

DO PLAINER BODIED MERINO EWES HAVE HIGHER LIFETIME REPRODUCTION RATES?

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SUMMARY

Significant phenotypic relationships between lifetime lamb survival and lifetime net reproduction rate (NRR) with neck and body wrinkle score were identified in 2 of 3 Merino resource flocks. For both traits, the relationships favoured plainer ewes. Commercial producers culling their wrinkliest ewes to reduce the risk of flystrike are unlikely to negatively impact the lifetime reproductive performance of their flocks.

INTRODUCTION

The lifetime productivity of Merino ewes in terms of their wool production, fleece characteristics, parasite resistance and reproduction is becoming increasingly important to Merino producers. This has been driven by the changing relative value of wool to meat production and continued decline in the terms of trade for agricultural commodities. An ever-increasing range of technologies and data management systems now allow either cohorts of animals within a flock to be selected and managed according to the average performance of the group; or individual animals selected and managed according to their performance relative to other individuals in the flock (Atkins *et al.* 2006). Lee *et al.* (2009a) identified potential gains to be made in lifetime NRR by retaining high performing ewes beyond the normal culling age and removing ewes with low reproduction from the breeding flock. Retaining the top 25% or 50% of older ewes for an additional 1-2 lambing opportunities based on pregnancy scanning information combined with udder examination at marking, together with removing poor performers (twice dry ewes) early in life, can improve production and profit in a Merino flock (Lee *et al.* 2014).

Increased public awareness of the animal welfare aspects of surgical mulesing (Greeff *et al.* 2014) has resulted in Merino producers reducing the degree of wrinkling, particularly since 1999 (Brown *et al.* 2010), through selection for plainer bodied animals. In addition, various within flock selection strategies such as selecting replacement breeding ewes with low wrinkle scores, culling individuals with high wrinkle scores and mate allocation (i.e. mating plain ewes with the plainest Merino rams) are now being advocated as a means for commercial producers to both reduce the incidence of flystrike and reliance on mulesing in their flocks (Richards and Atkins 2010). The impact of such phenotypic selection of ewes on their reproductive performance is unknown. Significant phenotypic variation exists for wrinkle scores (Hatcher and Preston 2015) as well as both annual (Safari *et al.* 2007) and lifetime reproduction traits (Lee *et al.* 2009b). While previous studies have reported phenotypic relationships between wrinkle score and annual reproduction events (Crook 1992; Turner and Young 1969), no studies have examined the relationship between wrinkle score and lifetime reproduction traits in Merino sheep. This study reports on the phenotypic relationship between neck and body wrinkle with lifetime NRR and its components.

MATERIALS AND METHODS

Lifetime reproduction data (from 2 - 6 years of age) were collated from three Merino genetic resource flocks (D-Flock, C-Flock and QPLU\$) run at the Trangie Agricultural Research Centre. Lambing and weaning performance of the ewes in each of these flocks were routinely recorded. An outline of each flock and its management is provided by Lee *et al.* (2009a). Data were available

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for 3,300 D-flock ewes (born 1975 - 1983), 1,411 C-flock ewes (born 1984 - 1993) and 5,393 QPLUS ewes (born 1992 - 2002). Neck and body wrinkle scores were assessed at weaning time in the three flocks using either a 1 - 9 scoring system (D- and C-Flocks, with 1 being low wrinkle score) or a 1 to 5 score (AWI Ltd and MLA Ltd 2013, QPLUS flock). The 1 - 9 scoring system aligns with the 1-5 system with scores 1, 3, 5, 7, and 9 corresponding to scores 1 to 5 respectively and 2, 4, 6, & 8 the ½ scores in between.

This preliminary study was based on phenotypic information of the number of times each ewe was joined, the number of parities (lambing events), the total number of lambs born and the number of lambs weaned from 2 to 6 years of age. From these data lifetime fertility (no. times lambed/no. times joined), fecundity (no. lambs born/no. times joined), lamb survival (no. lambs weaned/no. lambs born) and NRR (no. lambs weaned/no. times joined) were calculated for each ewe as was the average pre-joining liveweight (kg). ASReml (Gilmour *et al.* 2009) was used to fit the effects of genotype (bloodline within the D-Flock, animals having the same proportion of genes derived from each of the bloodlines within the C-flock, and selection line within-strain within the QPLUS flock), year of birth and wrinkle score (neck and body wrinkle scores were analysed for each lifetime reproduction trait in separate models). The significance of differences between the ASReml predicted means for neck and body wrinkle score was determined using T-tests. These were based on the least significant difference calculated from the standard error of the difference for each lifetime reproduction trait within each flock and the degrees of freedom.

