THE SURVIVAL OF GORSE SEEDLINGS UNDER GRAZING, TREADING AND MOWING

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Summary

The survival of gorse *(Ulex europaeus)* seedlings planted in association with different pasture species was measured under different regimes of grazing, treading and mowing. All treatments involving treading had a severe effect on gorse survival. Grazing without treading was less effective than normal grazing or treading alone. Mowing had least effect. Gorse survival was lowest under Yorkshire fog *(Holcus lanatus)* and highest under perennial ryegrass *(Lolium perenne)* with browntop *(Agrostis tenuis)* intermediate. The decline of gorse in the absence of grazing and the effect of time of initial grazing was also measured.

INTRODUCTION

Trials reported last year (Hartley and Phung 1979) showed that both pasture species and grazing management affected the survival of gorse seedlings. Fewest gorse seedlings survived under a long grazing rotation and Yorkshire fog and browntop were more effective than ryegrass at suppressing gorse. The results indicated that treading had an important effect on the decline in gorse seedling numbers.

Further work was, therefore, initiated to examine more closely the effects of treading, grazing and mowing in the presence of different grass species. The effects of ungrazed pasture and of different times of first grazing were also studied.

METHOD

The trials were conducted on the same site as the previous trial, a flat river terrace on Tokomaru silt loam, near Palmerston North (Hartley and Phung 1979). The two paddocks used were cultivated at the end of the previous trial. Plots were hand sown with the appropriate pasture species in April 1979 and were then raked and rolled. Forty kg/ha P was applied as a basal dressing.

Small gorse seedlings were collected from newly cleared gorse country in March-April 1979 and planted in seed boxes. The seedlings had nodulated when collected. During May healthy seedlings were transplanted into the sown pasture plots at 50 seedlings per plot, in a regular pattern, using a removable grid. Each gorse plot was 0.5 x 1 m and the position of the grid was marked with coloured plastic tags for ease of relocation. During August all gorse seedlings were checked and gaps filled from a reserve of the originally collected seedlings. Methiocarb pellets were then applied to prevent possible slug damage. Each trial had four replicates of each treatment in randomised blocks.

In one of the paddocks 96 plots were sown with either 'Grasslands Ruanui' perennial ryegrass, at 20 kg/ha, Yorkshire fog at 10 kg/ha or browntop at 3 kg/ha. Plots were 1.5 x 1.5 m (grazing and mowing treatments) or 1.37 x 1 m (treading treatments). Each plot was subjected to one of the following treatments —

Normal grazing	Treading once without grazing (1 treading)
Grazing without treading	Treading once after grazing (2 treadings)
Mowing to 2 cm	Treading twice without grazing (2 treadings)
Mowing to 6 cm	Treading twice after grazing (3 treadings)

All treatments were applied at approximately the same time, about once a month from September to March. A large mob of sheep was used that could graze the paddock out in 1-2 days.

The 'normal grazed' plots were left open. Those requiring 'grazing without treading' were fenced with sheep netting around the gorse plots only. Head sized holes were cut in the netting through which the sheep could graze the whole plots.

The mowing plots were caged and mown with a rotary mower during each grazing period.

Treading was done by walking the sheep around a race system across the plots. There were four races, two for single treading and two for double treading and one half of each race was open to be grazed with the paddock. After grazing, the sheep were walked along the race the appropriate number of times over grazed and ungrazed plots.

The width of the race was 1.37m so that the passage of one sheep along the race gave a treading pressure equivalent to three sheep/ha/day if they were grazing normally. This was based on the estimates of Hancock (1950) that a sheep walks an average of 2.74 km/day while grazing, and Edmond (1970) that the overhang of a sheep is 7.5 cm.

