

**YEARLING AND EWE FLEECE WEIGHTS IN ROMNEY AND PERENDALE FLOCKS
SELECTED FOR DIVERGENCE IN FAECAL NEMATODE EGG COUNT**

C.A. Morris, S.A. Bisset, A. Vlassoff, R.L. Baker, T.G. Watson and M. Wheeler

AgResearch, C/- Ruakura Agricultural Research Centre, PB 3123, Hamilton, New Zealand

SUMMARY

Three selection experiments in New Zealand, two involving Romneys (at Wallaceville and Ruakura) and the third involving Perendales (at Ruakura), have resulted in breeding lines showing significant divergence in faecal nematode egg count (FEC), following natural challenge. The pair of High and Low FEC lines in each experiment has experienced 18, 8 and 11 years of selective breeding respectively. In the present study, the High and Low lines are compared for greasy fleece weights in both yearlings and mixed-age ewes (YFW and EFW). Relative to the Low lines, the corresponding High lines had greater YFWs by 14.6 ± 3.0 , 7.9 ± 2.4 and $5.3 \pm 3.1\%$ respectively (mean of three, $9.1 \pm 1.6\%$), and they had greater EFWs by 11.7 ± 2.1 , -3.2 ± 3.8 and $8.0 \pm 2.7\%$ (mean of three, $8.2 \pm 1.5\%$). The conclusion is that selection for reduced FEC in Romneys and Perendales is associated with reduced greasy fleece weight, when animals graze together.

Keywords: Sheep, internal parasites, selection, faecal egg count, fleece weight.

INTRODUCTION

Faecal nematode egg count (FEC) following natural or artificial challenge has been used widely as a selection trait in studies of the feasibility of breeding sheep for improved resistance to internal parasites. FEC has proved to be moderately heritable in sheep (Morris *et al.* 1995; Woolaston and Eady 1995), and selection for low FEC in lambs leads to significantly reduced worm burdens of the majority of economically important ovine nematode species (Bisset *et al.* 1996). However, despite this it has become apparent, at least in dual-purpose sheep, that resistance to infection by nematode parasites is not necessarily synonymous with resistance to the effects of nematode challenge while grazing (Bisset and Morris 1996). Genetically Low FEC Romney lambs appear to have no significant growth rate advantage over their High FEC counterparts when both genotypes graze together under natural challenge (Morris *et al.* 1995). Other trials in New Zealand have indicated a slightly unfavourable genetic association (McEwan *et al.* 1992, 1995). Comparisons also show an unfavourable genetic association between FEC and dags (faecal soiling of the breech area) (Watson *et al.* 1986; Douch *et al.* 1995). Bisset *et al.* (1991) speculated that this may be the result of a more severe inflammatory response to larval challenge in the gut by some "resistant" genotypes than normally occurs in their more "susceptible" counterparts. Furthermore, evidence is accumulating of an unfavourable association between FEC and yearling greasy fleece weight (YFW) (Howse *et al.* 1992; McEwan *et al.* 1992, 1995).

In view of the fact that the primary goal of most work directed at breeding for nematode resistance in livestock is to minimise the amount of anthelmintic treatment required to maintain productivity in grazing animals, a good understanding of the correlated responses which can be expected following direct selection for the trait is vital. This paper reports the results of an analysis of YFW and mixed-age ewe greasy fleece weight (EFW) in three sets of FEC selection lines established at AgResearch Wallaceville and Ruakura between 1979 and 1986.

MATERIALS AND METHODS

The three sets of FEC selection lines used in the present analyses were managed on farms owned by AgResearch (formerly the Ministry of Agriculture & Fisheries), and their histories are as follows: 1. Romneys established in 1979 at Wallaceville Animal Research Centre near Wellington, and selected each year for High or Low FEC following natural challenge (mainly *Ostertagia circumcincta* and *Trichostrongylus colubriformis*) of 4- to 7-month lambs on pasture (Bisset *et al.* 1996). 2. Romneys established by Ruakura staff in 1985 (Baker *et al.* 1990), run on two local sites (Rotomahana and Tokanui) until 1992 inclusive; they were selected as lambs for High or Low FEC as at Wallaceville but with an unselected Control flock also maintained from 1986 onwards. From 1993 the elite High and Low animals and all Controls were transferred to and integrated with the Wallaceville lines. 3. Perendales established by Ruakura staff in 1986 (Watson *et al.* 1992), run at four North Island sites until the present day, and selected for High or Low FEC in 4- to 7-month lambs, using artificial challenge to generate the test infection (*Haemonchus contortus* or *Trichostrongylus colubriformis*) in early years and subsequently natural challenge as at Wallaceville.

