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GORSE CONTROL WITH GOATS

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Abstract

A grazing management trial in North Canterbury. compares the effects on burnt gorse, of goats or sheep grazed alone, or in mixtures with two goats equivalent to one sheep, with either rotational grazing or set stocking. Also, sheep alone are mob stocked on burnt gorse, and goats alone, set stocked on unburnt gorse.

Goats alone at stocking rates up to 35/ha and a sheep/goat mixture which is rotationally grazed, have reduced gorse to negligible proportions after two years, although relatively few burnt gorse stumps have yet died. Gorse control has been less successful where a sheep/goat mixture has been set stocked or where sheep have been mob stocked at 200/ha. The least effective treatments have been sheep either set stocked or rotationally grazed at up to 17.5/ha.

Stands of dense unburnt gorse up to 2m high were reduced from 66% gorse cover to 7% using 44 goats/ha set stocked for one year. Stocking rates of up to IO goats/ha had little effect on land with 50% gorse cover, but 30 goats/ha reduced gorse to 5% cover in the subsequent year.

The persistence of five grass species ('Grasslands Nui' perennial ryegrass, 'Grasslands Wana' and 'Grasslands Apanui'cocksfoot, 'Massey Basyn' Yorkshire fog and browntop) and their abilities to suppress gorse, were compared under rotational and set stocked goat managements. After two years, there were no significant differences among grasses under rotational grazing, but *browntop* had become significantly more successful than Apanui cocksfoot, under *set* stocking. Gorse *cover* was <5% in all grass species treatments, including the unsown *control* plots, with no significant differences between *set* stocking and rotational grazing.

Keywords: Gorse, goats, sheep, grazing management, ryegrass, cocksfoot, Yorkshire fog, browntop.

INTRODUCTION

Since goats were first liberated in New Zealand over 200 years ago, substantial feral populations have built up, especially in the North Island. Farming journals of the 1920's mention the use of goats to control scrub weeds such as blackberry, gorse and bracken (Wright 1927).

Gorse dominant scrublands occupy 53,000 ha in New Zealand, while grasslands containing mixtures of gorse with other scrub species, occupy 656,000 ha (Blaschke et *a/,* 1981). Much of this land could be brought into pastoral production by the use of goats and sheep and, in fact, increasing numbers of farmers are using goats to control and eradicate unwanted scrub. Yet only in the last few years has research attempted to quantify what happens to scrub weeds under defined goat management systems.

This resurgence of interest in goats as farm animals coincides with the development of goats for milk and cheese products, for mohair and cashmere fibre, and for export meat. Many farmers, having first purchased feral goats for scrub control are moving into these alternative enterprises (eg: Crouchley 1980). Analyses based on 1983 prices and costs show that goats are an attractive economic proposition for gorse control, compared with the use of chemical sprays (M.Krause, Department of Farm Management, Lincoln College, *pers. comm.).*

This paper reports on work in progress in Canterbury, where gorse populations and oversown grasses are being monitored, following burning with various stock managements. It also discusses the role of goats in dense stands of unburnt gorse.

METHODS AND MATERIALS

Grazing Trial

This is located on 10 ha of rolling gorse infested land at Loburn near Rangiora in North Canterbury, with an annual rainfall of 780 mm measured over two years.

Management

Dense gorse, 1-2 m tall was flattened by bulldozer and then burned in November 1980. A poor to average burn resulted in a tangle of charred and burnt gorse sticks. The burnt area was oversown with perennial ryegrass *(Lolium perenne* c.v. 'Ellets', 25 kg/ha) and white clover *(Trifolium repens* c.v. 'Grasslands Huia'; 3 kg/ha), topdressed with superphosphate (250 kg/ha) and lime (2.5 t/ha), and fenced into seven main paddocks. These were grazed according to treatments outlined in Table 1. A further 125 kg/ha of superphosphate was applied in March 1982.

Treatments occupied 0.8-1.0 ha. The rotation in treatments 4, 5 and 6 was 7 days on and 21 days off, with sub-paddock size of 0.2 ha. Treatment 7 was 3 days on and 27 days off with sub-paddock size of 0.1 ha. Three other paddocks remained unburnt and were set stocked with goats as listed in Table 4.