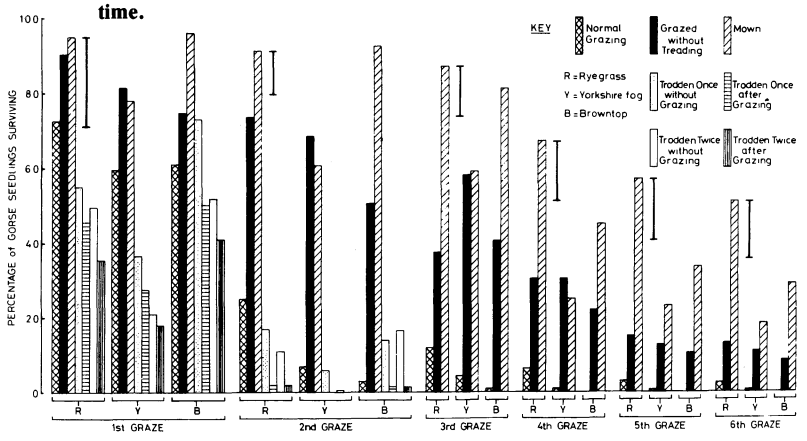
Where treading was done after grazing, the plots received an extra treading during grazing. Therefore, 'treading once after grazing' was trodden twice, 'treading twice after grazing' was trodden three times.

All plots in paddock B were sown with Ruanui at 20 kg/ha and white clover *(Trifolium repens)* at 3 kg/ha and caged. The plots were 1.5 x 1.5 m. Every 3 weeks, approximately, four plots were opened and the paddock mob-stocked for 1-3 days. After opening the plots remained open and were grazed again when the next and subsequent plots were opened.

RESULTS

The mean numbers of gorse seedlings surviving after each grazing/treading/mowing (hereafter calling grazing) for each pasture grass are shown in Fig. 1.

Fig. 1 Percentage of gorse seedlings surviving after each grazing/treading/mowing treatment under each grass species. The LSD 5% is shown for each grazing time.



Analysis of variance of the numbers of gorse seedlings surviving after each grazing showed highly significant effects of both treatment and species. The major difference occurred between treading and no treading (Fig. 1). Gorse numbers declined rapidly under all treading treatments including normal grazing. The trends summarised below are the main effects of treatments across all species or the main effects of species across all treatments unless specified otherwise. The performance of individual species under different treatments can be seen in Fig. 1.

At the first graze, 'normal grazing' did not differ from 'treading once without grazing' in its affect on gorse seedlings. Neither did 'treading once after grazing' differ from 'treading twice without grazing' where again foot pressure was equal. However, both the above double treadings reduced gorse survival significantly relative to 'normal grazing' and the single treading treatment. 'Treading twice after grazing' (three treadings) had less gorse surviving than any of the other treading treatments.

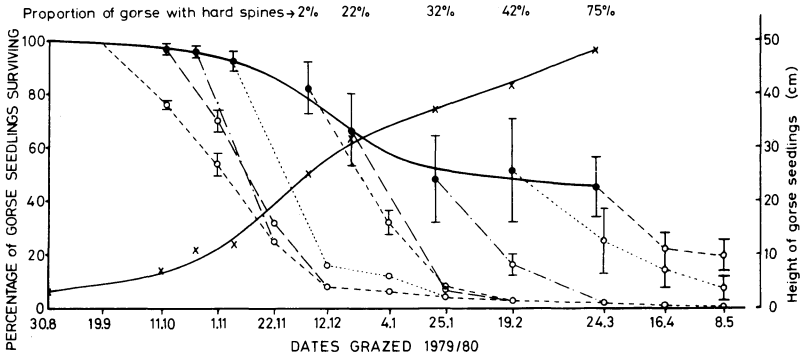
At the second grazing, normal grazing and both 'treading after grazing' treatments caused considerable losses of gorse while 'treading without grazing' was slightly less damaging. This is attributed to 18.4 mm rain which fell during grazing and resulted in some pugging. The extra treading was delayed a day to allow the ground to firm. Only 1 mm fell during the first graze. Because of the low numbers of gorse seedlings surviving treading the treading experiments were stopped after the second graze.

Except for the second cut when gorse survival was highest under 'mowing short', there was no significant difference between mowing heights and the data have been pooled. At all times there was a significantly lower survival under 'normal grazing' than under 'grazing without treading' or mowing. At all but the first graze there was a significantly lower survival under 'grazing without treading' than under mowing when measured across all species. This effect was not found under Yorkshire fog where the two treatments were similar.

