BRIEF COMMUNICATION: Preliminary estimates of genetic parameters for adult dag scores in New Zealand sheep and their relationship with juvenile measurements

KM McRae[a], KG Dodds[a], S-AN Newman[a], LF Brito[b], NK Pickering[c] and JC McEwan[a]

[a]*AgResearch Invermay, Private Bag 50034, Mosgiel 9053, New Zealand;* [b]*Centre for Genetic Improvement of Livestock, University of Guelph, Guelph, N1G 2W1, Canada;* [c]*Focus Genetics, Napier 4110, New Zealand.*

**Corresponding author.* Email: kathryn.mcrae@agresearch.co.nz

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Introduction

The accumulation of faecal material around the breech area of sheep (dags) is of interest to the New Zealand sheep industry for a variety of reasons, including financial penalties for presenting animals with dags at slaughter, reduced wool value, increased risk of flystrike and the labour cost associated with dagging both lambs and adult ewes (Pickering et al. 2012). Currently, dag scores at both three (DAG3) and eight (DAG8) months of age are routinely measured, and analysed in Sheep Improvement Limited (SIL). However, there are currently no formally published estimates of the genetic relationship between dag score as a lamb and dag score as an adult (DAGA) in the New Zealand sheep population. Adult dag score has been found to be highly repeatable between 12 months to two years of age (R = 0.42) and between two and three years of age (R = 0.44) in different strains of Merino sheep (Larsen et al. 1995).

Currently within SIL, the estimated breeding values (EBVs) calculated from DAG8 measures are reported as the adult dag score EBVs. There are now, however, multiple flocks recording adult dag score in the SIL database. An analysis of the correlation of adult dag score with DAG8 and DAG3 would confirm if the current SIL model is appropriate for reporting adult dag EBVs, or if the model needs revising to include adult dag measures and its correlations with DAG3 and DAG8.

Materials and methods

Genetic and phenotypic parameters were estimated for lamb and adult dag scores at weaning using data from 10,489 New Zealand-born pedigree-recorded animals from 10 flocks, born between 1991 and 2013. Of these animals, 3,827 had a DAG3 score and 1,807 had a DAG8 score. All animals had at least one adult dag score recorded. Dag score is a subjective, visually scored trait, and is measured on a scale from 0 (no dags) to 5 (complete coverage of the breech and down the legs, by faecal material). Animals were a mixture of dual-purpose composites, and purebred Romney and Perendales.

Performance and pedigree records were downloaded from SIL and DAG3 and DAG8 data were analysed as per the method of Pickering et al. (2013a). For DAGA, fixed effects were determined using the GLM procedure in SAS (SAS Institute Inc., Cary NC, USA). The final model included fixed effects of contemporary group (birth year, birth flock, recording year and recording mob) and number of lambs born (NLB) for the DAGA measurement parity. DAGA at different parities was fitted as a repeated measure. Variance and covariance components were estimated using ASReml v3.0 (Gilmour et al. 2009). Heritabilites were estimated from univariate models, with genotypic and phenotypic correlations obtained from bivariate analysis. The relationship between NLB and DAGA was examined using a mixed model procedure in SAS.

Results and discussion

Heritability estimates of DAG3 (0.40 ± 0.07), DAG8 (0.44 ± 0.07) and DAGA (0.44 ± 0.02) were moderate to high (Table 1). Both juvenile and adult dag score estimates were comparable with previous studies (Meyer et al. 1983; Bisset et al. 1992; Scobie et al. 2008; Pickering et al. 2012). The genetic correlations among all dag traits were positive and moderate, and 0.2 to 0.4 higher than the phenotypic correlations. The genetic correlation between DAGA and both DAG3 and DAG8 was 0.71 ± 0 .04 and 0.63 ± 0.05, respectively.

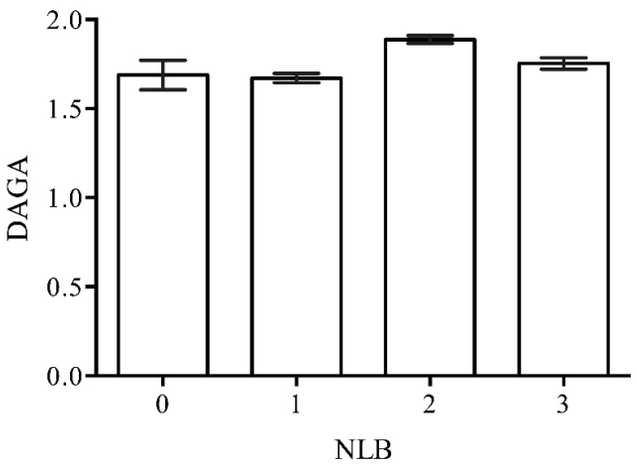
The mean (± SD) adult dag score was 2.0 (± 1.2). Adult dag score was moderately repeatable across years (0.53 ± 0.01). This value is in the range estimated by Larsen et al. (1995) (r = 0.44 to 0.61). This moderate repeatability and heritability demonstrates that there is a genetic component to adult dag score, which has important implications when retaining daggy ewes in the flock.

Table 1 Estimates of heritability (diagonal), genetic (below diagonal) and phenotypic (above diagonal) correlations, residual standard deviations (RSD) and repeatability (Rep) estimates for adult and juvenile dag scores in New Zealand sheep.

Trait1	DAG3	DAG8	DAGA
DAG3	0.40 ± 0.07	0.43 ± 0.02	0.32 ± 0.04
DAG8	0.80 ± 0.07	0.44 ± 0.07	0.49 ± 0.04
DAGA	0.71 ± 0.04	0.63 ± 0.05	0.44 ± 0.02
RSD	0.80	0.88	0.81
Rep.	-	-	0.53 ± 0.01

[1]DAG3, DAG8, DAGA = dag score at 3 months, 8 months, and as an adult, respectively.

Figure 1 Least squares means (± SEM) of dag score in adult ewes (DAGA), classified by number of lambs born (NLB).



DAGA was affected by number of lambs born (Figure 1), with animals that had twins (N = 11,858) having the highest dag score ($P < 0.05$). Ewes that produced triplets (N = 1,876) also had a higher dag score than ewes that produced a single lamb (N = 5,634). There was no significant difference in dag score between ewes bearing singles or triplets and those that were dry (N = 235). Multiple factors can contribute to dagginess in sheep, including levels of intake, and lactation/late pregnancy, which can result in rapid passage of digesta (Waghorn et al. 1999). Adult dag score is usually recorded at weaning, and ewes suckling twins have been shown to eat more than those suckling singles (Cabi 1980).

In summary, adult dag score has a high heritability and moderate to high genetic correlation with juvenile dag scores. The genetic parameters for DAGA in New Zealand dual purpose sheep have been estimated with sufficient accuracy that we suggest the inclusion of adult dag score parameters as well as DAG3 and DAG8 in the routine genetic evaluation of adult ewes. Routine recording of this trait would also be advantageous. While historically recording of adult dag score may have been overlooked because by the time it was recorded there was little opportunity for ewe selection, with the increasing use of genomic breeding values (GBVs) by industry, accurate estimates for this trait in young livestock will result in a greater impact (Pickering et al. 2013b; Pickering et al. 2015).

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