GORSE CONTROL WITH SHEEP AND GOATS

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SUMMARY

A year after burning dense gorse (*Ulex europaeus*) and establishing pasture, the amount of gorse regrowth from stumps was least under goat grazing at 20/ha and most under sheep grazing at 10/ha. Goats grazing with sheep produced intermediate results. Continuous grazing and rotational grazing (1 week on, 3 weeks off) gave similar levels of gorse control for each stock treatment. A rotational grazing treatment with 3 days on, 27 days off with sheep at 20/ha gave poorer gorse control compared to treatments containing goats. Gorse seedling populations were not significantly affected by type of stock or grazing management.

INTRODUCTION

Gorse remains a major scrub weed in New Zealand being either dominant (> 40% cover) or sub-dominant (< 40% cover) over 1.2 million ha, of which 49% is land with slopes greater than 20°, mostly too steep for cultivation (NWASCO 1975-1979). On non-arable land, control is usually achieved by burning gorse, establishing dense, vigorous, competitive pasture, and using high stocking loads of sheep. However, follow-up treatment with chemical sprays on gorse regrowth is invariably necessary (Meeklah 1981).

Goats have long been known to browse gorse readily (Wright 1927) but their effectiveness in control or eradication needs to be quantified in a variety of gorse situations. At 'Ballantrae' near Woodville, goats (continuously stocked) and sheep (mob-stocked) have reduced gorse height and the number of bushes surviving over 2 years (Rolston *et al* 1981). Although some form of rotational sheep grazing is often used in a gorse control programme, little is known about effective grazing systems using goats, or mixtures of sheep and goats.

The present experiment was begun to compare the effectiveness of sheep, goats, and sheep plus goats for gorse control under either continuous stocking or rotational grazing. The most effective control treatment is considered to be that which substantially reduces the amount of gorse, with a high mortality of gorse seedlings and stumps. This paper presents some results for the first 15 months of the trial.

EXPERIMENTAL

Trial establishment

A 10 ha stand of dense mature gorse, 1-2 m high, on rolling yellow-grey earth soil at Loburn, North Canterbury, was partly crushed and bent by a light bulldozer before burning in November 1980. The burn which took place 2 months later than planned left a dense stand of unburnt stems. Immediately after the burn, the area was oversown with perennial ryegrass (*Lolium perenne*) (25 kg/ha), white clover (*Trifolium repens*) (3 kg/ha), superphosphate (250 kg/ha) and lime (2.5 t/ha). After a dry spring, opportune rains ensured good pasture establishment, a flush of germinating gorse seed and considerable regrowth from burnt gorse stumps.

Seven unreplicated stock treatments, listed in Table 1, were begun in mid January 1981. Treatments 1 to 6 occupied 0.8 ha each, and treatment 7 occupied 1.0 ha. The rotation in treatments 4, 5 and 6 was 1 week on and 3 weeks off with paddock size of 0.2 ha. That in treatment 7 was 3 days on and 27 days off, with paddock size of 0.1 ha.

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Sheep were mixed age Perendale ewes, with Coopworth ewes added in December 1981. Goats were feral females. All stock were dry. The experiment began with an overall stocking rate estimated to be equivalent to 10 sheep/ha. This was increased to 17.5 sheep/ha in December 1981 to control the large mass of gorse and pasture present at the time. Throughout the experiment, one sheep was considered equivalent to two goats.

Gorse measurements

Seedling and stump densities were measured by the 'point distance — nearest neighbour' technique (Batcheler 1975), at points 2 m apart along eight permanent 50 m transects (10 transects of 40 m in treatment 7). In each treatment a total of 400 points were sampled to give measurements of 800 gorse stumps and 800 gorse seedlings. The height and diameter of individual gorse stumps and the height of individual seedlings were also recorded.

Stumps and seedlings were measured in March 1981, which was as soon as practicable after stock introduction in mid-January. They were measured again in September 1981 before the onset of spring growth. In March 1982, very dry conditions prevailed with no green pasture. Gorse bushes remained green but any seedlings which had emerged around and within crowns of stumps could not be distinguished from gorse shoots sprouting from stump crowns. As no green gorse seedlings were seen in the dried off pasture, only stump regrowth was measured in March 1982.

Analysis of data

Data from treatments 1 to 6 (Table 1) were subjected to an analysis of variance using the interaction between main factors as the error term. Main factors were grazing management (continuous, rotational) and stock type (sheep, goats, sheep plus goats). In this preliminary analysis, treatments which appeared to contain least gorse under goat grazing (treatment 4) and under sheep grazing (treatment 7) were compared, using variation between transects within each treatment, for error.

TABLE 1: Stocking rate¹ and stocking density² per treatment (1 sheep equivalent to 2 goats).

