

Genetic Correlations between Traits in Ewe Lambs and their Adult Lamb Production

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Total litter weight weaned per ewe joined (TWWj) is a biological index trait, integrating fertility, litter size, rearing ability and lamb growth rate. It is a trait of the ewe calculated as the sum of the weaning weights (adjusted for sex and age within site, season and year) of their individual lambs reared naturally. Selection on TWWj performance over repeated years can improve overall flock productivity. If other traits that are expressed early in life were correlated with and could predict TWWj they could be used as management tools in reducing costs and facilitating efficient selection. In a previous study, selection on TWWj resulted in more gain per generation in ewe productivity than any of its component traits (Afolayan et al, 2007). A major limitation for direct selection for TWWj and other reproduction traits is that expression is delayed until at least one or two years of age. The aim of this study is to evaluate the potential of early production traits to predict TWWj, as a measure of adult ewe productivity.

Variance components and genetic correlations were estimated from bivariate analyses using a sire model in ASReml (Gilmour et al. 2006). The data were from 2460 crossbred ewes which were progeny of 74 maternal breed sires and Merino dams. Traits included pre-weaning (preadg)- and post-weaning (postadg) growth rate of the ewe lambs, greasy weight (GFW), clean weight (CFW), yield (YLD), fibre diameter (FD) and worm egg count (WEC) from the hogget ewes. The crossbred ewes were joined naturally to groups of meat rams in 3 sites over 3 years to obtain lambing data for TWWj.

Table 1. Estimates of genetic and phenotypic correlations between TWWj and growth, wool and worm resistance traits and correlated response in TWWj from selection

	Preadg (g/d)	Postadg (g/d)	GFW (kg)	CFW (kg)	YLD (%)	FD (μ m)	WEC ($^3\sqrt{\text{eggs/g}}$)
Mean (SD)	207 (45)	104 (55)	4.4 (1.0)	3.3 (0.8)	75.6 (4.7)	26.9 (3.0)	6.1 (1.4)
h^2	0.09	0.45	0.44	0.44	0.45	0.68	0.18
σ_p^2	13.1	6.5	0.37	0.27	18.2	4.3	1.8
Correlations							
Genetic	0.58 \pm 0.23	0.50 \pm 0.16	-0.21 \pm 0.21	-0.32 \pm 0.18	-0.18 \pm 0.20	-0.35 \pm 0.17	-0.01 \pm 0.29
Phenotypic	0.07 \pm 0.02	0.08 \pm 0.02	-0.04 \pm 0.02	-0.06 \pm 0.02	-0.01 \pm 0.01	-0.03 \pm 0.02	0.00 \pm 0.02
Response in TWWj (kg) [†]	1.3	2.6	-1.1	-1.6	-0.9	-2.2	0

[†] Correlated response per generation, standardised selection differential = 1.

The genetic correlations with TWWj were high and positive for the growth traits, low and negative for the wool traits (not significantly different from zero) and zero for WEC (Table 1). The results indicate that genetic merit for ewe productivity could be improved by selection based on weight gains in both pre and post weaning growth phases. However, in view of the higher heritability for weight gains in later rather than earlier phase of growth, greater response to selection for TWWj ($h^2 = 0.17$, $\sigma_p^2 = 347$) would be expected using postadg. The correlated response in TWWj per generation if selection is based on postadg (2.6 kg) was similar to that obtained when selection was based on litter size (Afolayan et al. 2007) and only about 20% lower than the response expected from direct selection on TWWj (3.2 kg). The slightly negative genetic correlations between TWWj and hogget wool traits are similar to those reported in Merino sheep (Safari et al. 2007) and may need to be incorporated into selection indexes to avoid adverse responses.

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Afolayan, R.A., Gilmour, A.R. and Fogarty, N.M. (2007). *Proc. Assoc. Advmt. Anim. Breed. Genet.* **17**: 491.
Gilmour, A.R., Gogel, B.J., Cullis, B.R. and Thompson, R. (2006). "ASREML 2.0" VSN Int., HP11ES, UK.
Safari, E., Fogarty, N.M., Gilmour, A.R., Atkins, K.D., Mortimer, A.A., Swan, A.A., Brien, F.D., Greeff, J.C.
and van der Werf, J.H.J. (2007). *J. Anim. Breed. Genet.* **124**: 65.

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