INTEGRATED MANAGEMENT OF CALIFORNIAN THISTLE IN PASTURE

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SUMMARY

For two growing seasons, a dense infestation of Californian thistle (*Cirsium arvense*) in pasture was either topped or sprayed with MCPB in mid-December, and then rotationally grazed with adult sheep. Topping, followed by hard or lax rotational grazing and MCPB followed by hard rotational grazing reduced thistle numbers by 99% by January 1993, two years from the initiation of the treatments. MCPB followed by lax rotational grazing gave an 80% reduction over the same period.

Keywords: Californian thistle, shoot numbers, topping, MCPB, grazing.

INTRODUCTION

Californian thistle (*Cirsium arvense*), is an aggressive perennial weed common to most temperate regions of the world. It has been the subject of considerable research effort (Hodgson 1968; Donald 1990). It is recognised as the most economically important weed of intensely grazed pasture land in southern Otago and Southland. In 1989 MAF consultants at Balclutha and Gore surveyed 120 farms, and found that on average 33% of the grazing area on each farm carried Californian thistle infestations. It was estimated that the cost of control and loss of production caused by the weed was \$3,500 per farm per annum which equates to a regional cost of \$21,000,000. Similar results were obtained from a later survey of farmer opinion in the Gore area, (van Toor and Stuck 1993). In this survey an average of 9.6 hectares per farm was affected and the cost of control measures and loss of grazing was estimated at \$3,100 per farm each year.

In addition to reducing the quantity and quality of available forage, Californian thistle can increase the incidence of scabby mouth in lambs and have a direct effect on the value of deer velvet. Hartley and James (1979) showed that there were measurable economic gains in sheep liveweight obtained following the control of a thistle population of 30% ground cover.

Present recommended methods of controlling Californian thistle mainly involve mechanical topping or pasture spraying using MCPB or mixtures of MCPB and MCPA. However, Meeklah and Mitchell (1984), using several herbicides applied as sprays or by rope-wick boom, in some cases followed by mechanical topping, showed that most treatments failed to give worthwhile reductions in thistle numbers. The authors concluded that Californian thistle infestations were most effectively controlled when under stress from heavy stocking. This seems to reduce recovery by aerial shoots from surviving buds on the extensive root system.

Frequent mowing has been used successfully to reduce thistle numbers but less is known about the effectiveness of grazing except that rotational grazing reduces thistle spread while continuous grazing allows rapid spread (Donald 1990). Frequent mowing is not used widely in Southland for thistle control on lamb fattening units because excess pasture is needed for silage or hay production.

In the Manawatu, Hartley *et al.* (1984) conducted a two-year trial investigating topping, spraying and varying grazing densities for Californian thistle control. Hard rotational grazing with sheep, and MCPB followed by further rotational grazing reduced thistle numbers by over 90%. MCPB was considered more suitable than MCPA for use in pastures as MCPB does not suppress clover production and therefore does not affect sheep liveweight performance (Hartley 1983).

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The objective of the trial reported here was to compare four different management programmes for Californian thistle control which would be suitable for pastoral systems in southern New Zealand.

METHODS

The trial was situated near Invercargill in Southland on an established pasture with a heavy, even infestation of Californian thistle. The area was electrically fenced into sixteen paddocks each 1200 m² with eight either side of a 10 m wide access lane. In December 1990, eight paddocks were topped and the other eight were sprayed using MCPB (MCPB 400). Four paddocks in each group of eight were then lax rotationally grazed and four paddocks hard rotationally grazed giving a total of four treatments randomised within four blocks. The treatments were; topped, hard grazed (THG), topped, lax grazed (TLG), MCPB, hard grazed (HHG), and MCPB, lax grazed (HLG). The topping was to a height of 3–4 cm using a tractor mounted rotary mower. MCPB 1.6 kg/ha was applied in 250 litres of water/ha with a tractor mounted boom sprayer using 8002 Tee Jets at 210 kPa. Spraying was carried out on 18 December in both 1990 and 1991. Thistles were topped on 14 December 1990 and 30 December 1991. On 18 December 1990 60% of the Californian thistle plants were at the early bud stage while 40% were at the vegetative stage. On 18 December 1991 20% of Californian thistles were at the bud stage with an average height of 30 cm. The remainder were at the vegetative stage with an average height of 10–15 cm. On 31 December 1990, the trial area was grazed for 3 days by 700 sheep and for a further 3 days by 350 sheep to reduce pasture bulk.

Grazing rotations using 350 sheep/ha/day began on 14 January 1991 (year 1) and 30 December 1991 (year 2). The four paddocks in each treatment were grazed simultaneously. The number of grazing days in each treatment varied slightly between treatments and times due to weather conditions, pasture growth and shearing, but at each grazing pasture was eaten to the level required. Three rotations were carried out in each year for all treatments. In total the lax grazed treatments were grazed for 11.5 days in year 1 and 9 days in year 2. The hard grazed treatments were grazed for 14.5 days in year 1 and 13.5 days in year 2. Lax grazed treatments were grazed leaving pasture around 10–12 cm high (this being similar to normal grazing management for this property). Hard grazed treatments were grazed to 2–3 cm high with generally no thistle growth visible after grazing.

