RAGWORT (*SENECIO JACOBAEA*) CONTROL BY SHEEP IN A HILL COUNTRY BULL BEEF SYSTEM

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SUMMARY

Ewe hoggets set-stocked (SS) or mob-stocked (MS) at 1.5 or 3.0 stock units (su)/ha were used to control ragwort in a bull-beef grazing trial. Of ragwort plants in 3.0SS pastures 72% died within 12 months without flowering. By contrast, in cattle-only pastures 72% of ragwort plants died after having seeded. SS resulted in higher ragwort mortality than MS and 3.0 sheep su/ha resulted in higher mortality than 1.5 sheep su/ha. Plant height and area was greatest in cattle-only pastures; greater in MS than SS; and greater at 1.5 su/ha than 3.0 su/ha. MS reduced flowering, but induced multi-stem development in the second year. Ragwort population density declined from 9.2 plants/m² in 3.0MS to 0.2 plants/m² after 12 months while under SS ragwort densities increased. SS hoggets reached 63 kg liveweight at 20 months and no liver damage was found. Set stocking cattle-pastures with 3 sheep su/ha gave good control of ragwort and offers the potential for marketing heavy weight young sheep, or the early breeding of replacement stock.

Keywords: ragwort, bull beef, hill country, biological control, sheep

INTRODUCTION

Ragwort is widespread throughout New Zealand, particularly in moister areas of the North Island, and is classified as a Class B noxious weed (Wardle 1987). Chemical control can be successful but legume growth and function is often affected by chemical sprays. Mowing and clipping may prevent seeding but induces a high proportion of multicrown perennial plants in the following year (Poole and Cairns 1940; Thompson 1985). Sheep readily browse ragwort especially in the rosette stage (Cameron 1935), whereas mature stems, having a lower nutritive value, are not readily browsed. Sheep grazing does not induce multi-stem crowns as most grazed plants subsequently die without having set seed (Sharrow and Masher 1982).

Ragwort is toxic at all growth stages to ruminant livestock. Sheep have the ability to detoxify some of the alkaloid in the rumen, thus enabling them to eat ragwort without acute toxicity (Bruere *et al.* 1990). The toxic pyrrolizidine alkaloid, jacobine, is metabolised in the liver to active pyrrol derivatives (Craig 1979) which cause cirrhosis of hepatic cells. A liver damaged by ragwort poisoning has enhanced copper uptake and chronic copper poisoning is a common symptom of excessive intake of ragwort (McHowell *et al.* 1991). Acute poisoning is frequently found in young cattle fed ragwort-contaminated hay, but because the alkaloid is a cumulative toxin, prolonged intake of a low level of ragwort may also lead to chronic poisoning. Consequently, farmers typically use cull ewes to eat-off flowering ragwort.

The trial reported here is in its second year and is investigating the use of a small proportion of total stock units (su), as young sheep, grazing continuously or at a high stock intensity for a short period, in a rotationally grazed bull beef system in which ragwort had become a major weed.

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METHOD

Fifteen 1 ha paddocks in a 30 ha rotationally grazed bull beef finishing system at the AgResearch Ballantrae Hill Country Research Station were split into three replicates. Romney ewe hoggets at stocking rates of 1.5 and 3.0 sheep su/ha as either set-stocked (SS) (1.5SS and 3.0SS) or mob-stocked (MS) (1.5MS and 3.0MS) managements constituted the four sheep grazing treatments. A cattle-only treatment constituted the 'control'. Bulls entered the trial in April each year at 8 months of age at a winter stocking rate of 10.5 stock units/ha, and were grazed until 18-20 months of age.

During rotations of 30-50 days, cattle passed through paddocks with SS sheep. Sheep were mob-stocked in later October, mid December, early February and mid March. Each MS event lasted 4 days with sufficient sheep to total an annual stocking rate equivalent to 1.5 or 3.0 su/ha. Within each paddock 20 ragwort plants were tagged in June each year and their width and breadth (to estimate area), height, flowering stage, grazing damage and the number of main growing stems were regularly recorded until the plant died. Only results from plants tagged in June 1992 are reported here. All ragwort plants were counted, occasionally, in 40 fixed quadrates per paddock. Data were analysed by GLM (SAS, 1991). Although plant counts (n/paddock) were transformed by $\arcsin(n/20)^{1/2}$ to stabilise variance before repeated measures analysis, untransformed means are presented.

RESULTS AND DISCUSSION

Ragwort flowering and survival

Only 28% of plants tagged in June 1992 in the control and 3.0SS treatments survived until late autumn 1993, significantly fewer than in the 1.5SS or 1.5MS treatments ($P < 0.05$) (Fig. 1). In April of year 1 more (82%) cattle-only plants were in flower than in 1.5 sheep su/ha treatments (32-36%) which in turn had more than 3.0 sheep su/ha (0-5%) in flower ($P < 0.05$). In 3.0SS 55% had died without flowering in

Figure. 1: Number of surviving ragwort plants over 21 months following imposition of one cattle-only and four sheep-with-cattle treatments.

year 1. Of those ragwort plants surviving to February 1994, most plants in cattle-only and 1.5SS were in flower but flowering was minimal at 3 sheep su/ha ($P < 0.05$). During the second year (1993-94) few plants died before summer flowering. Less than 20% of plants survived to April 1994 in all but 1.5MS, in which 55% were still alive ($P < 0.05$). Ragwort is considered to be an annual or biennial plant with few plants having short-term perennality (Wardle 1987). It was not possible to determine the age of the plants at the start of this trial, but clearly many acted as biennials or perennials, especially under MS grazing at 1.5 su/ha. This was probably because sheep MS suppressed or inhibited flowering, in plants not killed. Prevention of flowering and high mortality with sheep SS confirms the findings of Sharrow and Masher (1982) in Canada but management had little effect on the number of stems. This finding is inconsistent with multicrown development under mowing (Thompson 1985) and chipping (Poole and Cairns 1940). Control plants all seeded before dying.