Sheep were mixed age, dry Perendale ewes. Goats were initially dry, feral females, later supplemented by first cross Angora x feral dry females and wethers. The overall stocking rate of the burnt gorse areas was at first equivalent to 10 dry sheep/ha with 1 sheep (weight 50-60 kg) considered equivalent to 2 goats (weight 20-30 kg). At the end of the first year (December 1981), the stocking rate was increased to 17.5 sheep/ha (equivalent to 35 goats/ha) in an attempt to control the seasonal flush of pasture and gorse. In winter 1982 the goat alone treatments were reduced to 22 goats/ha and given hay. In both winters of 1981 and 1982 hay was also fed to the mob stocked sheep during their rotation.

Gorse Measurements

The numbers of live gorse stumps per unit area were measured by the 'point distance — nearest neighbour' technique (Batcheler 1975). In each of the 7 burnt treatments a total of 400 points were sampled to give measurements of 800 gorse plants, including the height and average diameter of individual gorse bushes. Measurements were made in March and September each year. The March data, which are presented, indicate the net effect of gorse growth and stock consumption over the growing season.

Grass Species Trial

Two days after the gorse burn in November 1980, grass species were broadcast in small plots (5 m x 5 m) to establish populations equivalent to 25 kg/ha of perennial ryegrass. Five grass species (Perennial ryegrass, 'Grasslands Nui'; cocksfoot, 'Grasslands Wana' and 'Grasslands Apanui'; Yorkshire fog, cv. Massey Basyn; and certified browntop) were sown with white clover (3 kg/ha), 'Control' plots did not receive any seed. There were 4 replicates in a randomised block design, with each replicate located in a subdivision of treatment 4.

Measurements

Gorse seedlings were counted in six 0.1 m^2 quadrats per plot in December 1980 before goat grazing began. Emerging seedling grasses were not recorded because of the difficulty of identifying them among the tangle of burnt sticks and weeds. Sown grasses were visually ranked for abundance in November 1981

Table 1: STOCK GRAZING TREATMENTS ON BURNT GORSE

	Stocking rate/ha[1]				Stocking density/ha[2]	
	Jan '81-Dec '81		Dec '81-Mar '83		Jan '81 -Dec '81	Dec '81-Mar '83
	goat	sheep	goat	sheep		
Set-stock						
1 goats	20	0	35[4]	0	20	35[4]
2 sheep and goats	10	5	17.5	8.8	15	26.3
3 sheep	0	10	0	17.5[3]	10	17.5[3]
Rotational						
4 goats	20	0	35[4]	0	80	140[4]
5 sheep and goats	10	5	17.5	8.8	60	105
6 sheep	0	10	0	17.5	40	70
Mob-stock						
7 sheep	0	20	0	20	200	200

[1] Stocking rate is number of stock supported on 1 ha over period stated.

[2] Stocking density is number of stock on each paddock as it is grazed (expressed as per ha)

[3] Treatment 3 discontinued in August 1982

[4] Stocking Rate reduced to 22.5/ha from November 1982 to March 1983, with corresponding adjustment to stocking density.

while species ground cover was measured in December 1982 using point analysis (150 points per plot, first hits on each species recorded).

RESULTS AND DISCUSSION

Burnt Gorse

Gorse Cover

The proportion of potential pasture covered by gorse was calculated from the area occupied by individual bushes x the density of these bushes. Table 2 shows how gorse cover has increased under sheep grazing, and been reduced to low levels under goat grazing. The sheep-goat mixture has effectively reduced gorse cover under rotational grazing, but not, as yet, under set stocking,

Gorse Height

Goats have browsed gorse so heavily that in paddocks where only goats are used (Treatments 1 & 4), gorse bushes have been reduced to about 5cm (Table 2) and are almost indistinguishable from pasture. In the first year after burning, at least 10 goats/ha plus sheep, were sufficient to keep gorse down to 20-30 cm. Increasing the goat component to 20 goats/ha kept gorse even shorter to about 10 cm. Increasing goats still further to 35/ha in the second year reduced gorse to negligible proportions. In the sheep/goat mixture, rotational grazing has kept gorse much shorter than set stocking (7 cm compared with 23 cm). Gorse was also kept much shorter under goat stocking at 'Ballantrae' in the lower North Island (Rolston era/, *1982).*

The effects of goat grazing on gorse are in marked contrast to those of sheep. Even with a high winter stocking rate of 17.5 sheep/ha (treatment 6) the gorse grew to a mean height of 60 cm,

The widest variation in gorse height is under sheep mob stocking (treatment 7), where some bushes have been maintained at 5 cm by heavy grazing, whilst others have reached 100 cm well beyond the reach of sheep.

