

# PARAMETERS FOR WOOL PRODUCTION CHARACTERS AND CLASSER'S GRADE IN A PEPPIN MERINO STUD

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## SUMMARY

Data from hogget rams in a Merino stud in north western New South Wales for the period 1976-9 were used to derive estimates of genetic and phenotypic parameters for classer's grade, greasy fleece weight, washing yield, clean fleece weight and average fibre diameter. Means for the wool characters were 3.5 kg, 69.7%, 2.4 kg and 20.05  $\mu\text{m}$  respectively. Phenotypic correlations were mostly within the range of published estimates for Peppin Merinos. The correlations between wool production and classer's grade were positive; approximately 0.5 for both greasy and clean fleece weight. Both the phenotypic and genetic correlations between clean and greasy fleece weight were high (0.90). A number of other correlations between wool production characters differed significantly from previously published values; of note was the negative correlation between clean fleece weight and average fibre diameter. The genetic correlation of classer's grade with greasy fleece weight was medium and positive (0.60) and with clean fleece weight very strong and positive (0.80). Classer's grade had a low heritability (0.17).  
Keywords: Merino, stud, classer's grade, wool characters.

## INTRODUCTION

Estimates of phenotypic and genetic parameters are essential in the design of efficient breeding programs. There have been a large number of estimates made on the Australian Merino, particularly the Peppin, mostly for experimental flocks (Mortimer 1987). Gregory (1982a,b) presented estimates which included sheep grade determined by a sheepclasser. Rose (1980) presented means for wool characters within classer's grades for a Peppin Merino stud in south west Queensland.

This study provides estimates of phenotypic and genetic parameters from a Peppin stud and involves classer's grade and the measured wool characters commonly provided by fleece testing services and used as selection criteria in breeding programs. McGuirk *et al.* (1985) presented heritability estimates for wool characters from this stud but did not report correlations or include classer's grade.

## MATERIAL AND METHODS

### Location

The data were obtained from Mogila Merino stud, near Goodooga in north western New South Wales. The stud management and selection of rams in this Peppin stud have been described in some detail (Miller 1976; McGuirk *et al.* 1982).

### Data and analysis

Fleece measurement data and classer's grade were obtained at hogget shearing for 4 drops of ram progeny (born in 1976, 1977, 1978 and 1979). The traits studied were: greasy fleece weight (GFW), washing yield (YLD), clean fleece weight (CFW), average fibre diameter (DIAM) and classer's grade (CG). Rams were visually classed into 5 grades and arbitrary scores assigned to each grade - top reserves (4), 1st reserves (3), 2nd reserves (2), sales (1) and culls (0). The same classer did the classing throughout this study. Classing data were also scaled (Snell 1964) to satisfy, as far as possible, 2 assumptions basic to analysis of variance methods, that the residual deviations are normally distributed and that the residual variances are homogeneous. This method determines numerical scores for the categories of subjective scales by assuming an underlying continuous scale of measurements along which the scale categories represent intervals. The exact solutions are reached by an iterative procedure but approximate solutions are adequate for most practical purposes and were used to obtain the derived scores (DS). Records were available for a total of 2,394 rams in 59 sire groups. Data were analysed using the program LSML76 (Harvey 1977). The model used was:

$$y_{ijk} = \mu + s_i + d_j + e_{ijk}$$

where  $\mu$  = overall mean,  $s_i$  = effect of the  $i$ th sire,  $d_j$  = effect of the  $j$ th year of measurement and  $e_{ijk}$  = random error.

## RESULTS AND DISCUSSION

Table 1 shows least-squares means and parameter estimates for each trait. The mean for GFW (3.50 kg) when adjusted to 12 months' growth was slightly above the district average. Phenotypic correlation

estimates were mostly within the range published for Australian Peppin Merinos (Mortimer 1987). Estimates with DS were very similar to those with CG. The phenotypic correlation between CG and DS was very high (0.98). Classer's grade could thus be included in a selection index without the need to transform the CG. Correlations between CG and both GFW and CFW were moderate and positive (0.48 and 0.49 respectively), but with YLD (0.18) and DIAM (0.15) were negligible. These relationships support the observations in this stud of McGuirk *et al.* (1982) of significant differences in the mean production of CGs but a large range in individual production between rams in the same CG.

