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The Search For The Best Fine Wool Sires

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INTRODUCTION

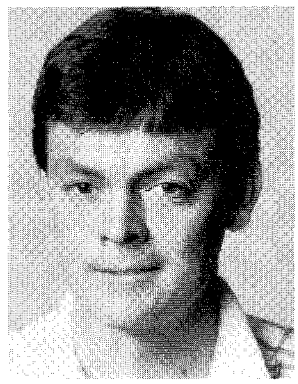
The development of frozen semen and laparoscopic artificial insemination (AI) has led to increased availability of sires across flocks and interest in identifying superior sires. Merino sire evaluation programs involve the visual and objective evaluation of groups of progeny of rams which breeders wish to have independently assessed prior to using the rams in their own flocks and/or marketing semen from the rams. The operation of these schemes is described in detail by Roberts *et al.* (1990) and Atkins (1990). Programs based on the independent progeny testing of Merino rams have been run by the New South Wales Stud Merino Breeders' Association in conjunction with the University of New South Wales since autumn 1987. In 1990 16 fine rams (including 2 link rams) were tested at Walcha, 28 medium wool rams (including 3 link rams) were tested at Hay and Deniliquin Field stations, and 11 medium rams (including 2 link rams) were tested at Dubbo.

Sire referencing in Australia started with on farm testing in Western Australia (Lewer 1987). There are, however, a number of advantages with 'test station' sire referencing including independence of results, no on-farm costs, better use of link sires and even treatment of sire groups, recording of multiple births and uniform heterosis effects (Roberts *et al.* 1988). In New Zealand additional advantages of a test station approach are that only 24 registered Merino studs have over 200 ewes and breeders with smaller flocks can participate without interference with mating programs, less Australian semen is required for link rams and test progeny can be viewed together on site for inspection (Cottle and MacDonald 1988). The disadvantages of a test station approach are that there are less progeny than for reference sires in an 'on farm' scheme, the use of superior reference sires by a large number of breeders doesn't occur, fewer sires are tested and fewer environments are assessed. The best approach is probably to use a test station to determine the superior sires which are then used in an 'on farm' reference scheme. This approach has been taken by the Corriedale stud breeders in New Zealand (Cottle and Beatson unpub. data).

Sire referencing of Merinos in New Zealand started in autumn 1988 (Cottle and MacDonald 1988) with the testing of 9 rams on fine wool dams. The program was continued in 1989 with 8 fine wool sires tested with 1 link ram between years (Cottle and MacDonald 1990).

METHODS

Progeny in the 1988 trial in New Zealand were born between 26 September - 2 October 1988, were shorn on the 9th October 1989 and body weighed on the 21st September 1989. Progeny in the 1989 trial were born between 3-13 September 1989, shorn on the 22nd September 1990 and body weighed on the 5 September 1990. Midside samples of wool were taken 3 weeks prior to shearing and measured for yield, fibre diameter (FD) and predictive colour (Wilkinson and Aitken 1981). The liveweight and



calculated fleece data (CFW-clean fleece weight) from the hogget progeny from both years were used to estimate the breeding value of sires by using a sire Best Linear Unbiased Predictor (BLUP) model (Harvey 1988). The sex, rearing status, ewe bloodline and year were treated as fixed effects. The progeny's dam's bloodline in 1988 was not recorded. The two bloodlines had been allocated in equal numbers between sires. Corrections are made by the BLUP model for the number of progeny by each sire. Estimated breeding value (EBV) of each sire was calculated as twice the BLUP of ram effects. The index value for each sire was calculated from the equation Index = 6.4 x CFW - 10.0 x FD (Nicol and Cottle 1990)

RESULTS

The EBVs for fleece and body traits of the above average rams are given in Tables 1-2. The significance levels of the fixed effects are shown in Table 3. The link sire's (Black Forest 74/85) progeny in 1989 on average were 0.3 μm coarser and cut 0.4 kg more clean wool than its progeny in 1988. This increased wool production was due in part to different dam type and different environments (year).