RESULTS AND DISCUSSION

For the D- and C-Flocks the distribution of wrinkle scores was skewed towards plainer animals (Figure 1), the average wrinkle score for each flock being 2.2 and 2.3 for neck wrinkle and 1.9 and 2.0 for body wrinkle. For these two flocks ewes with score 5 for neck and body wrinkle represented less than 0.4% of the flock. The distribution of wrinkle scores for the QPLUS flock was less skewed with average wrinkle scores of 3.1 and 2.4 for neck and body wrinkle. In the QPLUS flock score 5 animals represented 6% and 1.4% of all ewes for neck and body wrinkle respectively.

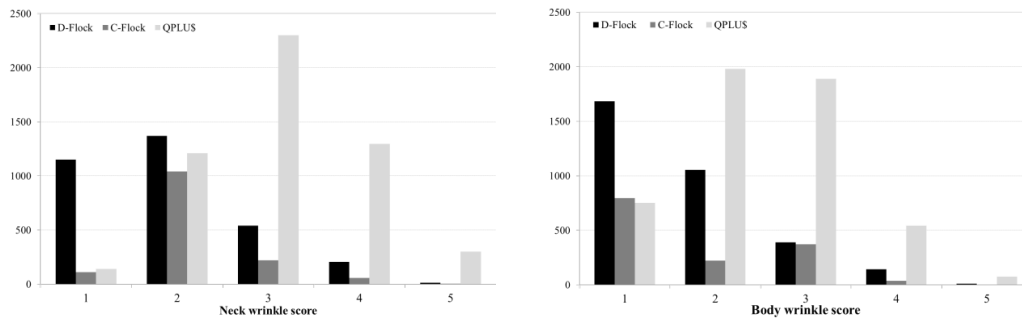


Figure 1. Distribution of neck and body wrinkle scores in three Merino resource flocks

Wrinkle score, neck or body, was not a significant source of variation in either lifetime fertility or fecundity in any of the three Merino resource flocks (Table 1a and 1b). However, while wrinkle score (neck or body) was not a significant source of variation in lifetime lamb survival for the D- or C-Flocks, a significant relationship was evident in the QPLUS flock ($P < 0.001$). For each wrinkle trait, lifetime lamb survival was highest for the plainer bodied ewes (i.e. those with wrinkle scores 1, 2 or 3) compared with the wrinklier ewes (i.e. score 4 or 5) (Table 1a and 1b). For body wrinkle, the relationship was more distinct with score 1 ewes having the highest lifetime lamb survival and lifetime lamb survival significantly decreasing with each increase in wrinkle score (Table 1b).

Table 1. Lifetime NRR, its components (fertility, fecundity and lamb survival) adjusted for genotype and year of birth effects and average pre-joining liveweight from 2-6 years of age, for a) neck and b) body wrinkle score of Merino ewes of three different Merino resource flocks, together with the standard error of the difference (s.e.d.)

