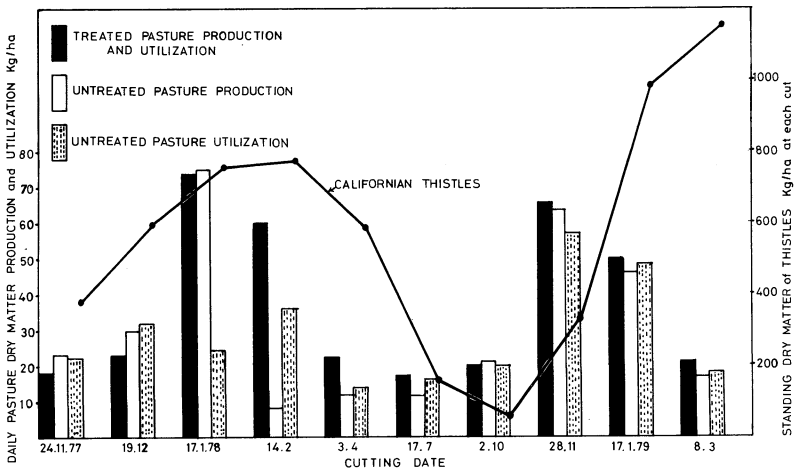
Total LWG/ha calculated from mean LWG (Table 1) adjusted for sheep numbers which vary slightly between treatments.

Assessments the following year showed the frequently sprayed treatment to have given the best thistle control with less than 50 stem/ha. Frequent cutting reduced thistle cover to about one fifth while cutting and spraying only halved the thistle cover.

Mowing trial

The effect of Californian thistle on pasture dry matter (DM) production is shown in Figure 1, together with the mean standing DM of Californian thistles on the untreated plots. The pasture DM production is expressed as mean daily production over the period between cuts. There was no significant difference in production between the three control techniques so their data are combined. Initially, treatment had no beneficial effect on pasture growth but as the density of thistles increased the sheep did not graze among them and utilization declined. Following the decline in utilization there was a sharp drop in pasture production (January/February). As the thistles declined and the sheep grazed among them pasture production with and without thistles equalized. During the second season the area was grazed moderately heavily by sheep and cattle and pasture utilization was greater. (Unused pasture reached 1260 kg DM/ha in the first year but only 600 kg DM/ha in the second year.) Under conditions of greater utilization Californian thistles did not appear to affect pasture production (Fig. 1).

Fig. 1. Daily dry matter production and utilization in presence and absence o Californian thistles and mean thistle density on untreated plots.



DISCUSSION

It would appear from the grazing trial cited here that it is economically worthwhile controlling Californian thistles. Three applications of MCPB virtually eradicated Californian thistles and the increase in production during treatment gave a return in excess of the cost of treatment. The thistle numbers remaining after 2 years treatment were low enough to make spot treatment feasible to complete the eradication.

The lack of stock response during the second summer of the trial may have arisen because of a general decline in thistle vigour over the untreated area or because of the more severe drought conditions that summer.

The mowing trial results suggest that Californian thistles, at the relatively low density on that site, did not interfere greatly with pasture production but did interfere with pasture utilization by sheep. Where thistles prevented stock access, as occurred in December 1977/January 1978, the unused pasture depressed further pasture production. During the second summer the area was grazed by both sheep and cattle and there was much less pasture left ungrazed. That season, in spite of a higher thistle density there was little difference in pasture production in the presence or absence of thistles.

Obviously the economics of Californian thistle control will depend on the density of the thistle infestation. Under sheep grazing it appears economically viable to apply the repeat treatments necessary to control Californian thistles. Californian thistles appear to have a major effect on pasture production indirectly via their affect on pasture utilization. Pasture utilization by sheep was seriously affected by Californian thistles but it may be less so under cattle grazing.

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