CONTROL OF RUSHES AND THISTLES IN PASTURES BY GOAT AND SHEEP GRAZING

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SUMMARY

Four set stocked treatments, all goats, 66% goats + 33% sheep, 33% goats + 66% sheep, and all sheep, were compared with sheep mob grazed. Rush (*Juncus* spp) heights after 2 years were 20 and 38 cm respectively for all goats and 66% goats treatments, compared with 60 to 105 cm for the other treatments. Californian thistle (*Cirsium arvense*), Marsh thistle (*C. palustre*) and Scotch thistle (*C. vulgare*) did not form mature seed heads in any of the treatments with goats. Goats grazed Scotch thistle to ground level by autumn. Mob-grazing with sheep at twice the annual stocking rate of the other treatments controlled rushes and thistles better than set-stocking, but was less effective than the goat treatments in controlling thistles.

INTRODUCTION

Goats have long been acknowledged as being of use in New Zealand for controlling scrub weeds including blackberry (*Rubus fruticosus*), gorse (*Ulex europaeus*), bracken (*Pteridium aquilinum*), manuka (*Leptospermum scoparium*) and Spanish heath (*Erica lusitanica*) (Kirtton and Ritchie 1979; Batten 1979). Rushes (*Juncus* spp) and thistles (*Cirsium* spp, *Carduus* spp) are widespread in North Island hill pastures, but little information exists on the effect goats have on these species. Batten (1979) reported that goats reduced the height of *Juncus gregiflorus*. In Australia goats have been reported to reduce the height, density and seed head production of variegated thistle (*Silybum marianum*) and to show preference for nodding thistle (*Carduus nutans*) and cotton thistle (*Onopordum acanthium*) to such an extent that they caused their destruction (Campbell *et al* 1979; Holst 1980).

A study was initiated in 1979 to investigate the response of coarse weed and pasture species to different ratios of sheep and goats and to different sheep grazing managements. Grazing effects on rushes and thistles (*Cirsium* spp) are presented here.

MATERIALS AND METHODS

The trial was conducted on 5 ha of hill country at Ballantrae Research Area, Grasslands Division, DSIR in southern Hawkes Bay. The area had a history of weed infestation, including gorse, manuka, rushes, Scotch thistle, Californian thistle and marsh thistle.

In early 1979 areas of previously sprayed, dead gorse were burned, and 5 paddocks fenced off. Grazing treatments were unreplicated and are described in Table 1.

The stocking rate on set-stocked treatments was 9 su/ha from April 1979 — August 1980 and 11 su/ha thereafter. Sheep (Romney ewes c.52 kg liveweight) were 1 stock unit (su) each, and goats (feral does, c.26 kg liveweight) were initially taken to be 0.5 su from April 1979 — December 1980 and 0.33 su thereafter. Grazing pressure was relatively low at all times; available pasture dry matter (DM) ranged from 1300 to 6200 kg/ha and was lowest in the sheep treatment during winter.

Pasture Weeds

TABLE 1: Treatment descriptions and number of goats and sheep used in each treatment.

Treatment		number/ha					
		April 79-Aug 80*		Aug 80-Dec 80		Dec 80-Aug 81**	
		Goats	Sheep	Goats	Sheep	Goats	Sheep
Goat 100	All goats, set stocked	18	0	22	0	33	0
Goat 66	66% goats, 33% sheep set stocked	12	3	13	4	22	4
Goat 33	33% goats, 66% sheep set stocked	6	6	7	7	11	7
Sheep 100	All sheep, set stocked	0	0	0	11	0	11
Sheep mob grazed	All sheep, mob grazed 6 or 7 times per year	0	19 +	0	21 +	0	21 +

* April 1979 to August 1980; 9 su/ha, and from August 1980, 11 su/ha.

** April 1979 to December 1980, goats = 0.5 su and from December 1980, goats = 0.33 su.

+ Calculated on an annual basis.

The sheep mob grazed treatment was grazed 6 to 7 times/year, for 2-3 days per grazing at c.1000 su grazing days/ha for each grazing. The criterion to start grazing was a pasture height of 10-15 cm, to end, a pasture height of c.1 cm. Thistles were measured two weeks after grazing.

Rushes

Thirty rush clumps per treatment were selected randomly, and the clump height measured. Three rush species, *J. australis*, *J. gregiflorus* and *J. sarophorus* were common while *J. pallidus* was less common.

Californian thistle

Six quadrats (2 x 2m) per treatment were selected in April 1979. Stems per quadrat were counted and the height and flowering status of 10 stems per quadrat were recorded.

Marsh thistle

Thirty plants were selected at random and the height and flowering status were recorded.

Scotch thistle

In 1979/80 thirty plants were selected at random and height and flowering status were recorded. In 1980/81, thirty plants in each treatment were permanently marked, and repeated measurements were made of their height, width and flowering status. All means were calculated on surviving plants.

In the data presented, total flowers per plant is the sum of immature buds and mature flowers.