Gorse survival was also affected by pasture species. The survival under Yorkshire fog was always significantly lower than under ryegrass with browntop giving intermediate results which were significantly lower than ryegrass and higher than Yorkshire fog at some counts. The loss of gorse seedlings under Yorishire fog was particularly high following treading and also high under mowing relative to the other two species.

Fig. 2 **Percentage survival, proportion with hard spines and mean height of gorse seedlings in ungrazed pasture against time. The decline in gorse numbers following grazing is also shown for each time of first grazing (broken lines). The standard errors are shown where they do not overlap. When plots coincide only the first line is drawn.**

- ● survival of gorse seedlings in absence of grazing
- o survival of gorse seedlings under grazing
- x height of ungrazed gorse seedlings



The effect of time of initial grazing and survival in the absence of grazing is shown in Fig. 2. In ungrazed pasture the decline in gorse survival followed a sigmoid curve. There was little effect until pasture growth reached a peak in November when lodging smothered much of the gorse. The decline appeared to stop in late January when the stronger gorse plants had grown through the lodged pasture. At the final count, 24 March 1980, gorse seedlings were assessed for their likelihood of surviving had the plots been left untouched. Thirty-nine out of 200 initially present were assessed

as probable survivors (19.5%). This estimate excludes the ultimate intra species interference that would be expected from gorse plants 10 cm apart.

The mean heights of the gorse seedlings at each date are also shown on Fig. 2 as well as the percent with hardened spines. At later grazing sheep were destroying quite large seedlings. Some seedlings 50-60 cm tall and prickly were being pulled out, leaving broken root fragments in the ground. Others with stem diameters of about 5 mm were being chewed off. After the next grazing about 25% of those chewed off had regrown, 25% died and the rest had disappeared.

The impact of the first and subsequent grazes on gorse survival appeared to increase as initial grazing was delayed, at least during the spring. Gorse mortality achieved by one graze in late November was similar to that achieved by four grazes commencing in September, three commencing in October or two in early November.

DISCUSSION

The results confirm a major effect of treading on gorse seedlings as indicated in the previous work (Hartley and Phung 1979). The implication of this is serious in an average gorse control situation where, due to steep terrain or protection by old stumps, many gorse seedlings will be protected from treading. This report covers only 8 months grazing though observations will continue. However, a small pilot trial started in spring 1978 shows the effect is likely to continue. Six hundred gorse seedlings were planted as above in ryegrass/white clover pasture. All were exposed to equal grazing but half were protected from treading. After 18 months there was one survivor in an open plot compared to 47 in foot exclusion plots and many of the gorse plants were becoming hard and bushy.

The effect of mowing on gorse survival was less severe than grazing alone, probably due to the number of seedlings actually pulled out by grazing. Since mowing would not be as selective as grazing, especially when the gorse hardens, the decline in numbers might continue though such a method of control might have to be pursued for a long period. The mown gorse seedlings, particularly in the ryegrass plots were, by March 1980, showing a spreading prostrate growth habit and looked set for a prolonged existence.

The effect of pasture species on gorse survival again showed ryegrass to be less effective than Yorkshire fog and browntop at suppressing gorse seedlings (Hartley and Phung 1979). These effects were detected on a relatively high fertility flat site. The species difference might be even greater in hill country where Yorkshire fog and browntop often invade naturally. This effect of species is in contrast to that found by Ivens (1979) making a similar study on spring sown gorse.

The pasture competition alone killed half the gorse, a similar level of mortality as found by Ivens (1979), and may eventually have accounted for 80%. However, this mortality is of no practical value because of the high numbers of seedlings that grow following gorse clearance (Ivens 1978). The effect of the first graze appears to be greater if it is delayed until pasture competition is strong. This confirms the advantageous effect of long rotation (Hartley and Phung 1979). However, the final results were similar regardless of when grazing started and more frequent grazing would have made better use of the pasture.

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