However, a diet analysis based on plant cuticles in the faeces showed that sheep ate substantial quantities of gorse. Nevertheless, goat faeces contained more gorse than did sheep faeces (Radcliffe, 1983, unpub.) confirming 'Ballantrae' results that goats prefer to eat gorse (Clark et *a/ 1982).*

Numbers of Live Gorse Stumps

The density of live stumps has declined in the goat rotational grazing treatment (Table 2) where many dead and decaying stumps can be seen. However, under goat set stocking, and in both sheep/goat mixtures, gorse stump density has so far remained relatively unchanged. Under sheep grazing, gorse bushes have grown and expanded, and individual shoot clumps have coalesced, so giving fewer, larger bushes per m^2.

Set Stocking versus Rotational Grazing

In the first year after burning, gorse control was similar using all goats, either under a rotational or set stocking management. Gorse populations also behaved similarly with all sheep grazing, under these two managements. However, in the sheep/goat mixtures, rotational grazing has given superior gorse control to set stocking. No adequate explanations can yet be offered for this, and further grazing management comparisons are underway on adjacent areas.

Overso wn Grass *Species*

All sown grasses established well, with Yorkshire fog being particularly promi-

Table 2: PERCENTAGE COVER', HEIGHT AND DENSITY OF LIVE GORSE BUSHES ON PADDOCKS BURNT IN NOVEMBER 1980 and MEASURED IN MARCH 1981, 1982 AND 1983.

	% cover			Height (cm)			Density (no. of live bushes/m^2)		
	1981	1982	1983	1981	1982	1983	1981	1982	1983
Set-stock									
1 goats	30	12	4	23	11	4	2.7	2.5	3.4
2 sheep and goats	20	46	37	20	31	23	2.0	1.2	1.8
3 sheep[2]	13	37	-	23	55	-	2.0	0.7	-
Rotational									
4 goats	13	5	2	17	8	5	2.5	1.9	1.5
5 sheep and goats	11	7	3	22	19	7	1.4	1.0	1.3
6 sheep	29	34	45	30	57	59	1.9	0.6	1.1
Mob-stock									
7 sheep	26	21	30	28	28	40	2.0	1.6	1.2

[1] Gorse density x mean basal area of gorse stump

[2] Treatment discontinued in August 1982.

Table 3: GORSE SEEDLING POPULATIONS IMMEDIATELY AFTER BURNING, WITH RESULTS OF GRASS SPECIES OVERSOWING AND GORSE COVER UNDER ROTATIONAL GRAZING AND SET-STOCKING BY GOATS.

Sown grasses	Gorse seedlings /m^2 before grazing began Dec. '80		Abundance of sown grasses after 1 year (O-5 scale)[1] Nov. '81		% cover of sown grasses after 2 years Dec. '82		% gorse cover after 2 years Dec. '82	
	Rot.	Set st.	Rot.	Set st.	Rot.	Set st.	Rot.	Set st.
'Nui'	340	70	2.0	2.5	27	14	2	4
'Wana'	*290*	*90*	2.5	2.0	27	25	2	3
'Apanui'	440	80	2.0	1.3	17	9	4	2
Yorkshire Fog	260	60	4.0	3.0	23	14	1	5
Browntop	270	40	0.8	1.8	17	35	4	4
Control, unsown	150	100	-	-	-	-	2	3
Sem	79	34	0.45	0.55	9.5	7.4	1.6	1.0
lsd (5%)	238	102	1.35	1.67	28.5	22.4	4.8	3.1

[1] 5 most abundant

nent in the year after sowing (Table 3). However, two years after sowing, there was no significant difference in cover of sown species under goat rotational grazing, although browntop had become more prominent under set stocking. 'Grasslands Wana' cocksfoot was superior to 'Grasslands Apanui' although differences did not reach significance. No grasses or clover, sown or volunteer, had any green leaf in the dry autumn of 1982.