Treatment	Grazing management	Jan '81 to Dec '81			Dec '81 to April '82		
		Stocking rate/ha		Stocking density/	Stocking rate/ha		Stocking density/
		goat	sheep	ha	goat	sheep	ha
1	Goat continuous	20	0	20	35	0	35
2	Sheep + goat continuous	10	5	15	17.5	8.8	26.3
3	Sheep continuous	0	10	10	0	17.5	17.5
4	Goat rotation	20	0	80	35	0	140
5	Sheep + goat rotation	10	5	60	17.5	8.8	105
6	Sheep rotation	0	10	40	0	17.5	70
7	Sheep fast rotation	0	20	200	0	20	200

¹ Stocking rate is based on the number of stock supported by one ha of land over the period stated (Hodgson 1979).

² Stocking density is the number of stock on land being grazed at a point in time (Hodgson 1979). In the present situation, the numbers of sheep and goats on each paddock, as it is grazed.

RESULTS

Gorse seedlings

Seedlings were patchily distributed in each treatment, tending to occur in clumps around the base of stumps, in open ground and in pockets among the dense litter of burnt and scorched gorse stems. They were usually, (but not always) absent from areas dominated by flatweeds, rank grass (> 5 cm high), or bare areas heavily trampled by

stock. Numbers of seedlings varied greatly between treatments with an average reduction of 50% between March and September 1981 (Table 2). Seedling height was also reduced in each treatment over this period (Table 2). There were no significant differences in density reduction or height reduction between treatments.

Gorse stumps

Most stumps sprouted fresh growth within a month after burning. Changes in the density of live bushes, the diameter and height of these bushes and the volume (mean crown area x height) of live gorse in each treatment are illustrated in Fig. 1.

Goats reduced the size (diameter, height) of gorse bushes significantly more than sheep, between March and September 1981. Goats also increased the apparent density of gorse stumps between March 1981 and March 1982. This was because large gorse clumps grazed by goats, fragmented into several smaller clumps. Although many of these were probably joined by roots, and so were not new individuals, it was most expedient to record each patch of gorse on the ground surface as an individual stump. Therefore under goat grazing, measured stump density increased, although each stump had become considerably smaller. Conversely under sheep grazing, measured stump density decreased, because small clumps had coalesced to form larger bushes.

Analyses of treatments 4 and 7 showed that goats under rotational grazing (treatment 4) achieved a significantly bigger reduction of gorse ($p < 0.01$) than sheep under fast rotational grazing (treatment 7). Sheep and goats in all treatments broke off fragments of gorse stems, up to 12 cm from the tip which littered the ground.

Fig. 1: Attributes of live gorse stumps on three measurement dates. Mean values for seven stock grazing treatments according to Figure key and Table 1.

TABLE 2: Density and height of gorse seedlings.

Stock main effect	Density (plants/m ²)		Height (cm)	
	March '81	Sept '81	March '81	Sept '81
Goat	47	22	3.7	1.9
Sheep + goat	41	24	4.3	1.7
Sheep	26	12	3.2	1.4
se (diff.)	31.1	12.5	1.17	0.20
Management main effect				
Continuous	24	14	3.1	1.6
Rotational	52	24	4.3	1.7
se (diff.)	25.4	10.2	0.95	0.17
Sheep fast rotation	15	3	2.3	1.1

DISCUSSION

In the first 15 months of this trial, feral goats have induced dramatic reductions in gorse regrowth following burning. The type of stock, i.e. goats, sheep, or sheep and goats together, has had much more effect on gorse than the type of grazing management imposed. That is, for each type of stock, the regeneration and utilisation of gorse is similar under continuous and rotational grazing (one week on, 3 weeks off). The fast rotation with sheep at a stocking density of 200/ha (treatment 7), has considerably less gorse than the slower rotation of sheep with a stocking density from December 1981 of 70/ha (treatment 6), but it still contains significantly more gorse than paddocks which were grazed by goats with lower stocking densities. Stock health was satisfactory and although all stock lost weight over winter 1981 only the fast rotation sheep in treatment 7 required hay to supplement pasture and gorse.

The interim effect which treatments may have had on seedling mortality between mid-January when stock were introduced and early March when the first gorse measurements were obtained is not known, but dense litter from burnt gorse probably mitigated differential effects of stock treading and stock diet in such a short time. The reduction in seedling height between March and September 1981, suggested that both sheep and goats had defoliated seedlings to a similar extent.

Reductions in seedling density between March and September 1981 were probably due to natural mortality of seedlings (Ivens 1978) as well as stock treatments. However, with the large variability in gorse seed germination inherent in a large scale field trial such as this, it is not surprising that a positive 'treading effect' on seedling mortality (twice as many goats as sheep) was not recorded in contrast to more uniform experimental conditions in Manawatu where seedlings were killed by sheep treading (Hartley *et al.* 1980). The absence of seedlings in March 1982 can probably be attributed to natural mortality exacerbated by drought.

The trial is yet in its early stages, but already it is clear that feral goats either alone or with sheep, may substantially reduce gorse which has regrown from burnt stumps.

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