TWO-STAGE SELECTION IN AUSTRALIAN CASHMERE GOATS

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SUMMARY

The consequences of using two-stage selection indices in Australian Cashmere goats were examined. It was assumed that information on down length and live weight at 10 months of age, and one record of the number of kids weaned by the candidate's dam would be available for the first selection stage. Information on down weight and down diameter (requiring laboratory analyses) would be available for the second stage, in addition to that collected for the first stage. Our results indicated that a large reduction of the proportion of animals from which fleece samples are sent for laboratory analyses could be made without seriously reducing total gain in economic units. Halving the population size at the first stage reduced gain by 7 per cent. However, selection at the first stage favoured heavy cutting but coarser than average fleeces. Thus, compared with single-stage selection, two-stage selection could result in a 'type' of goat cutting heavier, but coarser fleeces.

INTRODUCTION

Performance recording is laborious and costly. The laboratory analyses required for the determination of down weight and down diameter are particularly expensive. Pattie and Restall (1987) and MacLeod (1988) indicate that some form of two-stage selection could assist in reducing performance recording costs. The idea behind two-stage selection is to record all candidates in a first stage of selection based on characters that are cheap to measure, thus leaving the recording of more expensive characters for the second stage. In this paper we present results of two-stage selection for a comprehensive breeding objective for Australian Cashmere goats.

METHODS

The breeding objective was as defined by Ponzoni and Gifford (1989). Table 1 shows the traits included in the breeding objective and their economic value.

We assumed that information on down length (yDL), live weight (yLW) and dam's number of kids weaned (dNKW) was available for the first stage, whereas information on down weight

Table 1 Traits in the breeding objective and their economic values (EV)

Trait	EV ($)
Down weight (g)	
Young goat (yDW)	104.55
Breeding doe (dDW)	55.31
Down diameter (um)	
Young goat (yDD)	-1310.37
Breeding doe (dDD)	-3088.82
Number of kids weaned (%) (NKW)	104.26
Live weight (kg)	
Young goat (yLW)	641.66
Breeding doe (dLW)	47.61
Feed intake (kg of dry matter)	
Young goat (oFI)	-38.36
Breeding doe (dFI)	-36.74

(yDW) and down diameter (yDD) would be available only in a selected sample at the second stage.

RESULTS AND DISCUSSION

The results presented here were obtained using the phenotypic and genetic parameters assumed by Ponzoni and Gifford (1989). Table 2 shows the consequences of selecting varying proportions of bucks at the first and second stages, assuming the final proportion selected was 6 per cent. The results are total genetic gains in economic units expressed as a percentage [gain (%)] of that achieved by single-stage selection based on all the characters recorded. Single-stage selection based on the characters recorded in the first stage was only 26 per cent as effective as selection based on the complete set of characters. The effectiveness of two-stage selection increased with the proportion of individuals selected at the first stage. Selection of 40 per cent or more animals at the first stage resulted in 89 per cent or more of the potential gain. This means that a large reduction of the proportion of animals from which fleece samples are sent for laboratory analyses could be made without seriously reducing total genetic gain in economic units. Halving the population size at the first stage reduced gain by 7 per cent.

The results presented in table 2 are encouraging. They are based on the predicted total genetic gain in economic units, which is a useful statistic combining genetic and economic information. Note however, that a given total gain in economic units may be achieved in many ways by different changes in the traits in the breeding objective. Table 3 shows the genetic gain per generation in each trait in the breeding objective using single-stage (yDW, yDD, yLW and dNKW as criteria) and two-stage (1. yDL, yLW and dNKW; 2. as in 1. plus yDW and yDD as criteria) indices. It was assumed that the final proportion of bucks selected was 6 per cent and that there was no selection among does. With two-stage selection 50 and 12 per cent of bucks were selected at the first and second stages, respectively. Two-stage selection resulted in greater emphasis in down weight (yDW and dDW) at the expense of less emphasis in down diameter (yDD and dDD).

Table 2 Two-stage selection - all records taken at 10 to 12 mo of age: percentage of total genetic gain in economic units achieved selecting different proportions of bucks at the two stages

Proportion selected (x 100)		Gain (%)
First stage[A]	Second stage[B]	
6	C	26
10	60.0	54
20	30.0	75
30	20.0	84
40	15.0	89
50	12.0	93
60	10.0	95
70	8.6	97
80	7.5	98
90	6.7	99
C	6.0	100

[A] Selection criteria: down length and live weight at 10 to 12 mo of age, and dam's number of kids weaned (one record).
[B] Selection criteria: as for first stage plus down weight and down diameter at 10 to 12 mo of age.
[C] No selection at this stage.

With single-stage selection down weight and down diameter contributed 59.5 and 40.7 per cent of the total gain in economic units, respectively, whereas with two-stage selection their contribution was 68.9 and 32.0 per cent, respectively. This change in emphasis may be considered intuitively obvious since with two-stage selection the first round

will favour heavy cutting but coarser than average fleeces, and it is only in the second round that pressure to keep diameter low can be experienced. Small as they may seem, differences such as those observed in table 3 have to be examined carefully in terms of the likely long-term consequences of alternative selection strategies. Despite selecting for the same breeding objective, two-stage selection could result in a 'type' of goat cutting heavier, but coarser fleeces.

Table 3 Effect of using single-stage and two-stage indices assuming the final proportion of bucks selected was 6 per cent and there was no selection among does

	Genetic gain per generation	
Trait	Single-stage[A]	Two-stage[B]
Down weight (g)		
Young goat (yDW)	8.7	9.5
Breeding doe (dDW)	11.9	12.5
Down diameter (um)		
Young goat (yDD)	-0.22	-0.16
Breeding doe (dDD)	-0.25	-0.19
Number of kids weaned (%) (NKW)	0.34	0.53
Live weight (kg)		
Young goat (yLW)	-0.01	-0.07
Breeding doe (dLW)	-0.09	-0.13
Feed intake (kg of dry matter)		
Young goat (oFI)	0.2	0.1
Breeding doe (dFI)	0.6	0.5

A Selection criteria: yDW, yDD, yLW and dNKW.

B Selection criteria: first stage (50% selected), yDL, yLW and dNKW; second stage (12% selected), as for first stage plus yDW and yDD.

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