

WEED CONTROL OPTIONS IN HILL COUNTRY

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Abstract

Weed control in hill country requires a combination of biological control, management and herbicides. Gorse (*Ulex europaeus*) and nodding thistle (*Carduus nutans*) two important hill country weeds are used as examples. Management factors include, subdivision, pasture competition, stocking rate, grazing management and type of animal. Goats, goat-sheep mixtures, and sheep mob grazed have been found to restrict gorse to acceptable low densities and low heights. Herbicide options include blanket spraying and spot spraying. *Clover* damage and reductions in nitrogen fixation rates occur with MCPA, 2,4-D, and 2,4,5-T.

Key Words: gorse, nodding thistle, goats, grazing management, MCPA, 2,4-D, 2,4,5-T, nitrogen fixation.

INTRODUCTION

Weed control in hill country entails maintaining weed populations at acceptable densities, preventing weeds from spreading, while keeping herbicide use and pasture damage to a minimum. Weed control requires an integration of control methods and can combine the use of biological control, management techniques and herbicides to meet the above principles. The priority given to each principle depends on the weed species involved. Often principles will clash. It is, for example, difficult to prevent weeds from spreading while minimizing herbicide use. A weed density that is acceptable to one farmer, may not be acceptable to his neighbour or the Noxious Plants Officer. Given these constraints this paper examines weed control options in hill country, with gorse (*Ulex europaeus*) and nodding thistle (*Carduus nutans*) as examples.

In general control programmes should be planned over a period of years. The success of any weed control programme relies on the method used and the skills, initiative and enthusiasm of the farmer. The "gorse control groups" formed in the Wairarapa region appear to be a useful model with their sharing of knowledge, enthusiasm, bulk buying of herbicides, co-ordination of contractors and applications for funds from the regional Noxious Plants Co-ordinating Committee.

BIOLOGICAL CONTROL

Biological control can be defined as the deliberate introduction of organisms for control purposes. The gorse seed weevil (*Apion ulicis*) was introduced from England and released in 1931 (Miller, 1970). Although this

insect established successfully, infestation rates of pods produced during summer flowering were variable ranging from 10-98% (Miller, 1970) and pods produced from winter flowering were not attacked (MacCarter and Gaynor, 1980). The larvae of two European insects a weevil (*Apion scutellare*) and a moth (*Agonopterix ulicetella*) are foliage feeders and are being evaluated by Entomology Division, DSIR for gorse control.

Biological control of nodding and other *Carduus* thistles looks promising. The larvae of the receptive-feeding weevil *Rhinocyllus cornicus* prevents seed formation. The weevil released in 1973 (Jessep, 1975) has successfully dispersed from original release sites. Preliminary work with the crown-rot weevil *Trichosirocalus horridus* suggests a complementary relationship with *Rhinocyllus* which may improve control of nodding thistle.

MANAGEMENT

The effectiveness of pasture and animal management in controlling weeds is influenced by many interesting factors including grazing management, type of grazing animal, subdivision, pasture competition and stocking rate.

GRAZING MANAGEMENT WITH SHEEP

Grazing animals not only suppress gorse by defoliation, but can both uproot and cause damage by treading (Hartley et. al., 1980). Small gorse seedlings (height, 4.5cm) were controlled more easily by sheep than were taller (12.5cm) seedlings (Ivens, 1979).

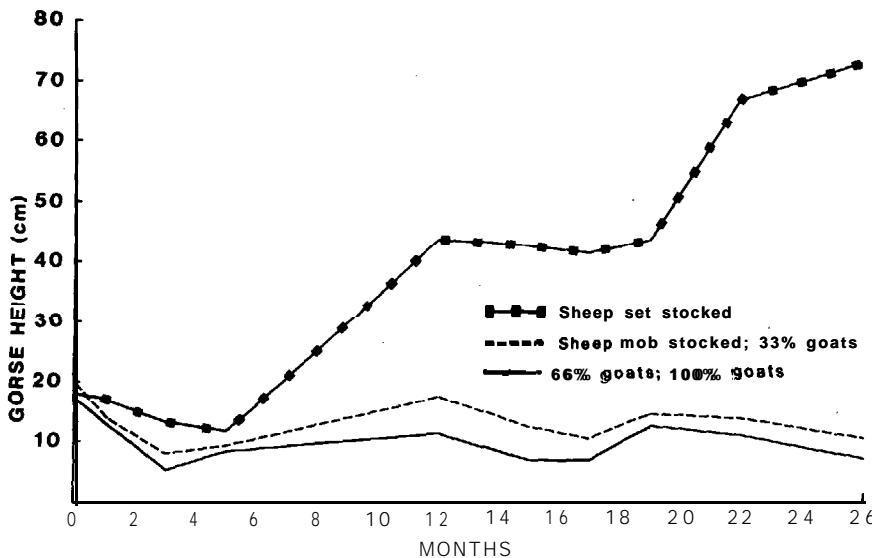


FIG. 1: Effect of grazing management on height of gorse bushes.

