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Combining Hogget and Adult Performance of Progeny in the New England Sire Evaluation Scheme

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Summary

Objective measurements and visual classing results from progeny of rams used in the 1990 and 1991 New England (fine wool) Sire Evaluation Scheme are presented. The information is linked across years by the use of reference or link sires. The effect of different weightings being given to hogget and adult (four-tooth) progeny results is studied. For the objectively measured traits the choice of weighting does not affect the ranking of rams as the correlations for estimated sire means between ages are very high. The correlations across ages for visually assessed traits were also high.
Keywords: Merino sire evaluation, fine wools

Introduction

The results of the New South Wales Merino sire evaluation schemes (SES) run at Hay, Deniliquin and Dubbo for medium and strong wools were presented in the previous issue of this journal (Cottle et al. 1993, Atkins et al. 1993). The results for the New England SES, which services fine wool breeders, have not been presented linked across years, although the 1990 drop has been linked to a scheme which ran in New Zealand from 1988-89 (Cottle and Russell 1992).

The combining of results from hoggets and four-tooths to calculate an overall estimate of progeny value in the medium wool SES was carried out slightly differently for objectively measured traits (Cottle et al. 1993) compared with visually appraised (Atkins et al. 1993) traits. Atkins et al. (1993) used a repeated record form of analysis to account for classers and age of progeny. Thus the two age records were given equal weight. Cottle et al. (1993) obtained a 'lifetime' value for each trait by combining the estimated progeny values (EPVs) on the basis of 2.87 hogget expressions and 3.87 adult expressions, as outlined by Maxwell and Brien (1988). The annual EPV was expressed as $EPV_L = 0.43\ EPV_H + 0.57\ EPV_A$, ie. close to equal weighting.

Atkins et al. (1993) found age had a significant influence on all visually assessed traits (destination, conformation, fleece quantity and quality) and there were significant interactions between age and sire and between age and animal. Therefore the relative weighting given to performance at the two ages could influence a sire's ranking. Maxwell and Brien (1988) assumed that all wethers are sold from the flock when they calculated

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relative weightings of performance at the two ages. The assumption of a different flock structure would have the effect of altering the relative weightings given to performance at the two and four tooth stages.

This paper presents the linked results from the New England SES from the 1990 and 1991 drops for both objective and visually assessed traits. In addition, the relationship between sire's progeny performance determined at different ages is examined. The effect of assuming a different flock structure to that of Maxwell and Brien (1988) on the EPV's combined across age groups is also considered.

Materials and Method

The results reported here come from two programs conducted at Walcha in the New England region of NSW, between 1990 and 1993. The rams entered were generally of local origin, classified as fine wool Merinos, although a number of other fine-wool growing areas were represented. The management, data collection and analysis methods were the same as those described by Cottle et al. (1993) and Atkins et al. (1993). The inclusion of 'link' or common sires allows comparison between sires entered in different years. In total, hogget fleece and body weight data from 854 progeny representing 29 sire families were collected. The objectively measured data were analysed using multi-trait Best Linear Unbiased Prediction (BLUP) to estimate progeny values for each sire for six main traits: hogget and adult clean fleece weight (CFW), fibre diameter (FD) and body weight (BW). Adult records were only available for sires entered in 1990, and so the adult progeny values of the 1991 sires were predicted from their hogget performance, through the genetic correlations between hogget and adult performance.

Visual traits were assessed by two classers working independently prior to each shearing. Each progeny was classed as being of 'Stud', 'Flock' or 'Cull' quality, and comments on the group traits, conformation, fleece quantity and wool quality (as defined by Casey, 1991) were recorded as either positive or negative. Analysis across years was completed using least squares procedures and results were presented graphically to simplify interpretation. Where animals were classed at both the two and four tooth stages, a repeated records form of analysis was used, effectively giving performance at each classing equal weight.

