Within-flock ranking of loose wool bulk and fibre diameter to predict wool lustre

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ABSTRACT

There is a specialised market for lustrous wools. No objective measurement of lustre is currently available. Elliott (1986) has suggested, on the basis of the correlation between loose wool bulk (LWB) and lustre (LS) in wools from a wide variety of sources, that measurement of (LWB) and average fibre diameter (AFD) might be a useful indirect selection criterion for lustre. The strength of the above relationships *within* flocks have, however, not been established.

Mid-side samples were taken from complete flocks of ram hoggets (n=390). Clean scoured yield, average fibre diameter and loose wool bulk were determined on all samples. Each greasy sample was independently assessed for lustre on a 7 point scale by three experienced wool appraisers. Within flock correlations between LS and LWB ranged from 0.36 to 0.58 for the best assessor (mean 0.48), much lower than the values (>0.90) obtained in Elliott's study. Inclusion of fibre diameter failed to markedly improve the prediction of lustre score. The coefficient of variation was lower for LWB (4.7%) and AFD (5.7%) than for LS (27.8%). The significance of these results for wool measurement and selection programmes will be discussed.

Keywords Wool, subjective measurement, lustre, bulk, objective measurement, within-flock ranking, fibre diameter.

INTRODUCTION

Lustre or gloss is an important subjective wool characteristic. High lustre is very desirable in some fashion fabrics. There is a specialised market for lustrous wools mainly as a blend with mohair, but lustrous wools are *slippery* and have low inter-fibre friction which makes them difficult to process.

Like handle, lustre is a subjective quality which is difficult to define. The lustre of fabric can be examined under varying angles of light incidence, but our impression of lustre is really a *perception of contrast* (Bereck and Blankenburg, 1983; 1984). At present there is no generally accepted quantitative method of measuring lustre in wool. Subjective assessment continues to be used when sorting wool for sale and for ranking sheep within a flock.

A study by Elliott (1986), in which lustrous and semi-lustrous Romcross type fleece wools were selected from woolbrokers bin lines, showed a very high phenotypic correlation (> 0.90) between lustre rank and loose wool bulk. Including fibre diameter improved the relationship (R^2 values) by 5%. He suggested that using measured bulk values as an indirect but objective method of selecting for lustre would be very useful to breeders of lustrous woolled sheep.

This project was designed to determine the within-flock relationship of assessed lustre to measured loose wool bulk (LWB) and to compare their potential for achieving genetic improvement in lustre.

METHODS

Ram hoggets from four ram breeding flocks of breeds noted for lustrous wool were used to test the above hypothesis. The breeds were Lincoln (103), Coopworth (96), Border Leicester (41) and English Leicester (45). Mid-side wool samples (approx. 60 g), one handspan from the back and over the last rib, were taken from each ram at hogget shearing (July and August 1987). The greasy mid-side samples were laid on tables in a controlled environment room (20RC and 65% RH) with artificial lighting by True Light fluorescents, with a spectrum matching natural outdoor light. Three independent wool industry assessors used a 7 point lustre scale to rank the samples.

TABLE 1 Mean and standard deviation of lustre score, loose wool bulk, fibre diameter and yield of ram hoggets in the four flocks.

Flock	No.	Lustre Score (Assessor) 1	2	3	Loose Wool Bulk (cm^3/g)	Average Fibre Diameter (μ)	Washing Yield (%)
1	45	3.1±0.96[a]	2.3±0.78[b]	3.6±1.18[a]	18.8±0.8	33.5±1.7	76.0±1.9
2	41	4.3±1.02[a]	4.7±0.96[a]	4.9±1.34[a]	21.0±1.0	37.9±1.8	76.0±1.9
3	96	5.2±0.98[a]	4.2±0.65[b]	5.1±1.02[a]	20.1±1.2	36.6±1.8	79.9±4.6
4	103	2.4±0.92[a]	2.3±1.00[a]	2.8±1.00[a]	18.6±0.8	37.4±2.7	79.7±2.8

1 = English, 2 = Border Leicester, 3 = Coopworth, 4 = Lincoln
Values in rows followed by different letters are significantly different ($P < 0.01$)

The lustre scale (LS) used was:

1 = very lustrous,
2 = lustrous,
3 = semi-lustrous,
4 = slight lustre,
5 = very slight lustre,
6 = no lustre,
7 = dull.