The correlations between the different traits are given in Table 4. The correlation between CFW and body weight was high (Table 4) so rams had above or below average breeding values for both these traits (Table 1). The correlation between FD and index value was close to 1.0 (Table 4), reflecting the high relative economic weight of FD for fine wool sires (Nicol and Cottle 1990). The correlation between CFW and FD was only 0.22 for the combined two years of data so the regression FD = 16.62 + 0.65 x CFW had a low r^2 of 0.05. However, this relationship of every 1 kg CFW increase being associated with an increase in FD of 1.5 µm is the same as that reported in Merino wether trials (Cottle and Wilkinson 1989).

DISCUSSION

The choice of economic values assigned to CFW and FD has a major influence on the ranking of rams using a multi-trait index. When the fine wool index used by the Lincoln University Wool Measurement Service (Nicol and Cottle 1990) was applied the rams with finer than average EBV for FD were ranked the highest (Table 2). The correlation between CFW and FD was fairly low (r^2<0.25), but only two rams (Cleardale and Forest Range) were better than average EBV for both CFW and FD. Only 3 of the best rams on index were above average EBV for CFW.

If the default index used by WOOLPLAN had been used (Ponzoni 1988) the ranking of rams would have changed considerably due to the lower economic value assigned to FD (Cottle 1990). The rams with above average EBV for WOOLPLAN index in order were: Cleardale (Collinsville based), Collinsville, Salt Creek, Forest Range, Black Forest Noah, Flaxton 628/87, Flaxton 535/85 and Black Forest 74/85. Half of these rams were coarser than the average EBV for FD. The ranking of rams on index is therefore a difficult problem as it requires forecasting of the relative strength of the market for different FD wools. Using the AWC floor reserve schedule as the basis for the calculation of economic values could also be regarded as risky!

The less controversial approach is to identify 'trait leader' sires as suggested by Roberts *et al.* (1990), as this avoids placing economic values on traits. However, one could argue that the organisations running sire evaluation programmes should provide some guidance in this area. If an explanation of the method used to calculate economic values is given with the results this could be regarded as a more informed approach than breeders applying their own *ad hoc* estimates. Breeders needn't accept the index chosen. Alternatively a number of indices can be calculated, based on different, informed price forecasts, with breeders choosing the option they believe most appropriate.

Another advantage of identifying 'trait leader' sires occurs when the trait is not of major economic importance but a breeder may have a problem in this trait and may wish to correctively mate for it. An example of this is the predictive colour trait.

Flocks with a colour problem may wish to identify a ram which is resistant to fleece yellowing problems (Wilkinson and Aitken 1985). The results presented in Table 4 suggest predictive colour is not phenotypically correlated with CFW or FD. Thus the rams with the best EBV for this trait (Malvern Downs, Castle Hill, Moutere) were around average EBV for CFW, FD and both indices and would not be listed as the best sires. However some breeders could be interested in these rams to improve colour in their wool clip. This is an atypical trait in that if fleeces are sampled correctly (i.e. not within 4 days of rainfall) the predictive colour score should not vary with environment (year), so results should be able to be directly compared between years. The average predictive colour score of progeny from the link sire was 4.3 in 1988 and 3.8 in 1989. This difference was non-significant and was due in part to the effect of ewe type (Table 3). The effect of sex and status was significant (Table 3) but very small, with single-born males having the best predictive colour score. This may be because this class of sheep has a finer fleece with a lower suint content (Aitken, Cottle and Wilkinson unpublished data). To be resistant to yellowing a predictive colour score of less than 2 is desirable.

The quest for the best fine wool sires in Australia and New Zealand will continue. It is not possible at this stage to claim one particular country has most of the best sires. Work is in progress to determine the optimum design for linking test sites between and within countries to produce the most cost-effective information.

