PHENOTYPIC AND GENETIC PARAMETERS FOR PRODUCTION CHARACTERS OF CASHMERE GOATS IN SOUTH WEST QUEENSLAND

MARY ROSE[A], *R. A. YOUNG*[A] *and S. J. EADY*[B]

*Animal Research Institute, Yeerongpilly, Qld 4 105.
[B]Formerly Dept of Primary Industries, Charleville, Qld 4470.

SUMMARY

Phenotypic and genetic parameters and the effects of sex, year of measurement and birth type are presented for fleece characters and liveweight of lo-month-old Cashmere goats. Bucks had heavier fleece weights and liveweights than does and higher yields but there was no difference in down diameter. Single-born goats had heavier fleece weights and liveweights. Year of measurement had a significant effect on most characters. Heritabilities for all characters were high. Phenotypic and genetic correlations were within the published range and confirm unfavourable genetic associations between down weight and diameter and between diameter and liveweight.

Keywords: Cashmere goats, fleece characters, heritability, genetic correlations, phenotypic correlations.

INTRODUCTION

Accurate estimates of genetic and phenotypic parameters for production characters are intrinsic to the design of efficient breeding programs for Cashmere goats, as is a knowledge of the effects of environmental factors on these characters in the accurate selection of animals based on measurement.

Pattie *et al.* (1990) have recently provided a review of the published estimates both for Australian and New Zealand goats. These data showed that there was considerable genetic variation between animals for Cashmere production, that most characters were moderately to highly heritable but that there existed a number of unfavourable genetic relationships between production characters. Rose *et al.* (1991) have also reviewed the current recommendations for breeding programs based on existing knowledge of these estimates.

In this paper we report the results of a study of a small breeding herd in southern Queensland which includes the effects of sex, year of measurement and birth type on fleece production characters and liveweight at 10 months of age and estimates of genetic and phenotypic parameters for these characters.

MATERIAL AND METHODS

The animals, the location and management of the herd and the measurements made on the animals have been described in detail by Eady and Rose (1988) and Eady *et al.* (1988). The entire flock was removed from Charleville to Hermitage Research Station at Warwick in March 1990 so both does and bucks from the 1989 drop were measured in July 1990 at Warwick.

Data presented are the combined production of 2 shearings; at 6 months and at 10 months. Complete records of greasy fleece weight (GFW), percentage yield of down (YLD), down weight (DWT), down diameter (DIAM) and liveweight (LWT) were available for 487 lo-month-old goats from 4 drops (1986-1989), the progeny of 18 sires and 235 dams. Two sires were used in 3 years, 4 in 2 years and 12 in only one year. There were 259 males and 228 females. There were 103 animals born as singles and 384 born in multiple births. Measurements for 205 progeny were available in 1987, 71 in 1988, 118 in' 1989 and 93 in 1990.

These data were analysed using the model:

$$Y_{ijklm} = \mu + s_i + G_j + T_k + B_l + e_{iiklm}$$

where Y_{ijklm} = the individual measurement; μ = population mean; s_i = the random effect of sire_i; G_j = fixed effect of sex_j; T_k = the fixed effect of year of measurement_k; B_l the fixed effect of the birthtype_l; e_{ijklm} = randomerror. Analyses were carried out using the program LSMLMW (Harvey 1987).

RESULTS AND DISCUSSION

Effects of environmental factors

Table 1 shows the least squares means for fleece characters and liveweight for each of the environmental factors. Bucks were heavier and had heavier fleece weights than does and the yield of down was lower in does. However the down diameter was sirnilar for males and females. Gifford *et al.* (1990) reported similar effects for sex although yield was lower for males than females in their herd.

