CONDITIONING OF ROMNEY SHEEP FOR RAGWORT (*SENECIO JACOBAEA*) CONTROL

K. BETTERIDGE¹, R.D. SUTHERLAND², R.A. FORDHAM²,
K.J. STAFFORD³ and D.A. COSTALL¹

¹*Grasslands, AgResearch, Private Bag 11008, Palmerston North, New Zealand*

²*Department of Ecology, Private Bag 11222, Massey University,
Palmerston North, New Zealand*

³*Department of Veterinary Clinical Sciences, Private Bag 11222, Massey
University, Palmerston North, New Zealand*

ABSTRACT

Management options were investigated to determine whether sheep preference for ragwort could be enhanced. Pre-weaning exposure to ragwort and the presence of adult sheep increased intake of ragwort by lambs in the first few weeks after weaning. However, this was of little practical significance for weed control purposes as ragwort-naïve lambs accepted ragwort soon after weaning. Ragwort eating by ewes, two-tooths and lambs classed as averse ragwort eaters remained unchanged after 10 days confinement on ragwort-dense pasture. There seems little prospect of training sheep that don't eat ragwort to become useful control-agents of ragwort.

Keywords: ragwort, *Senecio jacobaea*, sheep, lamb, food preference

INTRODUCTION

Ragwort is a common weed throughout New Zealand (Bourdôt *et al.* 1994), found particularly in pastures grazed by cattle. It is highly toxic to cattle (Cheeke 1994) and therefore its control is necessary in cattle pastures.

Many sheep are able to eat ragwort without becoming poisoned due either to the slow rate of toxic metabolite formation from the ragwort's pyrrolizidine alkaloids, or the high rate of deactivation of these metabolites in the liver (Cheeke 1994). Successful ragwort control by sheep has been reported, although some sheep appeared to be averse to ragwort (Betteridge *et al.* 1994).

Post-weaning preference for, or aversion to, food experienced before weaning can be influenced by the diet of the mother (Mirza and Provenza 1992; 1994) and develops more easily in lambs during suckling and grazing than when they are fully milk-fed (Squibbet *et al.* 1990). Lambs older than 7 weeks can also learn by observing other sheep (Chapple and Lynch 1986).

This study was conducted to determine whether management practices could enhance the sheep's preference for ragwort.

METHODS

Trial 1

Two weeks before lambing, two birth groups of thirty pregnant ewes were randomly selected from a mixed age flock. One group was taken to ragwort-free pasture (RFP) where they lambed and reared their young until three months of age. The other group remained on ragwort-containing pasture (RCP). In mid November all these sheep were brought together and lambs were weaned (mean liveweight 20 kg). Fifteen RCP and 15 RFP lambs formed lambs-only groups (RCP₀; RFP₀ respectively) and groups of 15 RCP and 15 RFP lambs were each run with six ewes (RCP₊; RFP₊ respectively) selected randomly from mothers in the alternative birth groups.

During weeks 1, 3 and 12 after weaning, each group was grazed within adjacent “lanes” and offered similar daily pasture allowances which contained an average of six non-seedling ragwort plants/m². Twenty ragwort plants were tagged for measurement in each daily ‘feed break’.

Prior to, and after 24 h of grazing, the marked plants (assumed to approximate a cylindrical shape) were measured (height and diameter) to provide an index of volume. The change in ragwort volume over 24 h was assumed to be a measure of ragwort consumption by treatment groups. Plant measurements were made in the five days immediately following weaning (Week 1) and for four days in Weeks 3 and 12. Mean pasture height was determined from 50 ‘first hit’ sward stick measurements and pasture mass was estimated from calibrations of height against pasture dry matter (DM).

During weeks 2, and 4 to 11, the sheep were grazed separately on similar ragwort-containing pastures. At the start of Week 12 the ewes were removed, so that ragwort consumption by lambs (mean liveweight 29.7 kg) was not confounded by presence of the ewes.

Trial 2

In April 1996, 16 sheep in each of three age classes (lamb, two-tooth, ewe) were selected during two, one hour observation periods on two consecutive days on eating behaviour such that within each age group eight sheep were classed as “averse eaters” and eight as “avid eaters” of ragwort. The “averse” and “avid eaters” were grazed as separate mobs on pasture containing a high density of large rosette and mature ragwort plants. Pasture allowance was such that after 10 days in the same break, animals were at a maintenance feeding level of pasture.

The behaviour of the animals (total number resting, eating pasture or eating ragwort) was monitored every 2 minutes for one hour on each of the first two, and last two days of the 10 day feeding period. The percentage of grazing time spent eating ragwort was analysed following normalisation of data by arcsine transformation. As the behaviour of individual sheep was not recorded each time, the age-class effect was assessed as the proportion of sheep within each class observed eating ragwort at least once during the observation period.

