Quantifying the relationship between birth coat score and wool traits in Merino sheep

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The birth coat of a Merino lamb can range from fine fibres and short tight curls to a coarse covering that is dominated by long, coarse protruding halo hairs (Fraser & Short, 1960). It is established from pre-natal primary fibres and a proportion of secondary fibres, and is replaced after birth with the hogget fleece through the maturing of the remaining secondary fibres (Ponzoni et al., 1997). Olivier et al. (1994) stated that hairier lambs are culled in practice in an attempt to reduce fibre diameter, change in fibre diameter with an increase in age and the so called coarse edge (percentage of fibre above 30 μm).

Birth coat type is reported to be highly heritable ranging from 0.65 to 0.70 (Schinckel, 1955; Ponzoni et al., 1997; Cloete et al., 2003; Kemper et al., 2003). These authors also reported moderate positive and negative correlations with other wool traits. Ponzoni et al. (1997) concluded that birth coat type as an early selection criterion in Australian Merino sheep is limited despite the high heritabilities reported in the literature. However, Olivier et al. (1994) reported that selection against hairy birth coats will probably decrease coefficient of variation of fibre diameter and coarse edge. Kemper et al. (2003) indicated that decreasing fibre diameter will also subsequently lead to a decrease in birth coat score in fine wool Merinos.

Most of the results in the literature were obtained from medium wool Merinos. The aim of this study was therefore to quantify the relationship between birth coat score and wool traits in a fine wool Merino stud.

Material and methods

The Cradock Fine Wool Merino Stud was established in 1988 as described by Olivier et al. (1999). Ewes were bought from Merino farmers with the finest clips throughout South Africa and four fine wool rams were imported from Australia. Data collected on ram and ewe hoggets born within this stud from 1988 to 2003 were used for the analyses. The number of records, means and standard deviations of the respective traits are summarised in Table 1.

The traits included in the analysis were birth coat type, clean fleece weight, mean fibre diameter, staple length, clean yield, number of crimps, Duerden, coefficient of variation of fibre diameter and comfort factor, as well as the subjective traits wool quality and variation over the fleece that were assessed on a linear scale from 1 to 50 (Olivier et al., 1987). Birth coat types was assessed on a scale from 1 to 4 with 1 being woolly and 4 being hairy and are illustrated in Figure 1. Birth coat was recorded since 1992, while coefficient of variation of fibre diameter and comfort factor was recorded since 1993.

	Number of records (n)	Mean	Standard deviation
Birth coat	4242	1.95	0.81
Clean fleece weight (kg)	5389	4.39	1.02
Mean fibre diameter (μm)	5412	19.26	1.51
Staple length (mm)	5412	102.72	15.61
Clean yield (%)	5026	67.78	6.45
Number of crimps	5014	14.20	2.38
Duerden	5014	99.42	9.41
Coefficient of variation (%)	3777	17.20	2.13
Comfort factor (%)	3780	99.39	1.01
Wool quality	5460	30.61	8.30
Variation over the fleece	5460	36.86	6.94

Table 1. Data description of the different traits

The means and standard deviations for the respective traits were obtained with the PROC MEANS-procedure of SAS, and significance levels for the fixed effects were obtained with the PDIFF-option under the PROC GLM-procedure of SAS (Littell et al., 2002). The effects tested included year of birth, sex, age of dam, rearing status, line (fine or strong wool), as well as the two way interactions between year and sex, year and line and sex and line. The age of the animals (linear regression) at the different traits was also tested for significance. Only effects that had a significant effect was included in the final model for each trait. The estimation of the genetic parameters and breeding values was done with ASREML (Gilmour et al., 2002).

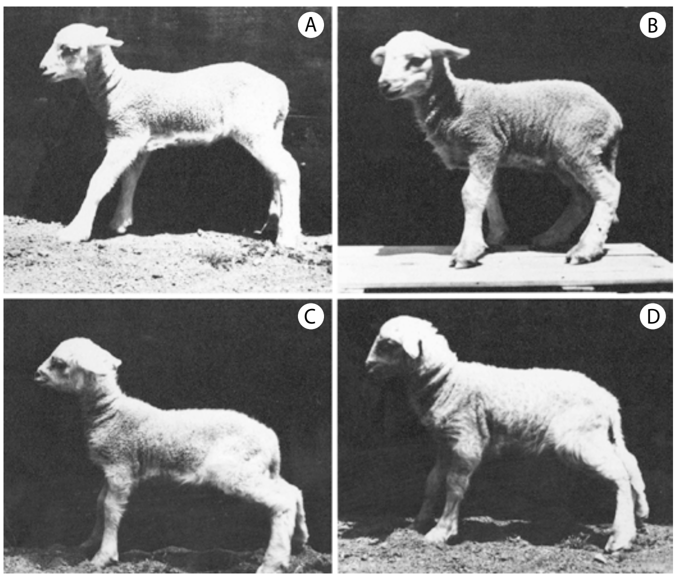

Figure 1. Illustration of birth coat types on a scale from A (1) to D (4) with A being woolly and D being hairy