RESULTS AND DISCUSSION

Rushes

The degree of defoliation of rushes by goats depended on the density of goats (Table 2) and a minimum of 12 goats/ha was needed to severely suppress rushes. In the goat 100 treatment no selectivity among rush species was apparent, and after 15 months the rush clumps were short, becoming open and being invaded by grass and clover. In the other goat treatments *J. pallidus* appeared to be grazed preferentially to the other rush species. Some suppression of rushes was obtained in the sheep mob treatment.

Pasture Weeds

TABLE 2. Mean height of 30 rush clumps.

Treatment	height (cm)		
	Feb. 1980	July 1980	Feb. 1981
Goat 100	40	14	20
Goat 66	54	28	38
Goat 33	96	84	93
Sheep 100	86	104	105
Sheep mob	48	43	60

Californian thistle density

During the first summer the stem density of Californian thistle was increased by goat grazing (Table 3). Removal of the stem apex by the goats probably resulted in loss of apical dominance and allowed below ground buds to develop into new stools.

TABLE 3: Californian thistle density, heights, and flowerheads in pasture grazed by goats and sheep.

	stems/m ²			Height (cm)		Mature flower heads/plant		total flowers /plant	
	April 1979	Feb. 1980	Feb. 1981	Feb. 1980	Feb. 1981	Feb. 1980	Feb. 1981	Feb. 1980	Feb. 1981
Goat 100	3	12	5	24	11	0	0	1.1	0
Goat 66	4	15	7	23	9	0	0	0.8	0
Goat 33	6	12	10	25	8	0.2	0	1.1	0
Sheep 100	3	7	2	30	22	1.9	0.3	4.3	1.1
Sheep mob	3	4	3	13	13	0	0	0.6	1.9

Thistle heights and widths

In all the goat treatments the heights of thistle species were markedly reduced (Table 3,4,5). Thistle heights were similar for the different goat ratios, suggesting a strong preference for thistles. Defoliation of Scotch thistle was negligible during the rosette stage (Table 5), but became intensive once the reproductive phase began with bolting. Similar patterns of defoliation were observed with the other thistle species, height and width differences due to goat defoliation becoming obvious by January. Both Scotch thistles including marked plants (Table 5) and Marsh thistles that bolted were eaten to ground level by autumn. Sheep mob grazing also reduced thistle heights compared with set stocking, but defoliation was not as severe as in the goat treatments.

TABLE 4: Marsh thistle heights and flower heads in pastures grazed by goats and sheep.

	Height (cm)			Total flowers/plant			Mature flower heads/plant
	Jan. 1980	Jan. 1981	Feb. 1981	Jan. 1980	Jan. 1981	Feb. 1981	Feb. 1981
Goat 66	53	28	22	21	5	3	0
Goat 33	—	31	18	—	10	2	0
Sheep 100	97	54	77	68	65	61	56
Sheep mob	72	48	64	67	59	31	5

Pasture Weeds

TABLE 5: Scotch thistle heights, widths and survival in pasture grazed by goats and sheep.

	Height (cm)					Width (cm)		
	Year 1		Year 2*			Year 2		
	Feb. 1980	Mar. 1980	Nov. 1980	Feb. 1981	April 1981	Nov. 1980	Feb. 1981	April 1981
Goat 100	30	21	16 (100)	17 (46)	0 (0)	36	14	0
Goat 66	35	25	11 (100)	15 (64)	0 (0)	29	13	0
Goat 33	38	40	11 (100)	17 (69)	0 (0)	31	16	0
Sheep 100	65	60	8 (100)	48 (93)	53 (48)	27	48	41
Sheep mob	56	53	8 (100)	37 (92)	45 (47)	21	32	31

* Means calculated on surviving plants, percent plants surviving in parenthesis.

Thistle seed production

Goat defoliation of thistles almost completely prevented mature seed head production (Table 3,4,6). Total flower heads per plant were also markedly reduced in the goat treatments and flowers were few in the second year when goat stocking rate increased. In the goat treatments the few mature seed heads present were consumed before seed was released. In contrast a considerable number of mature thistle seed heads were produced in the all sheep treatments. However, mob grazing of sheep did reduce the number of mature flower heads, particularly in February but buds that were not grazed in mid summer were able to mature before the next grazing in autumn.

TABLE 6: Scotch thistle mature seed heads and total flowers per plant in pastures grazed by goats and sheep.

	mature flower heads/plant				Total flowers/plant			
	Year 1		Year 2		Year 1		Year 2	
	Feb. 1980	Mar. 1980	Feb. 1981	Mar. 1981	Feb. 1980	Mar. 1980	Feb. 1981	Mar. 1981
Goat 100	0	0	0	0	7	2	1	0
Goat 66	0	0.1	0	0	10	4	0.1	0
Goat 33	0	0.3	0	0	12	8	1	0
Sheep 100	8	16	5	1	8	19	35	8
Sheep mob	0	19	0	1	19	20	8	1

CONCLUSION

Goats have a high preference for a range of thistle species, grazing them after the reproductive phase began with bolting. Six goats per ha will almost completely prevent thistle seed production. Rushes are low preference species and 12 goats per ha are required to markedly reduce rush clumps.

Sheep mob stocked increased control of rushes and thistles compared with set stocking, but was less effective than the goat treatments at controlling thistles, and similar to the goat 33 treatment for rush control.

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Pasture Weeds

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