Table 1. Least-squares means for fleece characters [greasy fleece weight (GFW), yield of down (YLD), down weight (DWT), down diameter (DIAM)] and for liveweight (LWT) of lo-month Cashmere goat progeny

For each character, means followed by different letters differ significantly *(P < 0.05)*

Factors	GFW (g)	YLD (%)	DWT (g)	DIAM (μm)	LWT (kg)
Sex					
Male	374.6a	41.4a	153.0a	16.6a	23.4a
Female	312.2b	34.6b	112.5b	16.4a	21.4b
Year					
1987	336.3a	33.7a	116.0a	16.7a	20.7a
1988	326.6a	36.6a	123.1a	16.2b	21.4a
1989	282.8b	42.8b	126.7a	16.0b	20.0a
1990	427.8c	38.8ab	165.2b	17.1a	27.4b
Birth type					
Single	357.5a	37.6a	136.4a	16.5a	23.6a
Multiple	329.3b	38.4a	129.2a	16.5a	21.1b

Birth type had a significant effect on both fleece weight and liveweight but not on yield, down weight or diameter. Goats born as singles had heavier fleeces and had heavier liveweights. These effects were similar to those of Gifford *et al.* (1990) for greasy fleece weight, yield and liveweight but they reported differences due to birth type for both down weight and diameter; the singles having higher down weights and coarser down.

Year of measurement had a significant effect on greasy fleece weight, down weight, diameter and liveweight. This was especially so for 1990 measurements when the comparison is confounded by a change of environment for does compared with other years. Couchman and Wilkinson (1988) found no such effect.

It would seem appropriate to investigate environmental effects and correct for any factor which is significant before using measurements at 10 months as the basis of selection.

Phenotypic and genetic parameters

Table 2 shows the least-squares means for each of the production characters and the genetic and phenotypic parameters for each production character

Table 2. Phenotypic and genetic parameters for fleece characters [greasy fleece weight (GFW), yield of down (YLD), down weight (DWT), down diameter (DIAM)] and for liveweight (LWT) of lo-month Cashmere goat progeny

Standard errors of estimates appear in brackets below the estimates. Phenotypic correlations are above the diagonal and genetic correlations below

	GFW	YLD	DWT	DIAM	LWT
Least-squares means	343.4	38.0	132.81	6.52	2.4
	(12.0)	(1.6)	(7.9)	(0.1)	(0.4)
Heritability	0.67	0.57	0.61	0.39	0.33
	(0.22)	(0.20)	(0.21)	(0.16)	(0.15)
GFW		0.22	0.68	0.40	0.26
YLD	0.26		0.83	0.41	0.26
	(0.28)				
DWT	0.72	0.85		0.52	0.03
	(0.15)		(0.08)		
DIAM	0.47	0.17	0.33		0.19
	(0.25)	(0.31)	(0.28)		
LWT	0.51	0.11	0.38	0.68	
	(0.26)	(0.33)	(0.30)	(0.24)	

Compared with herds reported by Couchman and Wilkinson (1988) in Victoria and Gifford *et al.* (1990) in South Australia for goats of similar age, these goats have higher fleece weights, lower yields and coarser down diameter. Down weights are similar to the Victorian herd but higher than the South Australian goats. These differences are however phenotypic and may not necessarily reflect genetic differences.Heritability estimates ranged from 0.33 for liveweight to 0.67 for greasy fleece weight; all characters were highly heritable. The heritability of liveweight, greasy fleece weight and down weight were higher than published estimates, for down diameter it was lower and for yield in the middle of the published range (Pattie *et al.* 1990).

These estimates would confirm that breeding programs based on mass selection for these production characters are likely to produce good responses. The phenotypic correlations between most characters are moderate although there is no correlation between down weight and liveweight. These estimates are generally within the range of those published (Pattie *et al.* 1990). This means that selection of goats with higher fleece weights than the mean would give animals which also have heavier down weights, coarser diameters and higher liveweights.

All estimates of genetic correlations were within the published range (Pattie *et al.* 1990) except those for liveweight with other production characters which were all positive and very much higher than other published ones. However in all cases they were associated with very high standard errors.

Conclusions

The unfavourable associations between down weight and diameter and between liveweight and diameter described by Pattie and Restall (1989) and Gifford *et al.* (1990) are again found here. As has been described previously by these and other authors, the use of appropriate selection indices can allow genetic improvement of down weight, diameter and liveweight within a breeding program (Rose *et al.* 1991).

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