EFFECT OF WOUNDING FOLLOWED BY INTENSIVE GRAZING ON CALIFORNIAN THISTLE CONTROL

R. F. VAN TOOR

Sustainable Production Division, AgResearch Lincoln, PO Box 60, Lincoln

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Long-term control of the aggressive perennial weed, Californian thistle (*Cirsium arvense*), in pasture depends upon depleting its root stock over 2-3 years by integrating a number of control methods (Donald 1990). Recommended methods include MCPB sprayed in late spring, mowing whenever thistles impede grazing, intensive grazing (Hartley and James 1979; Hartley *et al.* 1984; Mitchell and Abernethy 1993), and using rotary weed wipers to apply translocating herbicides (Martin *et al.* 1990). However, farmers report that Californian thistles were not a problem on sheep farms where clod crushers or heavy chain harrows were dragged over infested pasture. To verify these reports, a trial was conducted using a clod crusher to wound Californian thistle stems prior to intensive grazing.

The trial was conducted on six sites in Otago. A variety of clod crushers 2.4-3 m wide were tested. They generally consisted of metal skids with either two or three railway irons elevated at 50-100 mm above ground and fixed at right angles to the direction of travel. A clod crusher was dragged behind a vehicle at about 8 km/h over 6 x 30 m plots of pasture containing Californian thistle. The factorial treatment structure arranged in randomised blocks with four replicates at each site, consisted of: (a) no wounding (untreated) or wounding, and (b) time of wounding; wounding in mid December 1992 prior to or at flowering, wounding in mid February 1993 at the down stage, and wounding at both times. In the factorial analysis, December untreated control plots comprised the designated control plots and those to be treated in February, whereas February control plots consisted of the designated control plots and those treated in December. The paddock was grazed to 25-60 mm with 160-500 ewes/ha for 2-4 days within 2 days after each clod crusher treatment. The ewes were free to wander over the trial area from the surrounding pasture. The paddocks were then spelled from grazing until the pasture grew to 100-150 cm in height, then grazed by ewes and/or lambs under usual grazing practices. Thistle shoots were counted in each plot on a 30 x 1 m fixed transect before treatments were applied, 2-3 weeks after each treatment, and in December the following year (Table 1). All counts were analysed by analysis of variance.

TABLE 1: Number of Californian thistle stems/m² (mean over six sites) after treatment in December 1992, February 1993 or both.

Treatment	Pre-treatment sample (1992)	Post-treatment sample (1993)			
	16 Dec	4 Jan	4 Feb	25 Feb	15 Dec
Untreated	8.9	3.6	8.6	8.8	8.2
Wound Dec	8.7	1.0	8.1	6.3	5.1
Wound Feb	8.6	-	-	8.0	6.7
Wound both times	8.5	-	-	5.9	4.8
SED _(df=44)	0.51	0.23	0.29	0.60	0.48
Dec	ns	***	ns	***	***
Feb	ns	-	-	ns	*

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There was no evidence throughout the investigation that the degree of change in thistle numbers interacted with site. Subsequently, the results for the six sites have been combined. Analysis of pre-treatment thistle density showed no difference ($P > 0.05$) between treatments (Table 1). By 4 January, 3 weeks after the December treatment, the untreated population had declined from 8.9 to 3.6 stems/m², probably due to the intensive grazing, while the population that had been wounded/grazed in December had declined significantly more ($P < 0.05$), from 8.7 to 1.0 stems/m². Thistle densities in early February had returned to similar levels to those in December, with no evidence of a treatment effect. In late February, about 2 weeks after the wounding/grazing in mid February, there were 2.3 (SED = 0.38) fewer stems/m² in the December treated plots than in the December control plots, with no evidence of any February treatment effect. There was no time of treatment interaction evident at either sampling occasion. Initial reductions in thistle densities in plots treated in December ranged from 67-83% between sites (72% averaged over all sites). In the following summer, plots treated in the previous December and February contained 2.5 and 0.9 (SED = 0.34) fewer stems/m², compared with their respective controls, with no evidence of a time of treatment interaction. This implied that the combined long-term effects of wounding thistles in December and February were additive.

Sheep in the trial area were observed to preferentially graze wounded thistles in favour of untreated thistles within 48 hours of treating, indicating that wounding increased the palatability of thistles. Although thistle densities recovered soon after treatment, this regeneration apparently weakened the plant, as shown by the reduced number of thistles present (30-47% for December treatment) in the following summer. The greatest level of thistle control occurred immediately after one wounding-grazing treatment in December. The technique offers a low-cost method of giving an immediate reduction in thistle densities in early summer when ewes are available after weaning to provide the grazing pressure required. Treatment effects can continue into the following summer. The effects of wounding/grazing on the long-term depletion of thistle root reserves and enhancement of mycoherbicides, and whether the wounding effect can be improved with serrated bars, require further evaluation.

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