The average lifetime performance for the measured traits was estimated using different weightings for the two age records. The different weightings were derived from a consideration of flock structure. At first glance the appropriate weighting may be thought to be one hogget fleece: four adult fleeces for lifetime production. However one needs to consider the flock structure to determine the relative importance of hogget fleeces. The production of a breeding ewe over her lifetime in a flock is shown in Fig. 1. Thus if one assumes that all offspring are shorn as hoggets but only the ewe hogget replacements are kept than the ratio 0.43 EPV_H + 0.57 EPV_A is obtained. This is independent of the number of age groups in the flock and assumes 78% weaning, 5% deaths in lambs and 2.2% ewe deaths. Thus because hoggets are shorn before leaving the system, hogget fleece traits receive almost equal weighting to adult fleece traits.

If one assumes that wether replacements are kept in a constant size wether flock with a similar age structure to the ewe flock then the ratio of expressions becomes 0.27 EPV_H + 0.73 EPV_A. A greater weight is given to adult performance as the wethers are shorn as adults. This ratio is also independent of the number of ewe age groups. If the number of wethers (and age groups) is less than the number of ewes then EPV_A is weighted by a value between 0.57 and 0.73.

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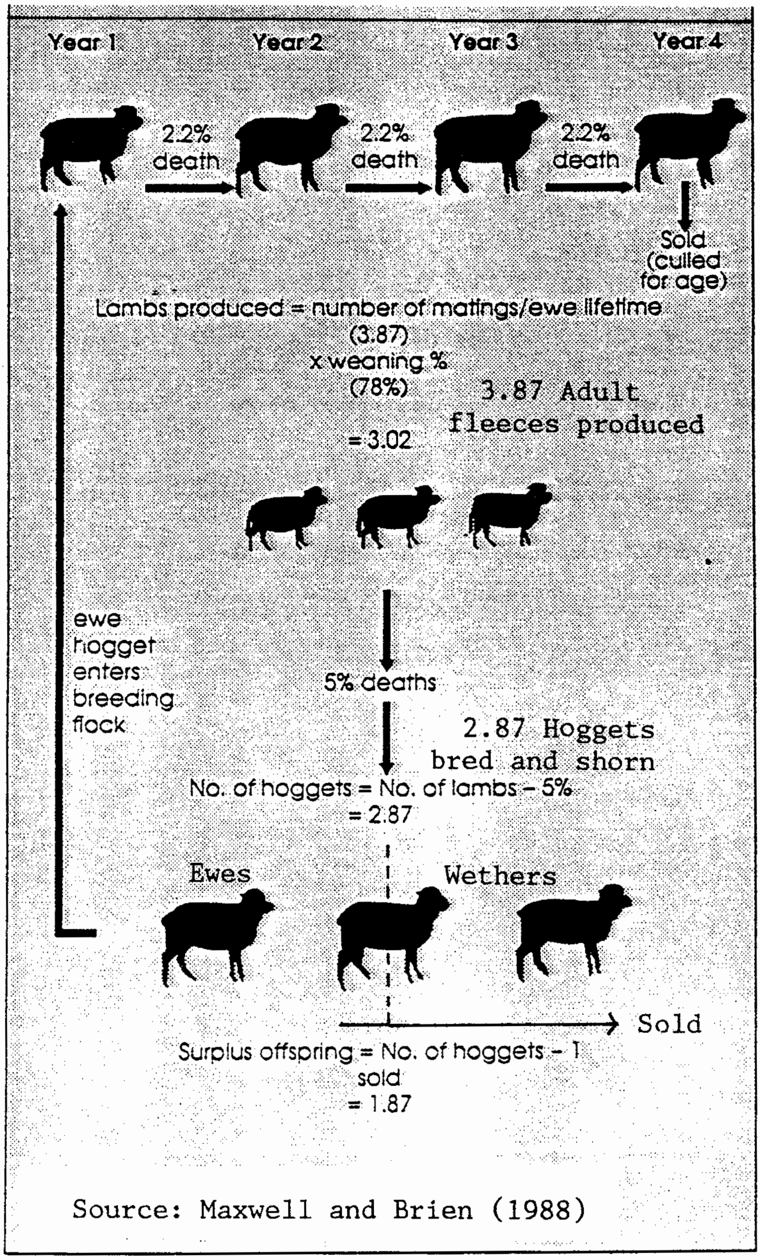
The effect of age on sire group was evaluated by simple correlation between two tooth EPV's and four tooth EPV's for the 1990 drop. The progeny values were determined using single-trait BLUP as multi-trait BLUP necessarily creates a dependency between the two age groups. Similarly, the effect of age on classing performance, measured as destination score was assessed. The relationship between combined values determined by using the weights 0.43:0.57 and 0.27:0.73 was also examined.