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Table 1
Rams above average estimated breeding value for fleece weight
Estimated breeding value

Ram	Progeny No.	Progeny Year born	Greasy fleece weight (kg)	Clean fleece weight (kg)	Bodyweight (kg)	Culls%
Collinsville 85/37	21	88	0.30	0.39	1.9	28
Flaxton 628/87	31	89	0.40	0.34	3.6	13
Cleardale Y986/85	41	88	0.61	0.32	0.5	0
Flaxton 535/85	34	88	0.22	0.26	2.9	3
Salt Creek 19	18	89	0.38	0.23	1.9	0
Pleasant Park 72/84	26	88	0.27	0.16	1.1	12
Forest Range 497/84	25	89	0.08	0.06	0.1	15

$$\text{ACCURACY} = \frac{h^2}{2}\sqrt{\frac{n}{1+(n-1)\cdot\frac{h^2}{4}}}$$

h= heritability, n = no. progeny

Table 2
Rams finer than average estimated breeding value for fibre diameter
Estimated breeding value

Ram	Progeny No.	Progeny Year born	Diameter (µm)	Index($)	Index (rank)	Predictive Colour	Culls%
Black Forest 74/85	56	88/89	–1.73	15.08	1	0.4	8
Black Forest Noah	19	89	–1.63	14.44	2	–0.2	11
Te Awa 11/87	29	89	–1.04	7.41	4	0.2	11
• Forest Range 497/84	25	89	–0.73	7.42	3	–0.1	15
Sierra Park Urquhart	35	88	–0.54	4.47	6	–0.5	3
Lochaber	38	88	–0.54	2.12	7	0.0	5
• Cleardale Y986/85	41	88	–0.34	5.05	5	1.5	0
Castle Hill 9/85	34	88	–0.32	1.43	8	–0.9	18

Table 3
Fixed Effects - least squares means
Hogget Parameters

Fixed effects	Greasy fleece weight (kg)	Clean fleece weight (kg)	Fibre diameter (µm)	Yield (%)	Body Weight (kg)	Predictive colour (score)	Index ˣ ($)
Sex							
Female	3.62	2.69	18.42	74.4	34.6	3.7	–0.90
Male	3.69	2.73	18.24	74.0	36.4	3.3	+0.90
	n.s.⁺	n.s.	n.s.	n.s.	###	##	n.s.
Status							
Single	3.81	2.83	18.29	74.4	36.5	3.2	1.14
Twin	3.50	2.59	18.36	74.0	34.4	3.8	–1.14
	###	###	n.s.	n.s.	###	###	n.s.
Ewe type (& year)							
1988 Mt. Otekaike/ Black Forest	3.37	2.43	18.29	72.2	36.1	4.2	–1.50
1989 Tara Hills	3.77	2.84	18.46	75.5	35.0	3.3	–0.76
1988 Mt. Otekaike	3.72	2.76	18.51	74.4	35.6	3.4	–1.42
1989 Black Forest	3.76	2.81	18.04	74.8	35.1	3.2	3.68
	###	###	n.s.	###	n.s.	###	#

⁺ Significance of fixed effects n.s. - not significant, # - P<0.05, ## - P<0.01, ### - P<0.001
ˣ Constant estimate

Table 4
Phenotypic correlations between traits in progeny. 1988 progeny above diagonal. 1989 Progeny below diagonal

	GFW	CFW	YD	FD	PC	BWT	Index
GFW	1	0.93	–0.10	0.36	n.s.	0.59	–0.17
CFW	0.95	1	0.26	0.28	n.s.	0.60	n.s.
YD	–0.21	0.10	1	–0.19	n.s.	n.s.	0.29
FD	0.22	0.18	–0.14	1	n.s.	0.21	–0.98
PC	n.s.	–0.11	–0.14	n.s.	1	n.s.	n.s.
BWT	0.62	0.66	–0.09	0.18	–0.10	1	n.s.
Index	–0.04	n.s.	0.15	–0.98	n.s.	n.s.	

GFW - greasy fleece weight, CFW - clean fleece weight, YD - yield, FD - fibre diameter, PC - predictive colour, BWT - body weight
n.s. - not significant