Preliminary genetic analysis of wool-shedding ability in sheep

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Self-shedding breeds are an appealing choice for prime lamb producers that want to eliminate the need for shearing. Occurring naturally in Spring, the whole fleece or a significant portion of the fleece can be shed. Assessed through visual shedding scores, the degree of genetic variation in wool-shedding ability exhibited moderate to strong genetic variation in UK and American flocks (Pollot 2011; Matika *et al.* 2013; Vargas Juardo *et al*. 2020). This study aims to conduct preliminary genetic analysis of wool-shedding ability in an Australian composite flock.

Wool-shedding ability was recorded on 3,515 animals across 4 years. The Sheep Genetics (2019) wool-shedding score on a 1 to 5 scale (Figure 1) was used. Each animal was scored once, with 1 as clean, 2 as wool on the saddle (~25% wool cover), 3 as wool on the saddle and halfway down the flank (~ 50% wool cover), 4 as wool over most of the body except for legs, belly and breach, and 5 as woolly on the whole body.

Figure 1. Sheep Genetics (2019) wool-shedding score, visually assessed on a 1 (clean) to 5 (woolly) scale.

Wool-shedding score was analysed using a linear mixed animal model, with the significant fixed effects of age at scoring (ranging from 43 days to 9 years), dam age, birth type, rear type, management group, month-year, sire breed and dam breed, and a random additive genetic effect (quantified through pedigree). There were 117 sires represented, with an average of 26 progeny per sire. To understand if wool-shedding is the same trait across age, wool-shedding score was analysed for all animals, lambs only (< 1 year) and sheep > 1 year. A bivariate model was also used to understand the consequence of selection for wool-shedding on adult weight.

The average wool-shedding score was 2.5, with all scores observed across age and month-year of recording (January, February, April, November and December). Wool shedding exhibited genetic variation at the different ages, with lambs showing the most variation (Table 1). These results reflect the estimates presented by Pollott (2011), where genetic variation was highest in lambs (0.54 ± 0.07) compared to older sheep (0.26 ± 0.06).

Table 1. Genetic parameter estimates for wool-shedding ability, scored from 1 to 5, across various ages

	Additive genetic variance ($\hat{\sigma}^2_u$)	Residual variance ($\hat{\sigma}^2_e$)	Phenotypic variance ($\hat{\sigma}^2_p = \hat{\sigma}^2_u + \hat{\sigma}^2_e$)	Heritability ($\hat{h}^2$)
All ages (n = 3,515)	0.24 ± 0.03	0.66 ± 0.02	0.90 ± 0.02	0.26 ± 0.04
Lambs only (< 1 year) (n = 2,616)	0.32 ± 0.04	0.32 ± 0.03	0.64 ± 0.03	0.50 ± 0.05
> 1 year (n = 899)	0.20 ± 0.07	0.57 ± 0.06	0.77 ± 0.04	0.26 ± 0.09

There was a strong genetic correlation between wool-shedding score in lambs and older sheep ($\hat{r}_g$ = 0.98 ± 0.24). This reflects the moderately strong to strong genetic correlation estimates of repeated yearly records presented by Vargas Juardo *et al.* (2020). Therefore, it is possible to select for sheep that are able to shed more completely, and selection for more shedding at an earlier lamb stage will also result in more at an older age.

While the phenotypic correlation between wool-shedding ability and adult weight was negligible (-0.04 ± 0.02), the genetic correlation was 0.26 ± 0.10. This suggests that the genes controlling adult weight and shedding ability are mostly independent, but selection for higher weights will also result in sheep that are less able to shed.

Future studies with repeated measures across time within years are required to adequately separate the differences between speed or timing of shedding and extent of shedding. The relationships between shedding ability and other important production traits should also be further explored. Nevertheless, this preliminary study indicates that it possible to select for sheep that are more able to shed their wool naturally.

References

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