Fig. 1 Flock Structure Assumed in the Calculation of Relative Weights



Results

The EPV's for measured fleece and body traits linked across years using a multi-trait analysis with hogget and adult performance combined using a 0.43:0.57 ratio are shown in Table 1. The combined value for 1991 drop progeny is based in effect on their hogget performance.

Table 1 Estimated Progeny Values for combined two and four tooth results from New England Sire Evaluation Program (1990 and 1991 drops)

			Estimated Progeny Value (EPV)			
Sire Code	Sire Name	No.	CFW (kg)	FD (µm)	ΔFD (µm)	BWt (kg)
4114	Auchen Dhu Orange 112	31	-0.02	0.35	N/A	-0.17
4003	Auchen Dhu Red 13	53	0.02	0.05	0.03	0.58
4115	Bullamalita Super Johnny	25	-0.19	-0.50	N/A	-0.66
4014	East Roseville 2299	25	0.20	1.07	0.41	-0.71
4111	**Europambela Blue 308**	33	-0.14	**-0.97**	N/A	-0.42
4007	Grathlyn Super Blue	46	-0.09	1.01	-0.42	-0.21
4108	Lorelmo 108	25	-0.12	0.11	N/A	0.11
4012	Lorelmo J4	28	-0.10	-0.08	0.06	-0.01
4113	Merignee P2	27	-0.01	-0.29	N/A	-0.11
4001	Mirani 214.5	48	0.01	-0.53	0.01	0.16
4107	Mirani 220.7	29	0.00	-0.34	N/A	-0.04
4009	Mirani 95.2	27	-0.18	-0.27	-0.17	0.05
4010	Mirramoona 698	30	0.00	0.71	0.06	0.93
4008	**Mirramoona 703**	26	0.00	0.08	-0.06	**1.06**
4106	Mirramoona 812	29	0.12	0.07	N/A	0.19
4016	Moutere 547	7	-0.03	-0.13	0.02	-0.20
4110	**Moutere Silky**	29	-0.33	**-0.86**	N/A	-0.55
4109	**Nerstane 225**	29	**0.65**	0.10	N/A	0.54
4015	**Nerstane 697**	22	**0.35**	-0.20	0.24	-0.67
4116	One Oak 0032	37	-0.04	-0.09	N/A	-1.44
4005	Petali 556	30	-0.14	-0.51	-0.09	-0.56
4013	Roseville Park 69	22	0.05	0.12	0.26	0.28
4006	Ruby Hills 225	22	0.11	0.01	-0.02	0.15
4104	Ruby Hills 6602	35	-0.13	0.31	N/A	-0.19
4004	Sierra Park Urq 64	22	-0.04	0.06	-0.23	0.35
4112	Winton Trump	33	-0.17	0.25	N/A	-0.30
2010	Woolaroo Blue 203	29	0.00	0.13	-0.04	0.34
4103	**Yalgoo 644**	30	0.15	-0.18	N/A	**1.01**
4002	Yalgoo 942	25	0.06	0.30	-0.06	0.22
Mean		854	2.66	17.78	0.65	29.80

1. Sire Code - Site/Year/No.
   Site: 4=New England, Year: 0=1990 1=1991,
   No.: 01=Sire 1 for that site/year 02=Sire 2 etc.
2. Link Sires are marked with an asterisk
3. ΔFD is the difference between four tooth and two tooth fibre diameter expressed as a deviation from the average difference (0.65µm). Sires maked N/A in this column have not yet had four tooth fibre diameter measured.
4. Trait leaders are marked in bold (two for each trait)

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The relationship between hogget and adult performance in each trait is shown graphically in Fig. 2, 3 and 4. The relationship between hogget and adult performance is strongest for fleece weight (correlation = 0.89) and then body weight (correlation = 0.86). The correlation between ages for fibre diameter is lower (correlation = 0.81). Although most of the animals are clustered quite closely around the regression line, a small number of outliers have caused the lower correlation, and a larger data set would be more informative.