A washing yield was obtained by scouring weighed samples in the Wool Science Department four bowl rake scour (repeatability 0.8%) then drying to a constant weight in standard CSIRO wool driers and adding the standard 16% regain for a yield of clean wool per sample. Average fibre diameter (AFD) was measured on the cored and blended scoured yield sample by airflowing two 2.5g sub- samples on the standard Wool Testing Authority (WTA) airflow (calibrated with IWTO standard tops). Loose wool bulk was measured on two 10g sub-samples of the carded (Wool Science Department, Lincoln University small commercial card), scoured sample, kept at 65% RH for 12 hours. Bulk was measured using the WRONZ Bulkometer (Bedford, 1977).

The data was analysed within each flock. The correlation of LS with LWB was calculated for each assessor. Fibre diameter was included with LWB as an independent variable in a multiple regression using LS as the dependent variable.

RESULTS

The four flocks ranged in mean lustre score from 2.4 to 5.2, mean loose wool bulk (18.1 - 21.0), mean average fibre diameter (33.5 - 37.9) and mean clean wool yield (79.9 - 76.0) (Table 1). The coefficient of variation was lower for LWB (4.7%) and AFD (5.7%) than for LS (27.8%). In two of the flocks, one assessor's mean LS was significantly different from the other two.

Within flock phenotypic correlations between LS and LWB ranged from 0.277 to 0.586. The correlations between LS and AFD ranged between -0.567 to -0.399 but inclusion of AFD with LWB (for the assessor with the highest LS/LWB correlation) showed little improvement in the R^2 value (Table 2).

DISCUSSION

Lustre was scored on the greasy samples rather than the scoured sample because greasy wool is the basis of on-farm wool assessment. Elliott (1986) showed a high degree of agreement between lustre rankings on greasy, scoured or carded wool.

Within-flock correlations between LS and LWB of 0.28 to 0.58 were considerably less than Elliott's (1986) across flock correlations of 0.80 - 0.94. The latter high correlations may result from a restricted sampling procedure whereas this work is based on complete within-flock data.

TABLE 2 Within-Flock phenotypic correlations of lustre score and measured bulk plus R^2 values for LS alone and LS and AFD

Flock		Lustre/Bulk Correlations Assessors 1	Assessors 2	Assessors 3	Mean Lustre Score alone	R^2 values* for Lustre Score plus Mean fibre diameter
1	0.39	0.36	0.59	0.44	0.34	0.35
2	0.44	0.58	0.50	0.51	0.34	0.50
3	0.46	0.33	0.45	0.41	0.21	0.22
4	0.36	0.34	0.28	0.32	0.13	0.29
Mean	0.413	0.401	0.454			

1 = English Lecicester, 2 = Border Leicester, 3 = Coopworth, 4 = Lincoln
* Values only shown for highest simple correlation

From the results of this work, there would appear to be little value in using LWB as a substitute for a ranking on phenotypic lustre score within a flock. However, should there be a strong genetic correlation between LWB and LS, indirect selection on LWB might be an appropriate strategy for genetic improvement in LS.

No estimate of this genetic correlation appears to have been made. However, a theoretical value for the genetic correlation which would result in a correlated response to (LWB) as great as the direct response to (LS) can be calculated. The value is >0.90 when a phenotypic standard deviation for LS (;1.010) and LWB (;0.929) measured in this study and a heritability of 0.35 for lustre (Rae, 1982) and 0.40 for LWB (Bingham et al, 1983) are used. Genetic correlations are seldom as high as 0.90 (Rae, 1983) therefore it is unlikely that selection for LWB would result in improvement in LS as great as that from direct selection for LS.

On the basis of this study LWB is not useful for within-flock phenotypic ranking for lustre or in increasing genetic improvement for lustre.

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