GENETIC DIFFERENCES AMONG MERINO BLOODLINES IN FLEECE ROT RESISTANCE FROM WETHER COMPARISONS

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SUMMARY
This preliminary study used data from four wether comparisons to estimate differences between Merino bloodlines in resistance to fleece rot. Significant differences in fleece rot severity between bloodlines were found for 22 bloodlines, but these means were estimated with limited precision. Among the 22 bloodlines, there were no significant differences in fleece rot incidence.

Keywords: Merino, wether comparison, fleece rot, resistance, bloodlines.

INTRODUCTION
The analyses of data across wether comparisons by Coelli et al. (2000) have provided commercial producers with valuable information on genetic differences between bloodlines in production traits influencing profit in Merino wool enterprises. As well as fleece weight and fibre diameter, the traits analysed to date cover performances in body weight and wool quality. A commercial producer can use these data to benchmark the performance of his/her current bloodline source relative to a personal breeding objective and then identify alternative bloodline sources which better match the breeding objective and will lead to an increase in profit over the current bloodline source. As noted by Coelli et al. (1996), a commercial producer may need to consider other traits in the breeding objective, apart from fleece weight and fibre diameter, when choosing a bloodline.

Resistance to fleece rot, the major pre-cursor of body strike, is one trait not included currently among the traits analysed. This is because few wether comparisons have routinely recorded information on fleece rot. Consequently, a direct means of genetic benchmarking of bloodlines on fleece rot resistance has not been available. This limits the ability of commercial producers to identify more resistant bloodlines for possible use as their ram sources and assess the impact of a bloodline change on other aspects of productivity. Raadsma (1988) found that differences existed between teams sampled from commercial Merino flocks within two wether comparisons in fleece rot resistance and production and wool quality traits. As well, experimental studies under natural conditions have highlighted the significant differences in fleece rot resistance between Merino strains and bloodlines within strains (Dunlop and Hayman 1958; Atkins and McGuirk 1979; Atkins and Mortimer 1989; Li et al. 1999). Relative to the within-bloodline genetic variation, the range in performance in fleece rot resistance between medium wool bloodlines reported by Atkins and Mortimer (1989) was found to be equivalent to at least four generations of single trait selection or, with variable incidences between years, considerably longer.

In environments where fleece rot and body strike have significant impacts on the profitability of Merino enterprises, information on bloodline differences in fleece rot resistance would assist
commercial producers in their choice of bloodline. In this paper, we use the limited information available to us in reporting preliminary estimates of bloodline differences in fleece rot resistance from wether comparison data.

MATERIALS AND METHODS
Fleece rot records on individual wethers within teams were available from four wether comparisons for the analyses. At the start of each comparison, there were at least 10 wethers per team (with 15 wethers per team in one comparison). Two of the comparisons were conducted over three years while the remaining comparisons were conducted over four years. Within each comparison, a score for fleece rot was assessed on the wethers prior to their annual shearing using the method described by Raadsma et al. (1988). Teams of wethers were assessed using a scale of 0 (unaffected) to 5 to indicate the severity of the fleece rot dermatitis, based on the presence and amount of bands of bacterial staining and serous exudate. These records on fleece rot score, as well as the derived trait of fleece rot incidence (0 scores for unaffected animals), were analysed, using REG (Gilmour 1988), by statistical procedures described in detail by Atkins et al. (1992). Initially, all available data within each comparison were analysed separately to obtain team means for each trait. Across the four comparisons, means for teams representing bloodlines with more than a single team in the data were then used in a weighted least squares analysis of variance. For this analysis, the number of teams was reduced to 71 teams (representing 22 bloodlines) from a total of 107 teams (representing 58 bloodlines) used in the within-comparison analyses. Effects for comparison and bloodline were fitted in this analysis, with the weighting factor used was the number of wethers recorded within each team.