Plant height

In cattle-only pastures ragwort grew significantly higher (at flowering) than in sheep-grazed pastures (Table 1). Maximum mean height of tagged ragwort plants was smallest in 3.0SS pastures where flowering was inhibited. In MS treatments, ragwort grew to 200 mm before being first grazed by sheep in October 1992 and subsequently plants remained short. Of those plants surviving into year 2, those in the cattle-only treatment were again tallest. For no apparent reason few plants were grazed in 1.5SS in year 2. This contrasted strongly with data for year 1 when all plants in 1.5SS were regularly grazed. In 1.5MS many plants were not heavily grazed in year 2 because the grazing of one paddock (replicate) in December was left too late and ragwort plants had grown above grazing height of the sheep. Flowers subsequently developed above grazing height on these plants and seed was set.

TABLE 1: Least square mean heights (mm) of tagged surviving ragwort plants (SEM) in pastures following imposition of one cattle-only and four sheep-with-cattle treatments.

Date	1.5MS	1.5SS	Treatment 3.0MS	3.0SS	Cattle only
Aug 1992	50 b ¹ (5)	75 a (5)	61 b (5)	34 c (5)	64 ab (5)
Feb 1993	217 b (22)	162 bc (22)	198 b (21)	110 c (28)	704 a (22)
Jul 1993	84 c (15)	147 ab (19)	86 bc (20)	51 c (29)	191 a (29)
Feb 1994	456 b (38)	639 ab (58)	178 c (51)	225 c (86)	774 a (112)

¹Means within rows having different letters are significantly different ($P < 0.05$).

Ragwort area

During the first year MS plants were larger (250-550 cm²) than SS plants (150-300 cm²) ($P < 0.05$) with similar patterns seen with surviving plants in year 2 except for 1.5SS plants which reached 2,300 cm² in late summer because they were not grazed in this year. Plants grazed by 3.0 sheep su/ha were largest at the start of the trial (300 cm²); were smaller (120 cm²) after 12 months ($P < 0.05$); increased in the second summer (230 cm²) and were only 50 cm² in autumn 1994. Plants in pastures stocked at 1.5 sheep su/ha were larger than plants in pastures stocked at 3.0 sheep su/ha ($P < 0.001$), reaching 500 cm² during the first year. Following each mob-stocking ragwort area was reduced by up to 50% over the 4 days, with plants reduced to 1-2 cm² stumps at the higher stocking rate. Clearly, maintaining a continued and high grazing pressure on ragwort is more desirable in order to weaken and ultimately kill the plants, and prevent flowering. Although MS management kept plants short during the summer period, the greater bulk of green leaf and stem remaining after each grazing, compared with SS plants, allowed their higher survival rate into the second year.

Ragwort population density

There was a large between-paddock variability in ragwort density at the start of the trial (0.1–24.8 plants/m²) which reflected previous paddock history. Although 3.0MS started the trial with 9.2 plants/m² (twice as many as in the other treatments ($P < 0.001$)), after 12 months it had only 0.2 plants/m², and no plants after 21 months (Fig. 2). A less pronounced decline in plant density occurred for the 1.5MS treatment. Conversely, under sheep SS, plant density increased over the same period ($P < 0.05$), especially at the lower sheep stocking rate. It is possible that these patterns reflected different grazing pressure by the sheep treatments, with sheep on SS and 3.0 su/ha treatments eating closer to the ground and “opening” the sward for easier establishment of ragwort seedlings (W. Beskow, pers. comm.). Pasture cover data were not available to support this hypothesis.

Figure 2: Mean ragwort density in pastures following imposition of one cattle-only and four sheep-with-cattle treatments.

There is an apparent contradiction between smallest ragwort plants and the high mortality rates being found under 3.0 sheep su/ha while population densities were seen to increase.

There are two independent processes operating. Firstly, tagged plants were already well established when the trial started and were unrelated to population density. These plants were heavily grazed. On the other hand population counts included plants ranging from seedlings to large mature, but many seedlings are unlikely to reach maturity (W. Beskow pers. comm.). These counts, which reflect buried seed loads, will determine ragwort establishment in the short term. Ragwort establishment in the longer term will be determined by seed production under the new management regimes imposed in this trial.

The ewe hoggets used in this trial gave very good ragwort control and reached 63 kg at 20 months. Although old sheep are often used for ragwort control so as to avoid chronic toxicity problems, livers of three SS and six MS 20-month sheep from this trial showed no sign of liver cirrhosis (R.L. Thornton, pers. comm.). Care is recommended,

however, if one mob of sheep is used continually in a MS regime to control tall dense ragwort, as their intake of the toxin will be much higher than in the present trial when MS sheep grazed over only short intervals.

Not all sheep eat ragwort. In selecting hoggets for restocking the trial in 1994 we determined that 5% of the larger mob refused to eat ragwort; farmers have said that sometimes a whole mob of sheep will avoid ragwort; and experience at Ballantrae has also shown that mixed age Merino wethers gave very poor ragwort control. Research is needed to determine why some sheep avidly eat ragwort while others reject it.

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