The use of different weightings for hogget and adult performance in the calculation of the lifetime EPV has little impact on the ranking of rams with the correlation for each trait being 0.99 or greater (see Fig. 5 for clean fleece weight). The 2-3 rams which change in ranking have very similar combined values to each other, whichever weighting method is used.

Fig. 2 The Relationship between Hogget and Adult EPV's for Clean Fleece Weight.

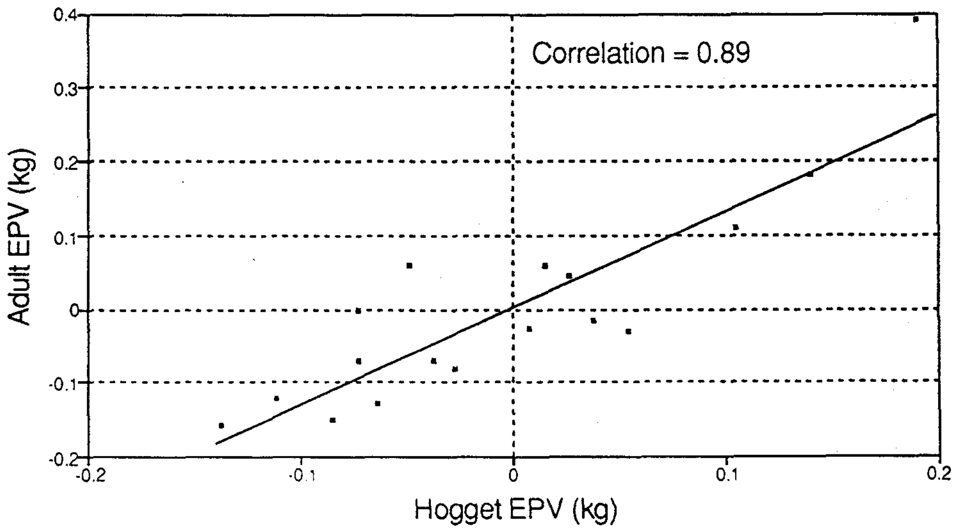

Fig. 3 The Relationship Between Hogget and Adult EPV's for Fibre Diameter.

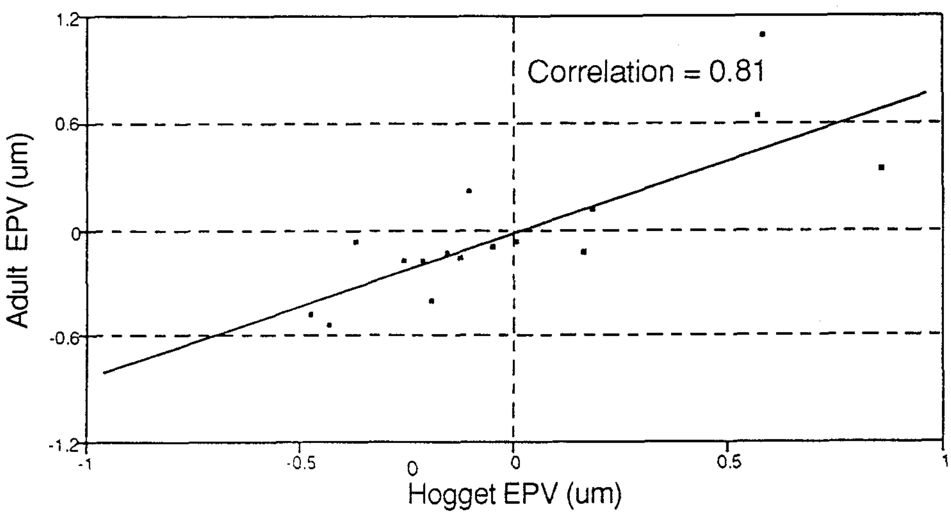

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Fig. 4 The relationship Between Hogget and Adult EPV's for Body Weight