TABLE I. EFFECT OF GRAZING TREATMENTS ON HEIGHT OF GORSE BUSHES (cm)

Treatment*	April 1979	April 1980	June 1981
	mean (range)	mean (range)	mean (range)
1. Sheep mob	18 (6-40)	12 (5-62)	13 (2-78)
2. 100% Sheep	18 (8-43)	43 (15-84)	73 (6-158)
3. 100% Goat	17 (4-40)	11 (6-19)	6 (3-15)
4. 66% Goat	17 (4-40)	15 (4-31)	5 (3-11)
5. 33% Goat	20 (6-50)	17 (7-28)	10 (3-28)

* Treatment I, sheep mob grazed, treatments 2-5, set stocked.

TABLE 2: EFFECT OF GRAZING ON GORSE PLANT DENSITY AND PERCENT SURVIVING IN PARENTHESIS, CALCULATED AS (NUMBER PRESENT/NUMBER PRESENT APRIL 1979).

Treatment	Gorse (plants/m ²)		
	April 1979	April 1980	June 1981
1. Sheep mob	7.1	1.8 (25)	0.9 (13)
2. Sheep 100	7.6	7.6 (100)	5.1 (67)
3. Goat 100	12.4	8.7 (70)	3.1 (25)
4. Goat 66	10.3	5.6 (54)	2.9 (28)
5. Goat 33	6.3	6.0 (95)	5.3 (67)

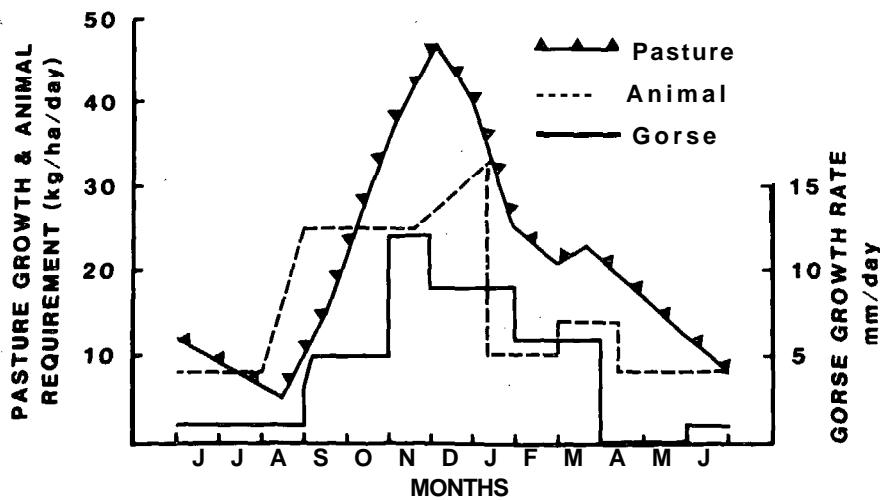


FIG. 2: *The relationship between pasture growth rate, animal requirements and growth rate of gorse at Ballantrae.*

At Ballantrae (Grasslands Division, DSIR, Research Area) in southern Hawke's Bay, the effect of sheep and goat grazing on weeds and pasture have been examined with five management treatments (Lambert *et al.* 1981). Sheep mob-grazed, 6-7 times per year at an average of 1125 su (stock units) grazing days/ ha at each grazing were compared with sheep set stocked, initially at 9 su/ ha (April 1979 — August 1980) and then at 11 su/ ha (August 1980 — November 1981). Gorse set stocked has grown rapidly (Fig. 1). However mob stocking controlled the growth of most gorse plants, with only a few plants escaping and growing taller (Table I). A high percentage of gorse plants was killed by mob stocking, during the trial (Table 2).

The growth rate of gorse under mob stocking has a similar seasonal pattern to pasture growth, with peak rates in November and December (Fig. 2). During this period pasture growth is greater than sheep requirements (10 ewes/ ha with lambs weaned early January). Gorse must be grazed during this late spring period before fresh growth hardens into spines.

