REPEATABILITY OF PERFORMANCE RANKING AND WOOL PRODUCTION CHARACTERISTICS OF MERINO EWES IN A SEMI-ARID FARMING ENVIRONMENT

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SUMMARY

A flock of 205 strong wool South Australian bloodline Merino sheep run in a semi-arid cereal/sheep farming environment at Wanbi in the Murraylands area of South Australia was used to determine repeatability estimates for body weight, greasy fleece weight, clean fleece weight and mean fibre diameter. A range of key indicators were used to assess the most appropriate age of measurement and selection, in order to provide the best compromise between selection accuracy and minimisation of the period that sheep must be retained until selection is undertaken.

Repeatability estimates and phenotypic correlation coefficients obtained from the South Australian strong wool Merino strain sheep were in the low to medium range in comparison with other Merino strains present in Australia. Single performance measurements collected at 12 months of age provided a reliable and accurate ($P<0.001$) indication of later performance for body weight and mean fibre diameter. A second performance measurement of clean fleece weight and greasy fleece weight at the 18 month age provided an accurate ($P<0.001$) indication of later adult performance for these characters.

The sheep selection system recommended to Merino producers is a two-stage selection procedure involving assessment of the flock at 12 months of age for greasy fleece weight and body weight, followed by culling and a second assessment of the remaining animals for greasy fleece weight and fibre diameter at the 18 month age.

Keywords: Sheep, Merino, repeatability, selection, wool

INTRODUCTION

Merino sheep producers are forced to reach a compromise when determining the most appropriate stage at which their animals are assessed to be culled from, or incorporated into the breeding flock. Early age assessment significantly reduces the cost of husbandry, particularly on-going expenses associated with feeding the animals. It also permits a more rapid utilisation of rams. However early-life temporary environmental factors such as maternal influence can reduce the reliability of visual appraisal and objective measurements. Delaying the assessment of Merino sheep until a later stage provides a more accurate indication of lifetime performance of the animals, however the increase in age of assessment also involves greater husbandry costs and lengthens the period until the animals are available for sale or breeding.

Culling and selection within Australian stud and commercial Merino sheep flocks occurs at ages ranging from 1 to 18 months. Walkley (1987) reported that in most ram breeding flocks, the ram drop is culled sequentially between lamb marking and the major classing conducted at a later age.

In Merino studs using objective measurement, Ponzoni (1980) reported shearing of ram lambs occurred at an average 4 months of age, classing of young rams occurred at an average 11 months of age and hogget ram shearing at an average 13 months of age.

Age of selection is primarily based on a background knowledge of repeatability estimates, however there has been a lack of information in relation to South Australian type strong-wool Merino sheep run in a typical semi-arid cereal/sheep production zone. This paper reports repeatability estimates for various wool and body characters measured on ewes of this bloodline and outlines a recommendation for the most appropriate age of assessment and selection of South Australian type strong-wool Merino sheep.

MATERIALS AND METHODS

Animals and traits measured. The trial utilised 205 "Gum Hill" strong wool South Australian bloodline Merino ewes born at the Wanbi Research Centre in 1991. The compatibility of repeatability estimates obtained from trials utilising ewes or rams has been demonstrated by a number of workers including Young *et al* (1960). All sheep were consistently run as a single flock in a typical semi-arid cereal/sheep farming environment. Apart from some initial light culling of lambs, the sheep were not subjected to any form of selection or culling throughout the period of the trial. In line with normal commercial and stud practice, no attempt was made to specify the age of dam or identify the animals as being single or multiple born. Between 1991 and 1994, shearing and collection of performance records occurred on five separate occasions at successive ages ranging from 6 months to 42 months. During the trial, measurements were recorded for greasy fleece weight, off-shears body weight, clean fleece weight and mean fibre diameter.

Mathematical and statistical analysis. Analysis of the data was used to calculate phenotypic correlation of trait between each age of measurement and adult performance, phenotypic correlation of trait between adjacent measurement ages, estimated repeatability of trait and the accuracy of producing ability estimate for trait. Analysis of variance followed the method of Becker (1985), with mean square data used in the computation of repeatability estimates being calculated using Genstat 5 (1992). Calculation of the simple correlations, arithmetic mean and standard deviation utilised Microsoft® Excel (1993). Adult Performance of an animal in relation to any trait is defined as the average of the measured performance of the trait in that animal at age 30 months and 42 months.

