FLEECE TRAITS TO BE CONSIDERED IN MERINO SIRE EVALUATION SCHEMES

D.J. COTTLE, J. EPPLESTON and E.M. ROBERTS

Department of Wool and Animal Science
University of New South Wales

Sire referencing must cater for both on-farm and central test situations. A more comprehensive list of records will normally be collected on central test stations.

This paper deals with the list of fleece traits that may be recorded on a central test station and assesses their importance. Whether fleece traits are recorded in the sires' progeny should depend on their heritability, variance, economic value, correlation with other traits, correlation between hogget and adult performance, cost of measurement and the future use of the sires. Fleece traits to be considered should have either direct effects on wool processing performance, with a premium/discount in the wool market or should affect the productivity of the sheep, e.g. fleece rot / flystrike.

Wool characteristics related to processing performance or productivity

The relative importance of raw wool traits on processing performance and value of end product have been described by Whiteley (1987), Rogan (1988) and Teasdale & Cottle (1991). Their importance in breeding programs has been outlined by Ponzoni et al., (1990). The main traits are listed in Table 1. Plate (1990) also listed foreign contaminants and pesticide residues as important, but these are adventitious and are not affected by breeding programs. Breeders and scientists (Roberts et al., 1990) also place emphasis on some additional traits, listed in Table 2, with indirect effects on endproduct value.

Cost of measurement

Litchfield (1988) estimated the costs of performance recording in his flock (yield and FD) to be about $3.11 per ram sold, including tagging, shearing, processing samples, reclassing, grading and selection of rams and ewes. Blair (1988) suggested the cost of presenting rams to sale with measurement figures was about $NZ180 per head when all farm organisation, data collection, selection and selling costs were included. Tables 1 and 2 contain the costs of measurement in the laboratory and field, all other costs are assumed to be part of usual fleece recording procedures.

Economic value

The economic value of the main wool traits can be estimated from the reserve price scheme schedule (Table 3). If the scheme is permanently dismantled these values will be more difficult to determine (Cottle et al., 1988). The premium/discount depends on the starting value and will change as the flock responds to selection (Cottle, 1990).

Table 1 Heritability, variance and cost of measuring wool traits related to processing performance (in order of importance)

Wool trait	Heritability	Variance	Cost ($)
Yield (%)	0.45	25	4.10
Mean fibre diameter (µm)	0.5	3	
Vegetable matter (%)	0.1	n.a.	-
Staple length (mm)	0.45	90	6.00
Staple strength (N/ktex)	0.15	80	2.00
Scoured colour (Y-Z)	0.4	0.7	5.00
Dark fibre ($\log_{10}(n + 1)$/10g top)	0.45	0.02	x
Resistance to compression (g/cm^2)	0.65	40	2.00
Crimp (per inch)	0.4	3	0.50
Fibre diameter coefficient of variation (%)	0.45	9	6.00
Staple length variability (%)	0.4	n.a.	*
Cotts	0.25	n.a.	1.50+
Tippiness (1-5)	0.25	0.4	
Character (1-7)	0.4	0.5	
Handle (1-7)	0.3	0.6	
Style	0.15	n.a.	

Source: Mortimer (1987), Fleet et al. (1990), James et al. (1990), Rogan (1988), Raadsma & Wilkinson (1990).

* available from staple length test, + classer plus keyboard operator, n.a. not available

x cannot be objectively measured on midside samples, instead assess pigmented fibres on points

Table 2 Heritability, variance and cost of measuring wool traits related indirectly to processing performance

Trait	Heritability	Variance	Cost ($)
Greasy colour	0.6	1.1	3.00
Fleece rot (liability)*	0.3	1.0	1.50
Body strike (liability)	0.3	1.0	
Fleece structure (1-5)	0.2	0.5	
Incubated colour (1-10)	0.3	10	3.00
Wax %	0.3	30	10.00
Suint %	0.4	9	
Skin profile			
- follicle curvature/depth (1-5)	0.4/0.35	2.6/n.a.	10.00
- thickness (mm)	0.25	0.16	
- S/P (ratio)	0.3	n.a.	200.00
- dP/dS (ratio)	0.73	0.03	

Source: * Falconer (1965), Hancock et al. (1979), Jackson et al. (1975, unpubl. data), James et al. (1990), Raadsma, H., pers. comm., Raadsma and Wilkinson (1990).