To control gorse growth in spring most farmers must either mob stock with ewes and lambs at foot, or wean some or all of the lambs early and use the ewes. An alternative would be a flock of wethers, as their nutrition is less critical than that of ewes.

Grazing programmes for weed control can break down in years when spring and summer growth are above average. But even in an average year a decision must be made to under-utilize certain areas of the farm by preferentially grazing certain paddocks. If no decision is made then the sheep will under-utilize steeper slopes and only graze in patches (Suckling 1975). Having adequate subdivision will pay dividends in a good growth season, both in controlling grazing and controlling weeds. Surplus feed can be conserved as hay or silage if topography allows. If conservation is not possible, grazing pressure must be kept on steeper, weed prone areas. This may require the buying or grazing of additional stock, for example works ewes or young dairy stock may be necessary.

GOATS

Goats have long been recognised for their ability to control scrub weeds including blackberry, gorse, bracken fern, manuka and Spanish heath (Kirton and Ritchie, 1979), but only recently have a few hill farmers attempted to incorporate goats into their farming system. At Ballantrae, the effects of goats and sheep on weeds and pasture have been examined (Lambert *et al.*, 1981; Rolston *et al.*, 1981). Sheep mob grazed were compared with sheep and goats set stocked. From April 1979 to December 1980, 1 doe = 0.5 su, and from December 1980 to November 1981, 1 doe = 0.33 su. Goat/ sheep percentages are on a su basis with 66% goats = goats 66% + sheep 33%, and 33% goats = goats 33% + sheep 66%. In the trial goats ate rushes and prevented thistles (*Cirsium* sp.) from seeding, by eating flower buds (Rolston *et al.*, 1981). Small gorse plants up to 50cm high (Table 1) were heavily browsed by goats (Fig. 1). The sheep mob, 100% goat, and 66% goat managements greatly reduced the density of gorse plants (Table 2).

Goats are a promising option for weed control in hill country especially if the clover dominant pastures produced by all goat grazing management (Lambert *et al.*, 1981) can be exploited. Goats are an alternative in gorse or weed areas close to kiwifruit orchards or vineyards where the risk of crop damage precludes blanket spraying with hormone herbicides.

SUBDIVISION

Inadequate subdivision can lead to al preferential grazing of easy slopes, overgrazing of sunny faces and undergrazing of shady faces. Overgrazing of pastures especially in periods of moisture stress commonly results in weed ingressions (Round-Turner, 1970), and particularly by thistles (Lynch 1973). Undergrazed shady faces are prone to ingressions by manuka, gorse and bracken (Suckling 1975).

Subdivision is particularly important in the control of seedling gorse. About 1000 su grazing days per hectare (e.g. 250 su/ ha for 4 days) are required at each grazing to control seedling gorse (Table 1). Paddock size should be consistent with this requirement.

PASTURE COMPETITION

A vigorous, dense pasture will compete with weeds and reduce the number that regenerate from seed. Both gorse (Ivens, 1978) and nodding thistle (Phung & Popay, 1981) germinate readily when vegetation is removed. Pastures damaged by insects, especially when overgrazed during dry summers, resulted in an increase incidence of weeds (Matthews 1977; Taylor 1966). Nodding thistle numbers were markedly reduced by treating pastures with insecticide to control grass grub (Taylor, 1981).

The survival and growth of gorse seedlings were markedly reduced when grown in competition with pasture species (Ivens, 1978; 1979; Ivens and Mlowe, 1980). Gorse seedlings do respond to phosphate, but in a newly sown white clover-ryegrass pasture fewer survived in pasture receiving 54 kg P/ha as superphosphate than in pasture receiving no fertiliser (Thompson, 1974), probably because of increased competition by associated pasture species.

HERBICIDES

The development of land from gorse with fire presents a dual problem of seedlings and stump regrowth.

A pre-burn herbicide application to kill rather than desiccate gorse, with 2,4,5-T (6kg/ ha) or picloram +2,4,5-T (1.2 + 4.8kg/ ha) applied 2 to 7 months before burning, reduced the number of stumps regrowing by 80-90% (Rolston & Talbot 1980). Spraying to kill without burning is also practiced. Either cattle are used to open up the gorse or the gorse is allowed to rot. However, introducing legumes at a later date can be difficult, because of competition from invading grasses.