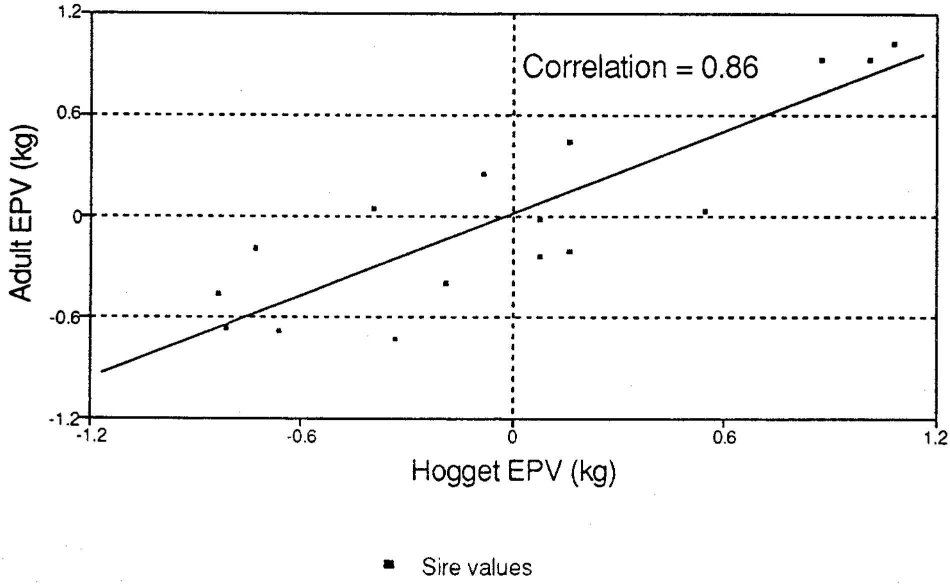
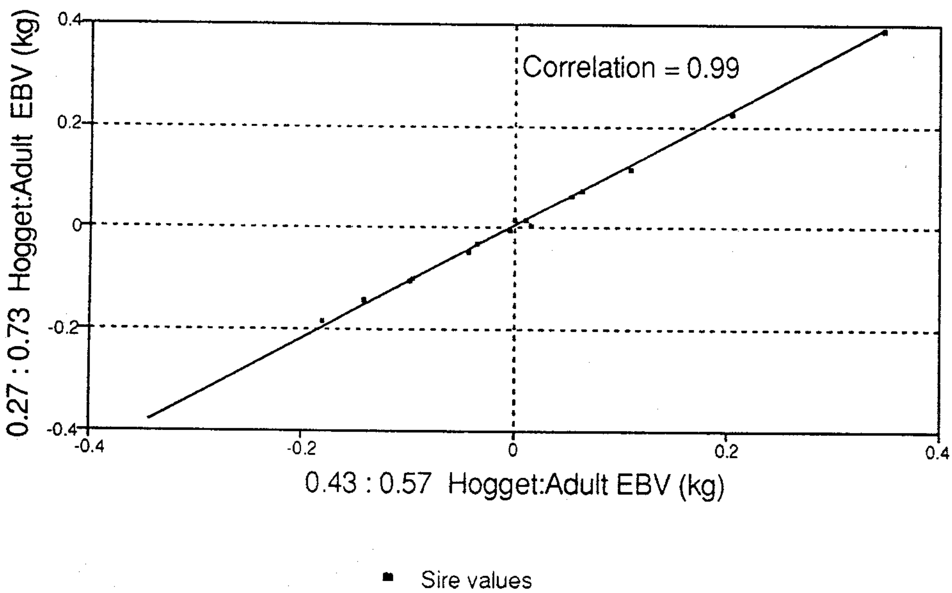


Fig. 5 The Relationship Between Combined EPV's for Clean Fleece Weight Determined by Different Weights



The combined performance of rams for visual traits is given in Table 2. The graphics depicting 'Classer's grade' describe the classing performance of each sire. Bars to the right of the midpoint indicate a greater number of 'tops' than 'culls' for that sire, while bars to the left indicate the opposite. The least squares deviations for %Tops and %Culls is also provided. The three group traits, Conformation, Fleece Quantity and Wool Quality are also summarised in Table 2. The positive and negative signs indicate the extent to which a sire is above or below the average performance for that trait (sires with close to an average performance have no sign).

There was a close relationship (correlation = 0.89) between the destination grade of progeny classed as hoggets and adults for the 1990 entered sires (Fig. 6). This high correlation gives us confidence that the combined results for 1990 and 1991 (hoggets only assessed) represents a true indication of the relative ranking of all sires for visual traits. Sires with above average performance in one group trait were more likely to be assessed as above average in the other group traits. However, sires can be found in Table 2 that have both above and below average performance for the various group traits.

