

# **The Characterisation and Utilisation of Genetic Resistance to Internal Parasites in Merino Sheep**

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A thesis submitted for the degree of Doctor of Philosophy of the University of New England.

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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## Abstract

Merinos from resource flocks across Australia were tested for resistance to gastro-intestinal nematodes (*Trichostrongylus colubriformis* and *Haemonchus contortus*) using faecal egg count (FEC) to measure relative resistance. FECs were not normally distributed and required transformation for analysis. Selection outcomes were not adversely affected by the type of transformation. The most appropriate transformation was  $\text{FEC}^{0.33}$ . Further adjustment of  $\text{FEC}^{0.33}$  to standard deviation units was found necessary when genetic links were used to compare animals across years.

A small proportion of the total variation in  $\text{FEC}^{0.33}$  could be attributed to Merino strain and bloodline effects (1% and 3.5%, respectively). The major source of genetic variation was found within bloodlines (22.2% of total variation). Paternal half-sib heritability estimates for  $\text{FEC}^{0.33}$  were significant ( $P < 0.05$ ) in 9 of the 11 analyses and had a weighted average of  $0.21 \pm 0.03$ . The environmental effects of sex, age of dam, birth-rearing rank and day of birth were found to be only occasionally significant, accounting for a small proportion (0.3-2.2%) of variation, whereas management group was often significant (2.2 and 19.4% of variation). Significant genetic variation for internal parasite resistance exists within Merino bloodlines, and within flock selection of resistant sires appears to be the most effective method of improving this trait.

There was no apparent correlated response in FEC in Merino flocks selected for clean fleece weight, fertility and fleece rot. A favourable response was observed in a flock selected for weaning weight. Phenotypic and genetic correlations estimated between FEC and fleece traits were not significantly different from zero in resource flocks and selection lines. In the resource flocks the genetic correlation between FEC and body weight (pooled across flocks) was significantly different from zero ( $-0.20 \pm 0.08$  for weaning weight,  $-0.18 \pm 0.09$  for 10 month body weight and  $-0.26 \pm 0.12$  for 16 month body weight). Sensitivity analysis showed that aggregate merit of production traits was influenced the most by the genetic correlation between FEC and fleece weight, followed by reproductive rate, then fibre diameter and least by the correlation between FEC and body weight.

Returns from FEC testing strategies were examined using discounted gene flow. A repeat measure of FEC on 30% of rams gave the best returns. Over the long-term, additional testing of ewes gave improved returns when combined with some ram testing strategies, but was relatively expensive in the short-term.

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