RESULTS

Trial 1

Ragwort had a mean height of 25, 29 and 48 cm (mean plant volumes being 0.26, 0.22 and 0.29 m³) during Weeks 1, 3 and 12 respectively, and was similar for each group within each week (week x group interaction; $P = 0.35$). Mean grass height was 16, 13 and 11 cm before grazing (3100–2100 kg DM/ha) and height reduction over 24 h intervals ranged from 46 to 48%. Mean ragwort consumption (volume reduction of individual plants) increased from 16 to 30 to 60% from Weeks 1 (27% RFP₀; 42% RCP₀), 3 (21%; 38%) and 12 (60%; 61%) respectively for both lamb-alone groups ($P < 0.05$). RCP₀ lambs ate more ragwort (42%) than RFP₀ lambs (28%; $P < 0.05$) averaged over the three periods. In Week 1, RCP₊ (46%) removed more ragwort than RFP₊ (31%) ($P = 0.09$) and again in Week 3 RCP₊ removed more ragwort (94%) than RFP₊ (42%; $P < 0.001$). These data do not distinguish between the ragwort eaten by ewes and lambs.

During Week 12, when lambs alone grazed the pastures, there was no difference in ragwort consumption by the four groups ($P = 0.68$).

Trial 2

In forming the ragwort-averse group 25% of lambs, 16% of two-tooths and 11% of mature ewes were not seen to eat ragwort. Avid eaters spent 14% of grazing time eating ragwort at the start and conclusion of confined feeding on ragwort-dominant pasture, whereas averse eaters spent less than 3% of grazing time eating ragwort (Table 1). Reluctance to eat ragwort following confined feeding was similar for each age-class (data not presented).

TABLE 1: Mean percentage of observed grazing time spent eating ragwort.

Data based on 30 observations per day of 24 sheep in each of two groups.

Animal group	Trial days	Grazing time (%)
averse eaters	1~2	0.5 b
	9~10	3.4 b
avid eaters	1~2	13.9 a
	9~10	14.1 a

Means followed by different letters differ significantly ($P < 0.01$)

DISCUSSION

It is clear that lambs reared on RCP ate more ragwort during the first and third week after weaning than those introduced to ragwort for the first time at weaning (RFP). This is consistent with previous research showing the food which suckling lambs experience influences their food preferences in later life (Chapple and Lynch 1986; Thorhallsdottir *et al.* 1990; Mirza and Provenza 1992; 1994). The post-weaning data showing greater consumption of ragwort by RCP₀ than RFP₀ strongly suggests that RCP₀ lambs had sampled ragwort before weaning.

The adult ewes were taken from the alternative groups to ensure that all the lambs stopped suckling at the same time. While these ewes may not have had the same influence on the lambs as if they had been their mothers, Squibb *et al.* (1990) suggested that any such maternal influence may not be important after seven weeks of age. Because ragwort consumption by the adult ewes within each lamb + ewe group is unknown, the influence of the ewes on the consumption of ragwort by weaned lambs could not be determined directly. Grazing observations of lambs and ewes, to be analysed, will determine this effect. However if, in Weeks 1 and 3, it is assumed that the ewes in the two groups ate the same amount of ragwort, then the greater removal of ragwort from RCP₊ compared with RFP₊ must reflect a higher ragwort consumption by lambs which had been exposed to ragwort before weaning. This difference was clearly seen between the lambs-alone groups at this time and is consistent with the influence adult sheep have been shown to have on the dietary preference of young lambs (Chapple and Lynch 1986; Squibb *et al.* 1990).

The estimated 47% pasture utilisation shows that the sheep were not forced to eat ragwort because of insufficient pasture. Thus, the increased intake of ragwort over time, such that at Week 12 each group ate similar amounts, shows a changing preference for the weed; and that the effect of pre-weaning exposure to ragwort and the impact of adult sheep on young animals lasts less than 12 weeks.

Confining sheep which were reluctant to eat ragwort to a near-maintenance ration in ragwort-dense pastures did not induce them to eat more ragwort. The large difference between averse and avid eaters in the percentage of grazing time spent eating ragwort, after several days confinement on ragwort-dominant pastures, suggests a negative feedback mechanism from the liver may have been active in ragwort-averse sheep. This may be because bioactivating enzymes were present in avid "eaters" and/or detoxifying enzymes of toxic pyrrole derivatives were absent in "averse-eaters" (Cheeke 1994) or because pyrroles had accumulated to an intolerable level in averse-eaters. The latter seems unlikely since lambs were unlikely to have reached this condition during their short exposure to ragwort. Conversely, as there was no age group difference amongst ragwort-averse eaters in their acceptance of ragwort following confined feeding, it seems probable that within-flock liver enzyme activity differences are likely to explain preference differences between ragwort-averse and ragwort-avid eaters. Johnson *et al.* (1989) reported a decline in bioactivating enzyme activity as sheep age which concurs with the observed decline in the percentage of ragwort-averse eaters in the large flocks as sheep aged.

CONCLUSION

While previous exposure to ragwort and the presence of adult ewes initially facilitated an increase in ragwort acceptance, this effect quickly declined. On the other hand, lambs which show aversion to ragwort seem likely to maintain that aversion for life.

If sheep are bought for the purpose of ragwort control, farmers would be advised to determine from the vendor whether the sheep had been observed eating ragwort as farmers are unlikely to be able to alter their preference for ragwort.

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