Averaging results from the most recent two lamb crops of the High and Low lines, divergences were 1.80, 0.65 and 1.19 $\log_e(\text{FEC}+100)$ units in the Wallaceville Romneys, Ruakura Romneys and Ruakura Perendales, respectively. Expressed in terms of back-transformed values (eggs/g), each High line passed 7.3, 2.0 and 4.5 times as many eggs as the respective Low line.

YFW data were collected throughout the Ruakura Romney trial. In the Wallaceville Romneys and the Perendales, YFW data collection did not begin until the 1990 and 1989 birth years respectively. In addition in some years, High and Low lines grazed separately so that we could investigate the effects of selection for FEC on nematode epidemiology, and thus the production data are not suitable for inclusion in this summary. The most recent valid years of YFW data from each set of selection lines are summarised here. For breeding ewes, the first EFW data were collected in late 1991 and late 1992 from young Ruakura Romney ewes, and in late 1995 from the mixed-age Wallaceville Romneys and the Perendales. Results were analysed using least squares, fitting significant fixed effects and selection line.

RESULTS

The comparisons of YFW and EFW for each set of High and Low lines are shown in Table 1. Taking a weighted average over experiments, YFW was significantly higher by $9.1 \pm 1.6\%$ in the High than Low lines ($P < 0.001$), and the corresponding figure for EFW was $8.2 \pm 1.5\%$ ($P < 0.001$), also in favour of the High lines.

Table 1. Fleece weights in the High (H) and Low (L) selection lines when grazed together

Flock/Breed	Class ^A	Years ^A	Records	(H-L)/L, (%)	Significance ^B
Wallaceville (Romney)	Y	1992-94	293	14.6 ± 3.0	***
	E (2 to 5+yo)	1995	247	11.7 ± 2.1	***
Ruakura (Romney)	Y	1991-92	212	7.9 ± 2.4	**
	E (2 & 3yo)	1991-92	91	-3.2 ± 3.8	n.s.
Ruakura (Perendale)	Y	1992-93	181	5.3 ± 3.1	†
	E (2 to 5+yo)	1995	199	8.0 ± 2.7	**

^A Y = yearling; E = breeding ewe; years of birth for yearlings, years of shearing for ewes.

^B *** = $P < 0.001$; ** = $P < 0.01$; † = $P < 0.10$; n.s. = not significant.

It should be noted that all results summarised in Table 1 were derived from pairs of High and Low lines grazed together. At Wallaceville, there were also two birth years (1990 and 1991) where female lambs from the selection lines grazed apart, and the High line mean for YFW was not significantly different from the Low line mean ($+1.9 \pm 3.6\%$). In these two years at Wallaceville, pasture larval counts were on average 2.6 to 2.9 times higher in the High line than in the Low line pastures. In the Perendales, the 1995-born selection line lambs (both sexes) grazed apart, and the High line mean for YFW was not significantly different from the Low line mean ($-3.7 \pm 2.8\%$).

DISCUSSION

Results show convincingly that selection for lower FEC is associated with a reduction in YFW and EFW in New Zealand Romneys and Perendales, when all animals grazed together. The conclusion is consistent with FEC levels in the converse selection lines (i.e. selection for high YFW compared with unselected controls) at Massey University (Howse *et al.* 1992), and at AgResearch (both the Woodlands and Hight lines; Morris *et al.* 1996). However, Eady *et al.* (1994) were unable to show the same correlation in Merino selection lines, and the reason for the inconsistency across breeds is at present unclear.

The contrast between selection line comparisons when grazed together and when grazed apart is still under intensive study in New Zealand, using experimental sheep and also population models. The results could influence advice to ram breeders as selection progress in industry flocks continues.

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