Fig. 6 Relationship Between Destination scores for 2-tooth and 4-tooth progeny

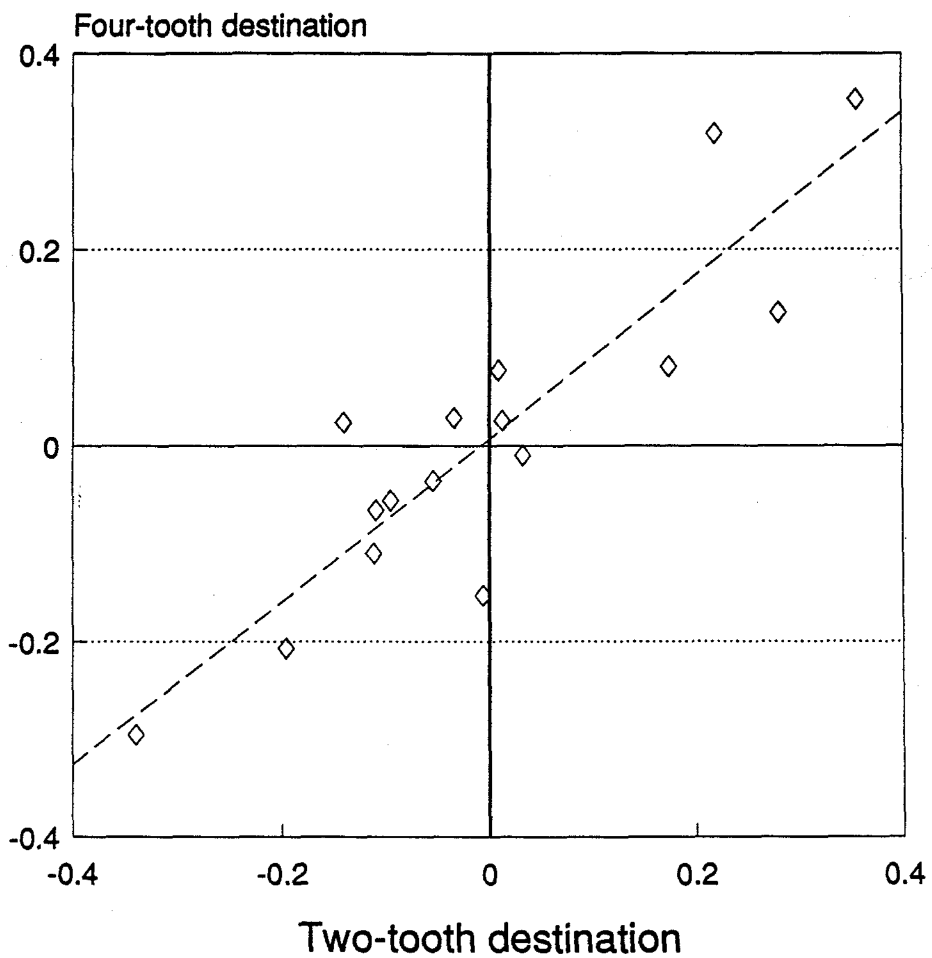


Table 2 Visual trait evaluation combined across years from the New England Sire Evaluation Program (1990 and 1991 drops)

Sire identification	%Cull	Classers Grade	%Tops	CON	QNT	QLY
Auchen Dhu Orange 112	-1		-15	-		
Auchen Dhu Red 13	+1		+6			
Bullamalita Super Johnny	+5		-8			+
East Roseville 2299	0		+3		++	--
Europambela Blue 308	+12		-20	--	--	
Grathlyn Super Blue	-5		+6			++
Lorelmo 108	+6		-20	-	--	
Lorelmo J4	+1		+2	-		++
Merignee P2	+6		-6			
Mirani 214.5	-9		+6			++
Mirani 220.7	+6		-2			
Mirani 95.2	+6		+5			
Mirramoona 698	-5		+4			--
Mirramoona 703	-1		+7	+		-
Mirramoona 812	-6		-14			--
Moutere (NZ) 547	+16		-6			-
Moutere Silky	+27		-23	--	--	-
Nerstane 225	-17		+33	++	++	+
Nerstane 697	-18		+28	++	++	
One Oak 0032	+6		-15			-
Petali 556	-5		0		--	
Roseville Park 69	-7		+16	++	-	-
Ruby Hills 225	-19		+18		++	+
Ruby Hills 6602	+3		-10		-	
Sierra Park Urq 64	+3		+5			+
Winton Trump	+10		-21	--	--	
Woolaroo Blue 203	+10		0			--
Yalgoo 644	-10		+7	++		
Yalgoo 942	-16		+15	++		
Mean	24%		23%			