In late autumn 1991, the internal fences were removed and the whole trial area was strip grazed by hoggets during winter, then set stocked with ewes which remained on the area for lambing and until weaning in December. Fences were then replaced. The date at which the ewes became available dictated the beginning of rotational grazing in the trial.

Counts of thistle shoots were taken on a 35 m long by 1 m wide fixed transect in each treatment before the start of each rotational grazing, except before the final grazing in year two (5 March 1992) due to uneven thistle emergence following the previous grazing.

RESULTS AND DISCUSSION

Counts at 14 January 1991 showed thistle numbers in the two MCPB treatments to be higher than those in the topped treatments (Fig. 1). Control in these treatments was dependent on the removal by grazing of thistle stalks which survived spraying. During mob grazing in late December 1990 before the rotational grazing treatments commenced, newly emerged thistle shoots would have been present only in the topped plots and it is likely that a high percentage of these shoots would have been eaten, reducing thistle shoot numbers in these treatments more than occurred in the herbicide treatments.

Counts taken on 19 December 1991 indicate the effect of each treatment over the first year. Reductions of thistle shoot numbers in each treatment were; TLG 60%, HLG 16%, HHG 48% and THG 85% respectively. Thistle stalks in the HHG treatment were

only grazed to ground level during the second rotational grazing. In the HLG treatment, thistle stalks retaining green leaf survived the three rotational grazings. The lower numbers in this treatment at the third count (20 March 1991) probably occurred because thistle plants were not under enough stress to initiate the growth of new aerial shoots. The rise in numbers in this same treatment between 20 March 1991 and 30 December 1991 would be due to the stronger root mass having the capacity to produce a greater number of aerial shoots. Thistle numbers progressively declined in these two treatments during the three grazings in the second year. After the first rotational grazing in year 2 (19 December 1991), 20% of thistle stalks present in the HLG treatment retained green leaf but only a trace remained after the second rotational grazing. Thistle stalks in the HHG treatment were grazed out at the first grazing.

Figure 1: Californian thistle shoot numbers assessed during 1991 and 1992 seasons. Spray, topping and grazing dates are shown. SEDs are indicated.

Over the two years, the decline in thistle numbers in the TLG and THG treatments followed a similar pattern to that in the herbicide treatments. The rapid drop in the TLG treatment was unexpected but as this treatment was grazed at the beginning and end of each complete rotation, young thistle regrowth would have been grazed more regularly. In comparison Hartley *et al.* (1984) recorded only a 35% decrease in thistle numbers after two years topping and medium grazing although thistles were exposed to longer intervals between grazings than in our trial.

At the final count (6 January 1993) 24 months after the first grazing the TLG and THG treatments and the HHG treatment had reduced Californian thistle numbers by 99% while the HLG treatment lowered numbers by 80%.

Seely (1952) reported that the food reserves of Californian thistle were sufficient to allow the production of new shoots for 1½ seasons in crop land where repeated cultivations prevented the transfer of nutrients to the roots. The programme of strip grazing used by the farmer on the trial area during winter would have assisted thistle control by removing any new regrowth which emerged in autumn following the final rotational grazing in each year. The beginning of each rotational grazing was determined by pasture recovery. Thistle regrowth from underground buds emerged in all treatments between rotational grazings in both years, sometimes growing to 20 cm

in height, but only occasionally did regrowth become unpalatable to stock. The farmer observed that at no time were stock under grazing stress in any treatment.

In a control programme which incorporates grazing, topping has the advantage of removing most of the above ground growth of Californian thistle stimulating emergence of new shoot regrowth which can then be grazed while soft. After spraying with MCPB however, thistles must be left for a period before grazing, and subsequent stocking rates must then be intensive enough to eat out the thistle stalks, thereby stimulating new growth.

Results from this trial demonstrate that Californian thistle shoot populations can be reduced to very low levels by regular short term rotational grazing for two consecutive years following either topping or spraying with MCPB.

For the success of a Californian thistle control programme in pasture it is considered essential that the above ground growth of the plant is removed regularly over the summer and autumn period. This repeated removal of vegetative growth is thought to interrupt the transfer of nutrients to the root system, thereby weakening the plant, and in time, reducing its ability to produce new growth.

As adult ewes normally become available between mid December and early April in Southland, the grazing programme for thistle control on lamb fattening properties would fit in with farm practice in the area. During this period infested paddocks could be targeted for Californian thistle management.

Further research involving topping and grazing is being carried out to examine the effect on Californian thistle root growth and bud production. Pasture production before and after grazing is also being measured.

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