

TWO-STAGE SELECTION IN AUSTRALIAN MERINO SHEEP

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Characteristics used as selection criteria in Merino sheep vary in both the age at which they can be measured, and in the cost involved in their measurement. A preliminary selection based on characteristics that can be assessed easily and cheaply at or soon after weaning will reduce the costs incurred in retaining and measuring sheep at the conventional age of 14-18 months. However, selection of a proportion of sheep at an early age will reduce the rate of genetic gain compared with that which could be achieved if selection were done only at 14-18 months, when all the required information is available.

This paper compares the total genetic gain in economic units from selecting a varying proportion of individuals at an early age with that achieved by selection at 14-18 months of age only. Two-stage selection is of particular relevance to Merino ram breeding.

The computations were based on the selection objective and values of phenotypic and genetic parameters defined by Ponzoni (1979); the traits in that selection objective were: clean fleece weight, fibre diameter, number of lambs weaned, weaning weight and ewe body weight at 5½ years of age. The characteristics chosen here as selection criteria were: clean fleece weight (CFW), fibre diameter (FD), dam's number of lambs weaned-one record (dam's NLW), weaning weight (WW), skin wrinkle score (Wr) and face cover score (FC). Information on dam's NLW and WW is available early in life for the first stage of selection, whereas CFW, FD, Wr and FC are recorded at a later age (e.g. 14-18 months). The procedure described by Cunningham (1975) was used to calculate the genetic gain achieved by using two-stage selection.

Table 1 shows the genetic gain in economic units achieved by selecting the best 6% of the sheep in different ways. The results are expressed in economic units and as a percentage of single-stage selection based on all the selection criteria. Single-stage selection based on dam's NLW and WW was half as effective as single-stage selection based on the complete set of criteria. The effectiveness of two-stage selection increased with the proportion of individuals selected in the first stage. Selection of 30% or more animals at the first stage resulted in more than 90% of the gain obtained from single-stage selection based on all selection criteria. Concerning ram selection, for example, this means that a large reduction in the proportion kept until 14-18 months of age would result in a comparatively small loss of genetic gain. Halving the population size at the first stage reduced genetic gain by less than 5%.

An appropriate choice of selection criteria at an early age could result in an important reduction of the budget for measurement with little loss of genetic gain. An extension of the work to cover alternative selection objectives and criteria is warranted.

REFERENCES

- CUNNINGHAM, E.P. (1975) Multi-stage index selection. *Theor. Appl. Genet.* 46: 55-61.
- PONZONI, R.W. (1979). Objectives and selection criteria for Australian Merino sheep. *Proc. Aust. Assoc. Anim. Breed. Genet.* 1:320-336.

TABLE 1: Total genetic gain expressed in economic units and as a percentage (%) of gain achieved by single-stage selection based on all selection criteria.

Percentage of sheep selected		Genetic gain	
First stage ⁺	Second stage #	Economic units (\$ per ewe lifetime)	%
6.0	§	4.71	49.0
10.0	60.0	6.87	71.5
20.0	30.0	8.31	86.6
30.0	20.0	8.82	91.9
40.0	15.0	9.08	94.6
50.0	12.0	9.26	96.4
60.0	10.0	9.30	96.9
70.0	8.6	9.38	97.8
80.0	7.5	9.41	98.1
90.0	6.7	9.44	98.3
§	6.0	9.60	100.00

+ At or soon after weaning; selection criteria: dam's NLW and WW

At 14-18 months of age; selection criteria: CFW, FD, dam's NLW, WW, Wr and FC.

§ No selection takes place at this stage.