a)							
Flock	Flock mean	Neck Wrinkle Score					s.e.d.
		1	2	3	4	5	
<i>Fertility (no. of times lambing/no. of times joined)</i>							
D-Flock	0.70	0.693	0.672	0.672	0.673	0.771	0.049
C-Flock	0.82	0.844	0.807	0.798	0.849	0.767	0.093
QPLUS	1.30	1.267	1.281	1.285	1.300	1.292	0.031
<i>Fecundity (no. of lambs born/ no. of times joined)</i>							
D-Flock	1.30	1.308	1.265	1.251	1.251	1.386	0.086
C-Flock	1.35	1.355	1.331	1.323	1.340	1.172	0.149
QPLUS	1.39	1.398	1.372	1.380	1.390	1.373	0.038
<i>Lamb survival (no. of lambs weaned/no. lambs born)</i>							
D-Flock	0.68	0.679	0.664	0.650	0.650	0.700	0.058
C-Flock	0.74	0.793	0.740	0.739	0.741	0.791	0.107
QPLUS	0.68	0.670a	0.692b	0.685b	0.644c	0.606d	0.028
<i>Net reproduction rate (no. of lambs weaned/ no. of times joined)</i>							
D-Flock	0.71	0.700	0.668	0.658	0.623	0.699	0.074
C-Flock	0.89	0.970	0.869	0.860	0.920	0.805	0.164
QPLUS	0.97	0.958a	0.973a	0.968a	0.906b	0.834c	0.044
<i>Average pre-joining liveweight (2-6 years) (kg)</i>							
D-Flock	45.8	45.3a	45.6a	46.5b	46.0c	47.7d	0.86
C-Flock	45.6	47.7	48.8	48.7	49.7	51.3	1.97
QPLUS	55.0	54.1a	55.0b	55.2c	55.1d	56.0e	0.22
b)							
Flock	Flock mean	Body Wrinkle Score					s.e.d.
		1	2	3	4	5	
<i>Fertility (no. of times lambing/no. times joined)</i>							
D-Flock	0.70	0.694	0.671	0.659	0.686	0.596	0.056
C-Flock	0.82	0.811	0.816	0.800	0.820	0.974	0.093
QPLUS	1.30	1.259	1.285	1.300	1.286	1.344	0.035
<i>Fecundity (no. of lambs born/ no. of times joined)</i>							
D-Flock	1.30	1.300	1.247	1.256	1.291	1.340	0.097
C-Flock	1.35	1.321	1.343	1.346	1.325	1.216	0.150
QPLUS	1.39	1.357	1.377	1.397	1.366	1.455	0.043
<i>Lamb survival (no. of lambs weaned/no. lambs born)</i>							
D-Flock	0.68	0.677	0.656	0.638	0.687	0.663	0.065
C-Flock	0.74	0.749	0.739	0.738	0.722	0.744	0.107
QPLUS	0.68	0.704a	0.687b	0.665c	0.611d	0.553e	0.031
<i>Net reproduction rate (no. of lambs weaned/ no. of times joined)</i>							
D-Flock	0.71	0.699a	0.654b	0.632b	0.672ab	0.502c	0.084
C-Flock	0.89	0.880	0.868	0.878	0.841	0.943	0.164
QPLUS	0.97	0.966ab	0.971a	0.946b	0.851c	0.812c	0.049
<i>Average pre-joining liveweight (2-6 years) (kg)</i>							
D-Flock	45.8	45.4	45.8	46.3	46.3	45.2	0.97
C-Flock	49.1	48.4	48.9	49.3	49.8	52.3	1.99
QPLUS	55.0	55.3	55.2	55.2	55.1	57.3	0.63

Within each flock, values followed by different letters are significantly different at P = 0.05.

Breeding objectives II

There was no significant relationship between neck wrinkle score and lifetime NRR for either the D- or C-Flocks, however this was significant for the QPLU\$ flock ($P < 0.001$). For that flock, the lifetime NRR was highest for those ewes with less neck wrinkle (Table 1a). For body wrinkle there was a significant relationship with lifetime NRR in both the D-Flock ($P = 0.038$) and the QPLU\$ flock ($P < 0.001$) but not the C-Flock (Table 1b). Previous research based on annual reproduction events found high wrinkle scores were related to poorer reproductive outcomes (Turner and Young 1969), with more wrinklier ewes weaning half as many lambs during their lifetime compared to plainer bodied ewes (Dun 1964).

These significant differences in lifetime lamb survival and lifetime NRR appear to be unrelated to the average pre-joining liveweight over the lifetime of the ewes. While both neck and body wrinkle score were significant sources of variation in pre-joining liveweight for the D-Flock ($P = 0.005$ and $P = 0.044$ respectively) and neck wrinkle a significant source of variation in the QPLU\$ flock ($P = 0.022$), the wrinklier animals tended to have the highest liveweight (Table 1 a and b). Lee *et al.* (2009a) found that pre-joining liveweight was generally poorly correlated with lifetime NRR and that those ewes with the highest lifetime NRR tended to have slightly lower liveweight immediately before joining.

This preliminary study has identified a phenotypic relationship between wrinkle score and lifetime NRR rate and its lifetime lamb survival component. Commercial producers who choose to cull the most wrinkly ewes (i.e. score 4 or 5) and retain those ewes with lower wrinkle scores to reduce flystrike risk are unlikely to have any detrimental impact on the lifetime NRR of their flock. Further work is required to estimate phenotypic and genetic correlations between wrinkle score and lifetime NRR (and its components) in order to determine whether implementing a selection program for fewer wrinkles will impact on the lifetime reproductive performance of the flock in future generations.

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