Table 3 AWC Reserve price premium ($/kg/unit improvement - 1990/91) and value of superior rams

Trait	Start and end value (Type 62)	Economic value ($)	EBV[+] ($)
Fibre diameter (μm)	21→20	2.53	42.55
Staple length (mm)	86→93	0.01	0.87
Staple strength (N/ktex)	25→35	0.06	2.39
Scoured colour (Y-Z)	1→10	0.20	1.42

[+]EBV of above average rams = $\sqrt{}$variance x 0.798 x ½h^2.$\sqrt{}$(n/{1+(n-1).h^2/4}) x economic value x fleece weight x number of expressions of fleece production per ewe lifetime (5.35).

Many of the listed traits have no identifiable role in price formulation or they have non-linear effects. For example colour is discounted by subjectively grading wool into H^1, H^2 & H^3 categories, which are poorly related to measured scoured colour (Thompson 1987). Teasdale (1986) suggested the effects on processing of wools with a lower (~4kPa or 40g/cm^2) resistance to compression may be valued at $0.10/kg. For white and pastel shades, tops with less than 100 dark fibres per kg are required by the trade. This is equivalent to one dark wool staple (pigmented or urine stained) in ten skirted fleeces. This level of contamination causes a discount of up to 4% of the selling price of tops and can add up to $10/kg to overall processing costs.

Fibre diameter distribution is not used in commercial trade at present. An increase of 1% in CV diameter is equivalent to a change of less than 0.2μm in mean fibre diameter in terms of minimum yarn evenness. The 'coarse edge' of the distribution (fibres over 30μm) have been implicated in stitch distortion in knitwear. Fabrics made from wools with over 5% of fibres greater than 30μm may be perceived as prickly (Plate 1990). A large CV diameter (> 25%) or a positively skewed distribution is needed for this to occur. The economic value of resistance to fleece rot and flystrike is difficult to assess and depends on the season. Raadsma & Rogan (1987) estimated the cost of blowfly strike control in high risk years was about $1.60/sheep.

Traits to be measured

The economic value of rams with above average wool quality can be predicted from their estimated breeding value - EBV (Cottle, 1986). This prediction is affected greatly by the number of progeny sired directly by the ram and indirectly by offspring in later generations. The best 50% of rams have a phenotypic mean 0.798 standard deviations above the unselected group mean. If rams are naturally mated for 2 years then a ram with an EBV of $1 generates about $45 in discounted extra returns. The EBV is calculated as the estimated genetic value (phenotypic deviation from mean x heritability) x economic value (based on lifetime returns - Ponzoni 1979). As about 40 progeny must be measured per sire the net benefits of measuring fleece traits can be estimated by comparing the EBV of above average rams (Table 3) with the cost of measurement (Tables 1 & 2). This approach overestimates the value of the trait if some information is available from correlated traits already measured.

It appears that only fibre diameter has an EBV, in the above context, well above the cost of measurement. The current small premiums for additional wool characteristics, if rams are only used for natural service, i.e. about 39 progeny produced per ram per year, make their measurement debateable. If these rams were used in an A.I. program (which is likely) the calculated EBV would increase accordingly and measurement could become worthwhile. The indirect methods of assessing fleece rot susceptibility (Raadsma & Wilkinson, 1990) may also be worth measuring given the potential high economic value of resistance to fleece rot and the low marginal cost of recording sheep classers' scores. Pigmented fibres should be monitored by the sheep classer because of the large discount for contaminated wools.

The procedures outlined in this paper should help breeders and scientists make rational decisions as to whether particular fleece traits should be measured.

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