

**REPEATABILITY OF FLEECE MEASUREMENT IN A GROUP
OF FINE-WOOL MERINO RAMS**

C.M. WADE^{1,3}, G. FAULKNER² and M.E. GODDARD¹

¹ Livestock Improvement Unit, VIAS
Department of Agriculture
PO Box 500, East Melbourne Vic 3002

² Ballarat District Centre
Department of Agriculture
Ballarat Vic 3350

³ Present address: Dept. Farm Animal Medicine and Production
The University of QLD, QLD 4072.

SUMMARY

Matched records were obtained for 224 rams shorn at 13 months of age with 7 months wool and at 22 months of age. Repeatabilities were assessed for a number of traits (Greasy fleece weight, body weight, average fibre diameter, yield, clean fleece weight, standard deviation of fibre diameter) along with Woolplan index scores - using Woolplan options 1,2 and 3. Repeatabilities obtained ranged from 0.66 to 0.77 for the traits considered. Multiple regression was used to ascertain the advantage of using standard deviation of fibre diameter and clean fleece weight measurements in addition to average fibre diameter to predict 22 month fibre diameter. No significant advantage was found. The study provides new information on the predictive value of fibre diameter variability and extends the range of information available on repeatabilities in immature fine wool merinos.

INTRODUCTION

Published estimates of the repeatability of fleece weight, fibre diameter and body weight imply that Woolplan indices will also be moderately repeatable. However, there is doubt that these estimates apply when the hogget shearing occurs at less than 15 months of age with less than 12 months wool growth. This is the type of animal on which Woolplan measurements are often taken. In addition, there are few repeatability estimates from fine-wool Merinos. The relationships between fleece characteristics are not known to be consistent across the different strain types (fine-medium-strong). The first aim of this paper is to estimate the repeatability of fleece weight, mean fibre diameter, standard deviation of fibre diameter, body weight and Woolplan indices for fine wool Merinos shorn at 13 months of age. The second aim is to determine if the standard deviation of fibre diameter could be used to predict which rams would increase in fibre diameter between the first and the second shearing.

MATERIALS AND METHODS

Sheep and measurements

After minimal culling 239 fine-wool ram lambs run as a single flock on the "Trawalla" stud of Mr K McKenzie, near Ballarat in Victoria, were shorn at 13 months of age with 7 months wool growth and then again 9 months later. Matched records were obtained for 224 of the rams. The rams, which were divided into 7 groups on the basis of their bloodline, were measured for the following characteristics in both shearings:

| | Flock average (22 months of age, 9 months wool) | |
|---|--|-------|
| 1) Greasy Fleece Weight | (GFW) | 3Kg |
| 2) Body Weight | (BW) | 39Kg |
| 3) Average Fibre Diameter | (FD) | 20 µm |
| 4) Yield | (YLD) | 72% |
| 5) Clean Fleece Weight | (CFW) | 2.2Kg |
| 6) Standard Deviation of fibre diameter | (SD) | 4.2µm |

Fleece testing was carried out at the Turretfield fleece testing laboratory. Using these measurements the following Woolplan indices were calculated for each ram in each year according to Woolplan program notes (Atkins et al 1988):

| | |
|----------------------------------|--|
| Woolplan Index Option 1 (IND1) - | No restrictions. |
| Woolplan Index Option 2 (IND2) - | Designed to maximise gain while keeping fibre diameter constant. |
| Woolplan Index Option 3 (IND3) - | Reproductive rate restricted. |

Statistical analysis

The repeatability was estimated by the within-group correlation between each trait in year one and the same trait in year two. Confidence limits were found (Steel and Torrie, 1981).

A multiple regression was used to predict fibre diameter and clean fleece weight at the 2nd shearing from the average fibre diameter, clean fleece weight and standard deviation of fibre diameter measured at the first shearing.

RESULTS

Repeatability

Significant differences between bloodline groups were observed for all single traits except yield in year 1. The repeatabilities of all traits, including Woolplan indices were approximately 0.7 (tables 1 and 2).

The phenotypic correlations between individual traits are listed in table 2, and between Woolplan index options in table 2.

Use of early measurement to predict adult fibre diameter

The equations to predict FD and CFW at 22 months (FD₂ and CFW₂) from early measurement on clean fleece weight (CFW₁), average fibre diameter (FD₁), and standard deviation of fibre diameter (SD₁) (± standard error of each regression coefficient) were found to be:

$$FD_2 = 6.08 + 0.67*FD_1 + 0.25*CFW_1 + 0.23*SD_1$$

(±0.06) (±0.32) (±0.17)

$$CFW_2 = 0.853 - 0.01*FD_1 + 0.94*CFW_1 + 0.03*SD_1$$

(±0.01) (±0.07) (±0.04)

The correlation between the predicted and true values for FD₂ was r=0.7, and for CFW₂ was r=0.74. The partial regressions of FD₂ on CFW₁ and SD₁ are not significant nor are the partial regressions of

CFW₂ on FD₁ and SD₁.