RESULTS
Means and repeatabilities (across years) for each comparison are shown in Table 1. Average fleece rot severity and incidence across the comparisons ranged from 0.1 to 1.4 and 0.9% to 31% respectively. Repeatabilities were generally less than 0.2 and decreased with mean incidence.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Fleece rot severity</th>
<th>Fleece rot incidence (%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Repeatability</td>
</tr>
<tr>
<td>1</td>
<td>1.40</td>
<td>0.26</td>
</tr>
<tr>
<td>2</td>
<td>0.70</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>0.23</td>
<td>0.21</td>
</tr>
<tr>
<td>4</td>
<td>0.11</td>
<td>0.09</td>
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</tbody>
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For the data used in the across-comparison analyses, the average fleece rot severity score was 0.66, indicating at most bands of slight staining in the fleece. Average fleece rot incidence was 13%. Comparison was a significant effect (P<0.001) on each trait. Ranges across comparisons for fleece rot severity and incidence were from 0.24 to 1.61 and 0% to 38% respectively. The bloodline effect was significant for fleece rot severity (P<0.05). Mean fleece rot severity scores for the 22 bloodlines in the data ranged between 0 (unaffected) and 1.43 (indicating light to heavy bacterial staining), with standard errors of the order of 0.21 to 0.47. Across bloodlines, fleece rot incidence ranged between 0% and 27% (standard errors of the order of 5% to 12%), but the differences were not significant.
The correlation between bloodline means for fleece rot severity and incidence was 0.95. Both severity and incidence of fleece rot showed little relationship with fibre diameter (Figure 1), based on means for the 16 bloodlines which had both estimates for the fleece rot traits in the present study and for fibre diameter deviations from average as reported by Coelli et al. (2000). Again taking bloodline means from Coelli et al. (2000), fleece rot severity had positive correlations between bloodlines with fibre diameter (0.32), clean fleece weight (0.56), yield (0.39), body weight (0.32), style (0.67) and colour (0.70). Fleece rot severity was correlated negatively with length (-0.18).

**Figure 1.** Bloodline trend for fleece rot severity (a) and incidence (b) versus fibre diameter deviation.

**DISCUSSION**

The analyses of these available data indicate that it is possible to use data from wether comparisons conducted in different environments to estimate bloodline differences in fleece rot severity. However, these bloodline differences have been estimated with limited precision for a small number of bloodlines. This means that these estimates are of little value in allowing commercial producers, who wish also to consider fleece rot resistance in their breeding objectives, to use information on fleece rot resistance when choosing a bloodline source. To reverse this situation, organisers of future wether comparisons will be encouraged to score fleece rot on each animal. The additional data, when analysed, should provide more useful and reliable information on bloodline differences in fleece rot resistance for commercial producers, particularly if the data includes more bloodlines with sufficient representation of teams across comparisons.

Some of the traits routinely recorded in wether comparisons could be used cautiously as resistance indicators for fleece rot. For the bloodlines of the present study, greater resistance was associated with finer fibre diameter and better style and colour but reduced clean fleece weight, yield and body weight and shorter staple length. These findings are consistent with the results of Raadsma (1988), Atkins and Mortimer (1989), Raadsma and Wilkinson (1990) and Raadsma (1993).
With data only available from four wether comparisons, it was not possible to use the analyses to investigate any bloodline by environment interactions. It is important to know if the resistance of a bloodline will vary under different environmental conditions. An experimental study by Atkins and Mortimer (1989) suggests that this may not be the case. They described a bloodline by year interaction for natural fleece rot incidence where the differences between Merino bloodlines for fleece rot were highly dependent on the incidences of the condition, with the differences increasing as incidence increased. As the rankings of the bloodlines did not change greatly across years, this bloodline interaction was suggested to be due to the scale of observation rather than changes in bloodline resistance under different environmental conditions. Much data from wether comparisons would be needed to test the extent and importance of bloodline by environment interactions of any type on fleece rot resistance. This is evident in the work of Coelli et al. (1999) which used wether comparison data from 716 teams representing 75 bloodlines to study bloodline by environment interactions for clean fleece weight and fibre diameter. Despite the size of this data set, they were able only to detect significant bloodline by region interactions for both traits but not able to determine how different classes of bloodlines performed in different environments.

Although the fleece rot traits of this study are categorical in nature, a linear model was used in the analyses. As more data become available, alternative analytical models (e.g. generalised linear, threshold and Bayesian models) will be examined for their ability to better account for the non-normal distribution of the data and to avoid the possibility of apparent bloodline interactions that may be due only to scale effects.

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REFERENCES