After burning, follow up control should be based on the philosophy of

minimizing herbicide usage. Two alternatives are spot spraying and low volume broadcast spraying. Where subdivision and grazing are controlling regrowth, spot spraying of escapes will be successful. High volume gun and hose spraying is being replaced by motorised, back-pack, mist-blowers, pioneered in Wairarapa in the early 1960s and micron-mist blowers in the 1970s by the late Mr Alf King. Spot treatment has a high labour content (66-75% of total costs) and was penalized when subsidies for noxious plants including gorse and nodding thistle were only for herbicides. In 1980 the Noxious Plants Council allowed special projects to be eligible for subsidies, resulting in both gorse and nodding thistle spot spraying programmes in Wairarapa with a 50% subsidy on total cost.

Where farmers have found control of gorse seedlings difficult by mob-stocking with sheep (often because paddock sizes are too large to achieve high stock densities), low volume blanket spraying during the first spring with minimum rates of 2,4,5-T (1.5-3.0kg/ ha) is required. This controls gorse seedlings and suppresses growth of gorse stumps and larger plants (F. Phillips *pers. comm*). At these rates of 2,4,5-T clovers appear to be checked, but not killed, while higher rates defoliate or kill clover (F. Phillips *pers. comm*). Low volume sprayings are repeated annually during the first two to five years of development until spot spraying can be initiated.

CLOVER INJURY

Clover growth is suppressed by some herbicides used for thistle and gorse control including 2,4-D, 2,4,5-T, dicamba, MCPA and picloram (Matthews, 1965; Bramley et al., 1967; Honore et al., 1980). At Ballantrae, MCPA, MCPB, 2,4-D and 2,4-DB were applied in autumn (May) and spring (September) 1979, to a pasture (7% white clover). The herbicides were applied at rates 1.0, 2.0 and 3.0 kg/ ha. Results averaged over the three rates are presented in Table 3. Clover yield and nitrogen fixation rate in November was significantly reduced by autumn and spring applications of MCPA and 2,4-D (Table 3). In contrast, 2,4-DB and MCPB did not injure clovers. Brock (unpub. data) found that 2,4,5-T applied to a grass-clover pasture in winter

TABLE 3. EFFECT OF AUTUMN AND SPRING APPLICATIONS OF PHENOXY HERBICIDES ON NITROGEN-FIXATION RATE AND CLOVER GROWTH IN NOVEMBER. EVALUATION IN WEEKS AFTER TREATMENT IN PARENTHESES.

Herbicide	N-fixation (kg N/ha/day)		CloverDM (kg/ ha)	
	Autumn (26)	Spring (8)	Autumn (29)	Spring (11)
Control	0.37 a*	0.31 a	380 a	350 a
MCPA	0.26 b	0.17 b	334 b	273 b
2, 4-D ester	0.12 c	0.13 c	255 c	185 c

* means separated by different alphabetic letters in Table 3 and 4, are significantly different (LSD) at the 5 percent probability level.

TABLE 4. EFFECT OF WINTER AND SPRING APPLICATIONS OF 2,4,5-T ON NITROGEN FIXATION AND CLOVER GROWTH IN A CLOVER-GRASS PASTURE, PALMERSTON NORTH, 1975 (J. BROCK, UNPUBLISHED).

2 , 4 , 5 - T (kg/ha)	N-fixation (kg/N/ha/day)		Clover DM (kg/ha)	
	Winter (6)	Spring (3)	Winter (8)	Spring (4)
0	1.10 b	1.64 b	1220 a	1740 a
1.0	0.20 b	0.03 b	290 b	320 b
2.0	0.03 b	0.01 b	30 b	220 b

(July) and spring (November) 1975 significantly reduced clover growth and nitrogen fixation rate (Table 4).

The indirect cost of broadcast spraying in terms of reduced nitrogen fixation and lowered pasture quality as a result of clover injury are often overlooked. Reduced liveweight gains of lambs on pasture sprayed with 2,4-D (Lewis, 1957), and of young dairy cattle on pasture with Californian thistle (*Cirsium arvense*) on pastures sprayed with MCPA, were associated with a decline in clover following spraying (Hartley and Thomson, 1982). The cost-benefits of spraying to control nodding thistle and other weeds in hill country are not known. However the results of failing to control gorse is the loss of large areas from grazing.

CONCLUSION

Goats have a place in hill country for controlling weeds. The funding of noxious weed control programmes on a herbicide only basis should be replaced by funding on a project basis, especially for group projects and should include projects using goats. Scrub weeds are controlled best by intensive farming systems with adequate subdivision and high stocking rates. Broadcast spraying with herbicides which deplete clover content should be avoided where spot spraying or alternative controls are possible.

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