Table 1. Phenotypic correlation matrix (within-group) - individual fleece measurements. Repeatabilities shown in bold type.

| | GFW ₁ | BW ₁ | FD ₁ | YLD ₁ | CFW ₁ | SD ₁ | GFW ₂ | BW ₂ | FD ₂ | YLD ₂ | CFW ₂ | SD ₂ |
|---|------------------|-----------------|-----------------|------------------|------------------|-----------------|------------------|-----------------|-----------------|------------------|------------------|-----------------|
| GFW ₁ | 1.00 | .47 | .32 | -.03 | .93 | .09 | .66 | .25 | .19 | .01 | .60 | .13 |
| BW ₁ | | 1.00 | .04 | .14 | .49 | -.16 | .27 | .73 | .01 | .10 | .28 | -.08 |
| FD ₁ | | | 1.00 | -.17 | .25 | .45 | .21 | -.02 | .67 | -.07 | .17 | .33 |
| YLD ₁ | | | | 1.00 | .32 | -.34 | .10 | .17 | .01 | .77 | .38 | -.28 |
| CFW ₁ | | | | | 1.00 | -.04 | .66 | .30 | .20 | .28 | .70 | .02 |
| SD ₁ | | | | | | 1.00 | .09 | -.24 | .36 | -.18 | -.01 | .64 |
| GFW ₂ | | | | | | | 1.00 | .25 | .37 | .04 | .93 | .20 |
| BW ₂ | | | | | | | | 1.00 | .05 | .13 | .28 | -.13 |
| FD ₂ | | | | | | | | | 1.00 | .07 | .36 | .45 |
| YLD ₂ | | | | | | | | | | 1.00 | .41 | -.20 |
| CFW ₂ | | | | | | | | | | | 1.00 | .10 |
| SD ₂ | | | | | | | | | | | | 1.00 |
| 95% Confidence limit of repeatability (lower) | | | | | | | 0.58 | 0.66 | 0.59 | 0.71 | 0.63 | 0.56 |
| 95% Confidence limit of repeatability (upper) | | | | | | | 0.73 | 0.79 | 0.74 | 0.82 | 0.76 | 0.71 |

* ₁ = measurement 1, ₂ = measurement 2.

Table 2. Phenotypic correlation matrix (within-group) - Woolplan options. Repeatabilities shown in bold type.

| | IND1 ₁ | IND2 ₁ | IND3 ₁ | IND4 ₁ | IND1 ₂ | IND2 ₂ | IND3 ₂ |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| IND1 ₁ | 1.00 | 0.89 | 0.98 | 0.89 | 0.74 | 0.68 | 0.71 |
| IND2 ₁ | | 1.00 | 0.91 | 1.00 | 0.61 | 0.74 | 0.62 |
| IND3 ₁ | | | 1.00 | 0.92 | 0.72 | 0.70 | 0.73 |
| IND1 ₂ | | | | | 1.00 | 0.81 | 0.96 |
| IND2 ₂ | | | | | | 1.00 | 0.84 |
| IND3 ₂ | | | | | | | 1.00 |
| 95% Confidence limit of repeatability (lower) | | | | | 0.67 | 0.67 | 0.66 |
| 95% Confidence limit of repeatability (upper) | | | | | 0.79 | 0.79 | 0.79 |

* ₁ = measurement 1, ₂ = measurement 2.

DISCUSSION

The repeatabilities were similar to those from a previous study for medium wool Merino sheep measured at 12 months and 18 months of age considering GFW and FD (Atkins et al. 1990). Had the repeatabilities been low this would have indicated that the early measurements were unreliable. This was not the case. The repeatabilities are sufficiently high to provide some reassurance that sheep which measure well at 13 months will still measure well at 22 months of age. The efficiency of selection at 13 months to improve lifetime wool production depends on heritabilities and genetic correlations which we have not attempted to estimate. Atkins et al. 1990, suggest the use of early measurements as one in two or more stages of selection. Despite the unfavourable correlation between fibre diameter and clean fleece weight, the Woolplan indices have similar repeatabilities to the individual traits.

Some small differences were found between phenotypic correlations reported here and those in other studies. The phenotypic correlations between GFW_1 - FD_1 , GFW_2 - FD_2 , CFW_2 - FD_2 , GFW_1 - BW_1 , were higher than parameters assumed for mature sheep by Woolplan (Ponzoni, 1988), and correlations between FD_1 - BW_1 , FD_2 - BW_2 were lower in this study than those for Woolplan. Other correlations including traits GFW, CFW, FD and BW were similar.

The correlations between GFW_1 - GFW_2 , FD_1 - FD_2 , and GFW_1 - FD_1 in this study were comparable with the same correlations given by Atkins et al (1990), which considered both immature and mature measurements. Correlations between FD_1 - GFW_2 and GFW_2 - FD_2 were lower in the Atkins study. Atkins et al. (1990) considered only GFW and FD measurements.

The relationships between some characters were found to change with time. BW and CFW are more closely linked at 13 months than at 22 months (table 2). It is likely that this effect is due to the greater influence of maternal environment at 13 months.

No reports on the repeatability for standard deviation of fibre diameter or on the phenotypic relationships between this trait and other fleece characteristics have yet been published. Including measurements of FD_1 and SD_1 with CFW_1 to predict CFW_2 was little better than using CFW_1 alone. After accounting for the effect of FD_1 neither SD_1 nor CFW_1 had a significant effect on FD_2 . In fact, including both CFW_1 and SD_1 increased the accuracy of predicting FD_2 only from 0.67 to 0.70.

This result does not support the use of measurement of fibre diameter variability to reduce the incidence of "micron blowout" in later life.

REFERENCES

- ATKINS, K.D., CASEY, A.E., MORTIMER, S.I. (1990) *AAABG Proceedings of the eighth conference*. Hamilton and Palmerston North New Zealand: 277
- ATKINS, K.D., PONZONI, R.W., WALKLEY, J.R.W. (1988) *Woolplan Program Notes, May 1988*. Woolplan Special Projects Committee.
- PONZONI, R.W. (1988) Paper presented to the Woolplan Special Projects Committee May 25-26 1988 Adelaide South Australia.
- STEEL, R.G.D., AND TORRIE, J.H. (1981) *Principles and Procedures of Statistics 2nd ed.* McGraw-Hill Tokyo