**Table 1. Phenotypic and genetic parameters for classer's grade (CG), greasy fleece weight (GFW), washing yield (YLD), clean fleece weight (CFW), average diameter (DIAM) and derived score (DS) of Merino hoggets**

|                                                                                                                                                        | CG              | GFW<br>(kg)     | YLD<br>(%)      | CFW<br>(kg)     | DIAM<br>( $\mu$ m) | DS             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|--------------------|----------------|
| LS means                                                                                                                                               | 1.12<br>(0.03)  | 3.50<br>(0.02)  | 69.67<br>(0.21) | 2.43<br>(0.02)  | 20.05<br>(0.07)    | 4.22<br>(0.07) |
| Heritability                                                                                                                                           | 0.17<br>(0.05)  | 0.32<br>(0.07)  | 0.29<br>(0.07)  | 0.21<br>(0.05)  | 0.27<br>(0.06)     | 0.16<br>(0.05) |
| CG                                                                                                                                                     |                 | 0.48            | 0.08            | 0.49            | 0.15               | 0.98           |
| GFW (kg)                                                                                                                                               | 0.60<br>(0.17)  |                 | -0.13           | 0.90            | 0.22               | 0.47           |
| YLD (%)                                                                                                                                                | 0.17<br>(0.19)  | -0.55<br>(0.14) |                 | 0.30            | -0.06              | 0.08           |
| CFW (kg)                                                                                                                                               | 0.80<br>(0.17)  | 0.90<br>(0.14)  | -0.13<br>(0.18) |                 | 0.18               | 0.48           |
| DIAM ( $\mu$ m)                                                                                                                                        | -0.07<br>(0.19) | -0.09<br>(0.17) | -0.18<br>(0.17) | -0.20<br>(0.18) |                    | 0.15           |
| DS                                                                                                                                                     | 1.00<br>(0.00)  | 0.58<br>(0.18)  | 0.20<br>(0.19)  | -0.09<br>(0.20) |                    |                |
| Standard errors of estimates appear in brackets below the estimates.<br>Phenotypic correlations are above the diagonal and genetic correlations below. |                 |                 |                 |                 |                    |                |

There was a high positive phenotypic correlation between GFW and CFW (0.90) which would permit selection of breeding ewes for CFW using GFW as the criterion. Yield had a low positive phenotypic correlation with CFW (0.30) and a negligible one with GFW (-0.13). The associations of both GFW and CFW with DIAM (0.22 and 0.18 respectively) were intermediate to the negligible values of most published estimates. The estimated phenotypic correlations of CG with production characters were much higher than those reported by Gregory (1982b). The magnitude of these correlations depends primarily on the skill of the classer to assess the characters but also on the phenotypic correlations between them. McGuirk *et al.* (1982) demonstrated the efficiency of this classer in achieving a high proportion of the selection differential available for CFW and significant differences between CGs and suggested his wide experience and long association with objective measurement could well account for his efficiency. As well as the classer's ability, correlations between GFW and CFW were higher in this flock than those reported by Gregory 1982b.

Greasy fleece weight and CFW showed a high positive genetic correlation (0.90). The genetic association between YLD and DIAM was negligible. Both of these estimates are in agreement with published estimates. A number of other correlations among wool characters differ significantly from published figures in both sign and magnitude. Yield and GFW had a medium negative correlation

compared with negligible estimates by other workers while the correlation between YLD and CFW was slightly negative and negligible compared with medium positive estimates by the same workers. The genetic correlation between GFW and DIAM was slightly negative though negligible while other estimates reported were low to medium positive. Of particular interest was the low negative correlation between CFW and DIAM (-0.20). However the confidence limits do include values in the presently accepted range. Gregory (1982b) found a similar negative genetic correlation between these 2 characters. A positive correlation means that selection for increased CFW is accompanied by a rise in DIAM and this adverse relationship has presented a special problem in selection programs where improved CFW is desired but a deterioration in wool quality is not.

It is not known what the relationships between CFW and its components were before selection based on measurement of all rams began in 1961. Since then there has been a consistent selection against rams which combined high CFW and broad DIAM. The stud classer is also known to place considerable emphasis on staple length (S.J. Miller pers. comm.). A similar emphasis was reported in a stud of similar genetic background where the classer had worked with selection based on measurement (Rose 1980). She reported considerable differences in staple length between sires, reserves and flock rams; the means being 74.8 mm, 70.7 mm and 67.5 mm respectively.