RESULTS AND DISCUSSION

Phenotypic correlation with adult performance. Tests conducted to detect differences between the correlations of "age of measurement Vs adult performance" indicate measurement of body weight and mean fibre diameter at 6 months of age provided a medium level of phenotypic correlation with adult performance (Table 1). At this age, clean fleece weight had a very low phenotypic correlation compared with greasy fleece weight. The second assessment of measurement rankings at the age of 12 months produced high phenotypic correlations for all physically measured characters apart from clean fleece weight. High phenotypic correlation coefficients were maintained for body weight, greasy fleece weight and fibre diameter at successive measurement ages. However the phenotypic correlation coefficient for clean fleece weight remained in the low to medium range until the 30 month measurement age.

Table 1. Single character phenotypic correlation of age of measurement Vs adult performance

Character	6 months vs adult	12 months vs adult	18 months vs adult	30 months vs adult	42 months vs adult
Body weight	0.56	0.76	0.81	0.97	0.98
Greasy fleece weight	0.30	0.63	0.81	0.94	0.93
Clean fleece weight	0.17	0.39	0.55	0.89	0.87
Fibre diameter	0.58	0.77	0.76	0.92	0.94

Phenotypic correlation between adjacent ages. Phenotypic correlation between the rankings of physical measurements taken at ages 6 months and 12 months was relatively high for body weight and mean fibre diameter, while greasy fleece weight had a medium phenotypic correlation and clean fleece weight had a low phenotypic correlation coefficient (Table 2). When the 12 month and 18 month measurement rankings were compared, the phenotypic correlation coefficient of mean fibre diameter was of a similar magnitude to that of body weight and greasy fleece weight.

Table 2. Phenotypic correlation of single characters between adjacent measurement ages

Character	6 months vs 12 months	12 months vs 18 months	18 months vs 30 months	30 months vs 42 months
Body weight	0.73	0.73	0.80	0.89
Greasy fleece weight	0.56	0.72	0.72	0.76
Clean fleece weight	0.32	0.39	0.41	0.54
Fibre diameter	0.66	0.73	0.77	0.74

Estimated repeatability. The estimated repeatability of wool production characters is presented in Table 3. Body weight and mean fibre diameter had high repeatability estimates, while greasy fleece weight had a medium repeatability estimate and clean fleece weight had a much lower repeatability estimate. Repeatability estimates established by this trial are in the low to medium range of previously established estimates obtained using various Merino strains and bloodlines (Beattie 1961; Mullaney *et al.* 1970; Turner 1977; Atkins *et al.* 1992).

Table 3. Estimated repeatability of measured characters in strong wool Merino sheep

Character	Repeatability	Standard
Body weight	0.68 ***	± 0.026
Greasy fleece weight	0.55 ***	± 0.032
Clean fleece weight	0.33 ***	± 0.034
Fibre diameter	0.67 ***	± 0.027

*** T-test for differences from zero (P<0.001)

Accuracy of producing ability. When the accuracy of producing ability for each measured character was calculated, only greasy fleece weight and clean fleece weight failed to provide an accuracy of 75 per cent with the use of a single record. The use of two records for clean fleece weight still resulted in an accuracy of producing ability below the 75 per cent threshold, although the level of accuracy for greasy fleece weight did rise to 84 per cent. Two records provided a very high accuracy level of 90 percent for body weight and mean fibre diameter.

CONCLUSIONS

Repeatability estimates for the South Australian Merino strain are in the low to medium range of previously established estimates for Australian Merino strains. Providing the flock is run as a single

management group, between season environmental variation does not markedly affect relative animal rankings of measured characters.

Single records of mean fibre diameter and body weight taken at 12 months of age provide an accurate indication of adult performance for these characters. However to enable accurate selection for greasy fleece weight, sheep must undergo a two-stage selection program with measurements being collected at 12 months and 18 months of age. A two-stage selection program is also necessary to assess clean fleece weight, however the degree of accuracy will be somewhat less than greasy fleece weight.

When multi trait animal selection is conducted without the use of a selection index, a two- stage process involving measurements collected at 12 months and 18 months of age is necessary. Measurements collected at 12 months are body weight and greasy fleece weight, while measurements collected at 18 months are greasy fleece weight and mean fibre diameter.

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