No one grass species suppressed gorse better than any other grass species. Two years after burning, the gorse cover was <5% in all grass species plots and also in the unsown control plots which were invaded by volunteer grasses and weeds. Also gorse cover was similar under both rotational grazing and set stocking (Table 3). Yet a month after burning, many more seedlings had established under rotational grazing, compared to set stocking (290 v 70 seedlings per m^2) (Table 3) and one year after sowing the gorse cover over all sown plots was estimated as 40% under rotational grazing compared with 20% under set stocking.

Over all plots, the rotationally grazed paddocks contained more ryegrass, cocksfoot and white clover than did the set stocked paddock. The latter contained more browntop and flatweeds, mainly dandelion ***(Taraxacum officinale)***, plantain ***(Plantago*** spp), mouse-eared chickweed ***(Cerastium glomeratum)*** and scotch thistle rosettes *(Cirsium vulgare)*.

At Loburn, gorse seedling populations of 40-440/m^2 were comparable to those measured after burning by Ivens (1978) and natural mortality was probably also high. In two previous studies (Thompson 1974 and Hartley & Thai 1982) it was reported that more gorse seedlings died in white clover, browntop and Yorkshire fog swards than in perennial ryegrass swards. However, at Loburn, swards regrowing from basal buds of stumps, appeared to contribute far more to gorse cover than did seedlings, although seedlings growing amongst short basal shoots could not easily be identified. The present performances of grass species must therefore be assessed against the total gorse population,

Unburnt Gorse

In these paddocks, the proportion of land covered by green living gorse was estimated from aerial photographs. Visual assessments on the ground, rated gorse very much higher.

In Table 4, paddock 1 shows that goats set stocked at 10/ha for a year had a negligible effect on gorse, but increasing the stocking rate to 31 goats/ha reduced gorse from 48% to 11% in 9 months. Results from paddock 2 suggest that if gorse covers 70% of the land then at least 20 goats/ha are needed to make a substantial impact within a year. The third paddock illustrates that gorse can be reduced from 66% to 29% in only 5 months by a high stocking load of 44 goats/ha. ***Once gorse*** has been thus weakened its dissolution is rapid (Table 4). Opened up gorse stands were colonised by volunteer grasses (mainly ***Agrostis*** spp and sweet vernal ***(Anthoxanthum odoratum))***, white clover, suckling clover ***(T. dubium)***, thistles and mouse-eared chickweed ***(Cerastium glomeratum)***.

Thus goats can be used successfully as a tool in land development, to consume and open up dense scrub, before preferred species and fertiliser are introduced.

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Table 4: REDUCTION IN COVER OF UNBURNT GORSE BY SET-STOCKED GOATS (NO GOATS BEFORE JANUARY 1981)

Gorse Cover %	Date	Number goats/ha
Paddock 1		
52	November 1981 / January 1982	10
11	September 1982	31
48	January 1983 / February 1982	
Paddock 2		
70	January 1981	5
70	February 1982 / April 1982	
46	September 1982	18 approx.
	December 1982	
40	January 1983	23
Paddock 3		
66	Februarv 1982	0
68	April 1982 / January 1981	
29	September 1982	42-46
7	January 1983	

REFERENCES

Batcheler, C.L. 1975: *Proc.* N.Z. *Ecol. Soc. 22: 28-33.*

Blaschke, P.M.; Hunter, G.G.; Eyles, G.O.; van Berkel, P.R. 1981: *N.Z. J. Ecol. 4:* 1-19.

Clark, D.A.; Lambert, M.G.; Rolston, M.P.; Dymock, N. 1982: *Proc. Anim. Prod. Soc. 42: 155-157.*

Crouchley, *G. 1980:* N.Z. *J. Agric. 141 (5): 9-14.*

Hartley, M.J.;Thai, Phung Hong. 1982: N.Z. *J, Exp. Agric. 10:* 193-196.

Ivens, G.W. 1978: *Proc.* N.Z. *Weed& Pest Cont. Conf. 31: 53-57.*

Radcliffe, J.E. *1983: Proc. Ruakura Fmrs' Conf.* (in press)

Rolston, M.P.; Lambert, M.G.; Clark, D.A. *1982: Proc. N.Z. Grassld Ass. 43:* 196-203.

Thompson, A. 1974: *Proc.* N.Z. *Weed & Pest Cont. Conf. 27: 6-10.*

Wright, R. 1927: *N.Z. J. Agric.: 295-296.*