Estimates involving associations with CG or DS are of interest since no published data are available for a Merino stud. These relationships could be used to predict changes in production characters in flocks where sires are selected on CG alone without objective measurement. The genetic correlation between CG and DS was almost 1. Correlations with other characters of either CG or DS were therefore very similar. The genetic correlation between CG and GFW was medium to high positive (0.60) and with CFW very high positive (0.80). These estimates were very much higher than those published by Gregory (1982a) which were 0.13 and 0.19 respectively. The correlation of CG with YLD was low negative and with DIAM negligible. These were of similar order to the South Australian estimates of 0.10 and 0.10 respectively.

In general the wool characters were moderately heritable, all being between 0.2 and 0.32, and could be expected to respond to mass selection. The estimates and their standard errors are in good general agreement with those of McGuirk *et al.* (1985) who used data from this stud but analysed them using restricted maximum likelihood. They used data from this stud for the period 1974-83 which included the 4 years' data of this study (1976-9). These values are at the lower end of the range published for Australian Merinos. Classer's grade and DS had low heritability estimates and were in agreement with the estimates published for sheep grade of South Australian Merino rams which were 0.14 for both half-sib correlation and for dam-offspring regression (Gregory 1982b).

Heritability estimated from intraclass correlation between half-sibs are largely free of bias from non-additive effects but there is an inherent bias in intraclass correlations since the expectation of a ratio does not equal the ratio of expectations. Of special interest here, however, is the bias due to the selection of sires which is liable to bias estimates towards zero. Selection of ewes may also further reduce genetic variance among sire groups. Since the sires in this stud are largely selected on CFW, a highly heritable character, the heritability estimate for CFW (and indeed for other components of wool weight) are likely to be underestimated. Using the graphs of Ponzone and James (1978), if 2% of sires are selected and the true heritability is 0.40, the estimate may be less than 0.7 of the true value. The estimated or biased value in this study was 0.21 so the true value may be 0.30; a value in agreement with published values. This adjustment is appropriate only where selection of sires resulted in truncation of a particular trait. As rams were culled visually for a number of fleece and body faults prior to measurement and an independent culling level was applied to exclude rams with a DIAM more than 10% above the mean, the bias may not be quite as large as this.

## CONCLUSIONS

The value of estimates obtained from many years of accumulated data in a stud which has based its selection on measurement is evident. The use of such estimates in developing its selection program using selection indices is now possible. Although selection using measurement has been used for many years in this stud, heritabilities suggest that the wool characters should respond to mass selection. The finding of a negative genetic correlation between CFW and DIAM may require further investigation. Given the large standard error of the estimate a more accurate estimate is required. The reversal of what has been regarded as an antagonistic relationship in improving both the quantity and quality of wool could increase the efficiency of selection by removing the need to restrict DIAM in this stud.

These parameters for CG and wool production characters in a stud are of interest in understanding how traditional classing interacts with objective measurement in a breeding program which incorporates both.

However before seeing these findings as some criteria of the classer's competence, it is important to appreciate what the sheep classer is trying to achieve and just what grades are. In grading rams he is fulfilling two functions. He culls all animals which are unacceptable for a large number of fleece and body characteristics and he allots the others into rams with superior characteristics from which the stud will choose its sires and the remaining animals which will be sold to clients for use in commercial flocks. The classer here, for example, has divided 2,000 rams into 5 extremely broad categories of largely varying size. Allowing for this, these data would suggest that, for an experienced classer, grade is quite well correlated phenotypically with wool production, both GFW and CFW, and as might be expected, there is little relationship with either DIAM or YLD. It is interesting to note that there is a high genetic correlation between this CG and CFW, the major determinant of return from wool production. Overall it could be concluded selection can combine measurement with traditional classing to achieve a high level of efficiency. Where all rams are measured, removal of cull rams will reduce the cost of measurement for sale rams. In studs where selection of sires involves measuring only reserve rams it has been shown that very little selection pressure is lost through classing performed by an experienced classer (McGuirk *et al.* 1982).

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