Results and discussion

The direct heritabilities (h^2), maternal heritabilities (m^2), maternal permanent environment effect (c^2) and the correlation between the direct and maternal genetic effects (ram) are presented in Table 2. The h^2 for clean fleece weight, fibre diameter, staple length, clean yield, coefficient of variation of fibre diameter, wool quality and variation over the fleece falls within the range of h^2 reported in the literature (Groenewald et al., 1999; Safari et al., 2005). The values obtained in this study for birth coat is lower than the values reported in the literature (Schinckel, 1955; Ponzoni et al., 1997; Cloete et al., 2003; Kemper et al., 2003). No comparable values could be found for the h^2 of DD and comfort factor. The high heritability of comfort factor can most probably be ascribed to the lack of variation within this trait.

	h^2	c^2	m^2	ram
Birth coat	0.45±0.04	0.06±0.02	0.03±0.02	
Clean fleece weight (kg)	0.54±0.05		0.09±0.02	0.29±0.14
Mean fibre diameter (μm)	0.73±0.03	0.04±0.01		
Staple length (mm)	0.47±0.03			
Clean yield (%)	0.70±0.03			
Number of crimps	0.49±0.04	0.07±0.02		
Duerden	0.63±0.07	0.02±0.01	0.02±0.02	-0.50±0.24
Coefficient of variation (%)	0.61±0.04			
Comfort factor (%)	0.91±0.02			
Wool quality	0.54±0.03			
Variation over the fleece	0.38±0.03			

Table 2. The direct heritability (h^2), maternal heritability (m^2), maternal permanent environment effect (c^2) and correlation between direct and maternal genetic effects (ram) for the respective traits (± s.e.)

The genetic and phenotypic correlations between birth coat type and the other wool traits are presented in Table 4. The correlations between birth coat and clean fleece weight, fibre diameter, staple length and clean yield are in the same order as correlations reported in the literature (Ponzoni et al., 1997; Kemper et al., 2003). The correlations between birth coat and coefficient of variation of fibre diameter fall within the values reported by Ponzoni et al. (1997) and Kemper et al. (2003).

It is evident from Table 3 that the correlations between birth coat and fibre diameter and clean yield indicate that a decrease in birth coat would have a positive effect on these traits through decreasing fibre diameter and improving clean yield. Clean fleece weight and staple length will tend to decrease and the number of crimps tends to increase with a woollier birth coat. Despite the positive correlations between birth coat and fibre diameter and clean yield, the fact that the correlations between birth coat and the economic important traits are low suggests that direct selection for these traits is still the best option and that culling on birth coat will not necessarily lead to an improvement in these traits.

The slightly higher correlations between birth coat and coefficient of variation of fibre diameter, comfort factor, wool quality and variation over the fleece suggest that selecting woollier lambs could help to decrease coefficient of variation of fibre diameter and variation over the fleece and to increase comfort factor and wool quality.

	r_g	r_p
Birth coat		
Clean fleece weight (kg)	0.07±0.07	0.09±0.02
Mean fibre diameter (μm)	0.10±0.07	0.05±0.02
Staple length (mm)	0.09±0.07	0.05±0.02
Clean yield (%)	-0.13±0.06	-0.03±0.02
Number of crimps	-0.14±0.07	-0.07±0.02
Duerden	-0.02±0.07	-0.02±0.02
Coefficient of variation (%)	0.27±0.06	0.19±0.02
Comfort factor (%)	-0.34±0.06	-0.19±0.02
Wool quality	-0.20±0.07	-0.11±0.02
Variation over the fleece	-0.20±0.08	-0.13±0.02

Table 3. Genetic and phenotypic correlations between birth coat and the other wool traits (±s.e.)
r_g – genetic correlations; r_p – phenotypic correlations

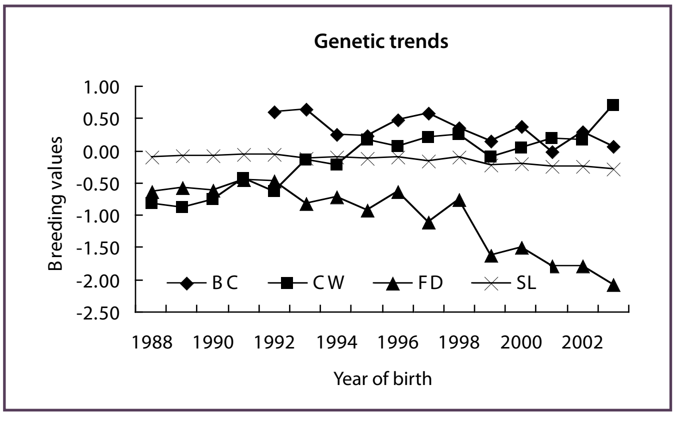

Figure 2. Genetic trends for birth coat type (BC), clean fleece weight (CW), fibre diameter (FD) and staple length (SL)

Conclusion

It can be concluded from this study that culling of hairier lambs would not necessarily lead to a decrease in fibre diameter or a change in the other economically important traits. Therefore, direct selection for these traits is still the best option. However, selecting animals at selection age that were woollier at birth could assist the selection process of identifying animals that will tend to have lower coefficient of variation of fibre diameter and less fibres over 30 μm (comfort factor), as well as better wool quality and less variation over the fleece. ■

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