Discussion

It can be seen from Tables 1 and 2 that there is considerable variation between sires for both the objective and visually assessed traits. The reliability of the results is dependent on the number of progeny produced by each sire, and the heritability of the trait, with high progeny numbers and heritabilities leading to more consistent and meaningful results. The procedure used in the estimation of the progeny values in Table 1 takes these factors into account by regressing or adjusting a sire's results toward the population mean by an amount determined by the reliability of the figures. For example, if two sires produce progeny having similar fleece weights, the sire with the greatest number of progeny will be assigned a higher progeny value because his results are more reliable. This procedure guards against sires with low numbers of progeny having extremely high or low values by chance. The progeny value is the 'best' estimate of a sire's genetic merit that can be determined with the available information. Additional data will move the sire's results closer to his true breeding value.

Although there is a relationship between two and four tooth performance, Figures 2, 3 and 4 indicate that there is variation in the relative performance of sires between years, especially for fibre diameter. This result is surprising given that previous work has shown a very high correlation across age groups for fibre diameter (Atkins 1990). There are a number of possible reasons for the low correlation between progeny values observed here. Atkins (1990) used a multiple bloodline flock containing only one fine-wool flock to estimate the between ages correlations, and hence it may not adequately describe the situation for fine-wool sheep. In addition, the 1990 drop endured an extremely dry year as four tooths in 1992 compared to 1991. In such a situation, a sire x environment interaction is far more likely than when stable climatic conditions and feed levels occur. A larger number of animals used in the determination of the across year correlations, as data accrues over time, will be more informative.

It appears that as the hogget and adult results are highly related for measured traits the relative weighting given to hogget and adult performance is not very important. The best ratio to use is probably the one which is easiest to explain. Like many areas in sheep breeding, agreement is not straight forward. Technically there is little difference in the difficulty of weighting the objective or visual age performances by different amounts. An agreed ratio needs to be decided so that results can be consistently presented in future. The authors suggest a 1:1 ratio is simplest and will not differ much from other ratios, especially if multi-trait BLUP techniques are used.

Compared with the combined visual trait information from Hay and Deniliquin (Atkins et al. 1993), the visual data reported here from the New England showed three important differences. Firstly, there was a stronger correlation between hogget and adult assessment with no significant interaction with age for either individual progeny or sires. Secondly, although there was a positive association between performance on the group traits, sires were identified that had above average performance for one trait but below average performance for another. Thirdly, the proportion of sires with significant visual trait deviations was higher in the New England data set. These differences have arisen because more animals in these data were given a positive or negative comment on type traits, regardless of their final destination grade. This procedure, which can be recommended for all sire evaluation schemes, substantially reduced the error variance between animals and increased our ability to accurately identify differences between sires in visual trait performance.

Central test sire evaluation programs produce a large array of information for each sire.

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There is a risk that interested breeders may be subject to 'information overload', and that the important benefits of the programs may be obscured. The combination of data into a more concise form is an important component in the successful extension of the schemes. Likewise, the graphical presentation of the visual data is an attempt to communicate maximum information in the clearest way, allowing breeders to 'see the forest through the trees'.

The use of the visual information is vital to the use and success of sire evaluation. Few breeders would be willing to purchase highly priced semen from a ram on the basis of objective measurements alone. If the prospective purchaser cannot see the progeny first hand, the provision of the visual data in a standard format is the next best alternative. Equally, sires should not be purchased on the basis of visual information alone. Central test sire evaluations provide reliable information when in the past there has been none, and as such, they are a valuable resource for the entire industry.

Acknowledgments

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