BRIEF COMMUNICATION: Parasite-related traits in lambs sired by resistant or resilient Romney sires

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INTRODUCTION

Finding methods of dealing with increasing levels of anthelmintic resistance is important to the New Zealand sheep industry. Genetic selection within the sheep population for animals that are less reliant on anthelmintic therapy is one approach, and AgResearch has bred selected lines of Romneys over recent decades. These have included lines for resistance and for resilience (Bisset *et al*., 2001). The resistant line, selected for low faecal egg count (FEC) in lambs, was established in 1979. The line selected for increased resilience in lambs was set up in 1994. Resilience is the ability of animals to maintain acceptable health and growth under high parasite challenge, with minimal need for anthelmintic treatment. We report results here from a study to evaluate sires from these two long-term breeding lines, with progeny measured for weaning weight (WWT) and faecal egg count (FEC) at weaning.

MATERIALS AND METHODS

Ethics

This work was carried out with the approval of the AgResearch Grasslands Animal Ethics Committee, AEC project number 10852.

Animals sampled and trial design

Four sires from the Resistant line, and four from the Resilient line, were mated in April 2008 at Ballantrae Hill Country Research Farm to ewes from the Resilient selection experiment. Ewes were managed in four replicated farmlets (Mackay *et al*., 2006), where farmlets consisted of two with 'Conventional' (CONV) management, and two with 'Low-Chemical' (LC) management. LC management complied with the organic production standards of BIO-GRO New Zealand, until March 2007. Dams on the CONV and LC farmlets had been selectively bred for resilience since 1994; equal selection intensity was applied from 1997, so that all four farmlets, with approximately 100 ewes per farmlet, had ewes with similar mean breeding values (BV) for resilience. In contrast to the time period of the farmlet trial described by Mackay *et al.* (2006), no ewes in the CONV farmlets were treated with anthelmintic before or during lambing.

A pair of Resistant and Resilient sires was single-sire mated in each farmlet. The selection of Resistant and Resilient sires was based on BVs already estimated from their own and half sibs' performance. Ewes remained on their farmlet of origin throughout pregnancy, lambing and lactation. Within each farmlet, ewes from the two mating groups grazed together from the end of mating until just before lambing. Lambs in this study were tagged at docking in October 2008, within farmlets. In order to identify the sire of each lamb, ewes from the two mating groups in each farmlet were separated from the start of lambing until their lambs were tagged. The lambs received no anthelmintic treatment whilst with their dams. They were weaned in late November at approximately 90 days of age, at which time a WWT record and a faecal sample for FEC were taken from each lamb. In total, 396 lambs were tagged, varying between 36 and 56 per sire. Of these, 383 had a WWT recorded and 359 had a faecal sample taken.

Statistical analysis

Results for FEC were transformed to natural logarithms as $\log_e(FEC + 100)$, to reduce the tail to the right-hand end of the distribution. The WWT and $\log_e(FEC + 100)$ data were analysed by least squares (SAS, 1995), fitting five effects: CONV versus LC management treatment, farmlet replicate within treatment, sire line, sire line interactions, and sex of lamb. Lambs had not been matched to dams at birth, so no dam age, birth type or date of birth data were available.

RESULTS AND DISCUSSION

The effects of sire line were significant for both WWT and $\log_e(FEC + 100)$ ($P < 0.01$). Mean WWT of Resilient-line progeny averaged 1.36 ± 0.37 kg (7.2%) more than that of Resistant-line progeny. Mean back-transformed FECs were 263 vs 203 eggs/g, respectively. This was a 30% increase. The sire-line difference in FEC reflected effective selection for low FEC in the Resistant line ancestors. For WWT, plotting progeny adjusted-WWT against the sires' own BVs for WWT available before the present trial, three of the four sires per source had BVs which were good predictors of progeny WWT ($r^2 = 0.92$), whereas the other sire per source had an intermediate progeny WWT (r^2 = 0.74 for all sires combined). From the sire BVs for WWT, a difference of 2.54 kg would have been expected between progeny groups, compared with the difference of 1.36 kg actually recorded. This could be explained by heterosis, likely only from the Resistant-sired progeny, or by the unexpected performance of the two sire progeny groups mentioned. Without these progeny groups, the difference between sire sources was an expected 3.08 kg and an actual 2.18 kg.

The CONV *vs* LC treatment effect was significant for both WWT and $\log_e$(FEC + 100) (P <0.001), and the interaction of sire line with management treatment was significant for WWT (P <0.05). The least square mean WWT of lambs was greater by 1.32 ± 0.37 kg (6.9%) in the LC farmlets than in the CONV farmlets. This result appeared inconsistent with the earlier findings of Mackay et al. (2006), where there was an 8% WWT advantage to lambs on the CONV farmlets. However, adaptive responses of ewes may have changed during the 10-year management experiment on the farmlets, although these changes could not readily be seen whilst the CONV ewes and lambs still received drench until the spring of 2006. The LC mean for FEC was lower than the CONV mean with back-transformed values being 195 and 271 eggs/g respectively, a 28% reduction. This also is a reversal of earlier data, probably reflecting LC flock adaptation to a drench-free environment. In Ballantrae lambs at weaning, between 2003 and 2006, the predominant nematode larvae cultured in both the CONV (52%) and LC (34%) treatments were *Ostertagia* genera. Other larvae cultured were *Trichostrongylus, Cooperia*, *Oesophagostomum* and *Chabertia* genera. The most striking difference between the two treatments was the higher prevalence of *Haemonchus* in the LC (23%) compared with the CONV (2%). The increase in FEC of lambs on the CONV farmlets over and above that of lambs on the LC farmlets in 2008 suggests a higher parasite larval challenge on the CONV pastures during the lambing period. This might reflect the lower levels of experience of nematode challenge by the CONV ewes over the lambing period, as a consequence of 10 years of anthelmintic bolus treatment in the CONV ewes and their ancestors.

CONCLUSIONS

Long-term selection in the Resistant and Resilient lines led to a Resilient-line advantage in progeny WWT of at least 7%, although a greater advantage would have been expected without the likely heterosis experienced by progeny of Resistant-line sires. The Resistant-line advantage in progeny FEC at weaning was 60 eggs/g, or 23% of the Resilient-line mean, reflecting the cumulative effect of FEC selection in the Resistant-line ancestors. The CONV and LC management comparison also showed superiority in WWT and FEC of lambs on the LC treatment after 10 years of differential management, probably because of better adaptation by LC-farmlet ewes.

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