Estimates of environmental effects and some genetic parameters for weaning weight and fleece weights of young Angora goats

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ABSTRACT

Data from 1048 young Angora goats by 15 sires in the Department of Lands and Survey's flock at Waitangi were used to obtain preliminary estimates of the effects of year, age of dam, sex, rearing rank and birth day (age). Characters studied included weaning weight, 6- and 12-month fleece weight, and yearling fleece weight (the sum of 6- and 12-month weights). Estimates were also obtained of the heritabilities of, and the genetic and phenotypic correlations among, these traits.

The weaning weights of kids out of dams aged 3, 4, 5 and 6+ years of age were heavier ($P<0.001$) than those out of 2-year-old dams by 1.9, 2.2, 2.0 and 2.5 kg respectively. Corresponding differences for 6-month fleece weight of kids were 0.05, 0.05, 0.04 and 0.04 kg ($P<0.01$) but those for 12-month fleece weight were not significant. Males were heavier at weaning than females (1.6 kg, $P<0.001$) and also had heavier 6-, 12-month and yearling fleece weights (0.08, 0.10 and 0.18 kg respectively; $P<0.001$). Single-reared animals had significantly heavier weaning weights and 6-month and yearling fleece weights than multiple-reared animals (2.4, 0.09 and 0.11 kg, respectively). Age was a highly significant source of variation for all traits.

The heritabilities of weaning weight, and 6-, 12-month and yearling fleece weights were respectively 0.28, 0.23, 0.40 and 0.53. Genetic correlations between weaning weight and 6-, 12-month and yearling fleece weights were respectively 0.0, 0.38 and 0.24. Corresponding phenotypic correlations were 0.58, 0.28 and 0.44.

Keywords Angora goats; environmental effects; heritabilities; genetic and phenotypic correlations; weaning weight; fleece weights.

INTRODUCTION

The expanding Angora goat industry in New Zealand will probably develop along the lines of other established livestock industries. Genetic improvement in commercial flocks producing mohair and meat will depend on selection policies pursued in breeding flocks from which bucks are purchased. Interest in selection objectives and performance recording systems for Angora goats is increasing. However, selection objectives must be linked with a knowledge of genetic and phenotypic parameters and sources of environmental variation, in breeding plans applied through any national goat performance-recording system ("Goatplan").

At present there is no information on genetic and phenotypic parameters for productive characteristics of Angora goats in New Zealand, and only a limited amount is available from other countries. The objective of this study was to provide preliminary estimates of environmental effects and genetic and phenotypic parameters of some traits in an Angora goat flock.

MATERIALS AND METHODS

Data for the study came from the Department of Lands and Survey's Angora goat flock at Waitangi. The Restricted Maximum Likelihood technique (Patterson and Thompson, 1971) was used to fit the fixed effects of year of birth (1978 to 1982), age of dam (2, 3, 4, 5, 6+ years), sex, rearing rank (single, multiple) and a covariate of birth day (age), as well as random sire and sire x sex effects. Heritabilities were estimated by the paternal half-sib method.

Using data from 1048 animals (representing 15 sires), analyses were conducted on weaning weight, fleece weights recorded at 6- and 12-months of age and the sum of these 2 weights to represent a yearling fleece weight.

RESULTS

The absolute ranges (and percent of overall means) in estimates of year-of-birth effects were 4.9 kg (30.2%) for weaning weight, and 0.10 (16.7%), 0.25 (26.6%) and 0.31 kg (20.3%) for 6-month, 12-month and yearling fleece weights respectively. Estimates of all other fixed effects on the characters studied are shown in Table 1.

Relative to kids out of 2-year dams, those out of older dams had heavier weaning weights ($P<0.001$) and 6-month fleece weights ($P<0.01$). The yearling fleece weights of kids out of 3-, 4- and 5-year old

TABLE 1 Estimates of environmental effects, standard deviations and heritabilities for weaning weight and fleece weights of young Angora goats.

Effect	Weaning weight	Fleece weight 6-mo	Fleece weight 12-mo	Fleece weight Yearling[1]
Number of animals	1048	972	967	944
Mean	16.2	0.60	0.94	1.54
Environmental effects (kg ± s.e):				
Age of dam (yrs)				
3-2	1.9***	0.05***	0.03	0.08**
4-2	2.2***	0.05***	0.02	0.07*
5-2	2.0***	0.04***	0.02	0.06*
⩾6-2	2.5***	0.04**	0.0	0.04
Average s.e.d.	0.3	0.01	0.02	0.03
Sex:				
Male-Female	1.6 ± 0.2***	0.08 ± 0.01***	0.10 ± 0.03***	0.18 ± 0.03***
Rearing Rank:				
Multiple-Single	−2.4 ± 0.2***	−0.09 ± 0.01***	−0.02 ± 0.01	−0.11 ± 0.02***
Birthday covariate (kg/day)	−0.07 ± 0.01***	−0.005 ± 0.0002***	−0.002 ± 0.0003***	−0.007 ± 0.001***
Standard deviations (kg):				
Genetic	1.41	0.05	0.13	0.20
Phenotypic	2.67	0.11	0.20	0.28
Heritabilities (± s.e.):	0.28 ± 0.16	0.23 ± 0.14	0.40 ± 0.28	0.53 ± 0.28

[1] The sum of 6-month and 12-month fleece weights

dams were respectively 0.08, 0.07 and 0.06 kg heavier than those of kids out of 2-year dams ($P<0.05$). Age-of-dam differences were not significant for 12-month fleece weight.

Male kids were 1.6 kg heavier than females at weaning ($P<0.001$) and had significantly heavier 6-month (0.08 kg), 12-month (0.10 kg) and yearling fleece weights (0.18 kg). Multiple-reared kids had significantly lighter weaning weights and 6-month and yearling fleece weights than kids reared as singles. The corresponding difference in 12-month fleece weight approached statistical significance ($P<0.10$). Younger animals had significantly lighter weaning weights and 6-month, 12-month and yearling fleece weights than older animals.

The genetic and phenotypic standard deviations and heritabilities for the traits studied are also shown in Table 1. The standard errors of the heritability estimates were large, reflecting the limited number of sires represented. The genetic correlations between weaning weight and 6-month, 12-month and yearling fleece weights were respectively 0.0, 0.38 and 0.24. The corresponding phenotypic correlations were 0.58, 0.28 and 0.44. Genetic correlations between 6-month fleece weight and 12-month and yearling fleece weights were both greater than unity. The phenotypic correlations were respectively 0.53 and 0.59.

DISCUSSION

Environmental Effects

As expected, age of dam, sex, rearing rank and birth day were important sources of variation in weaning weight and 6-month fleece weight. Age-of-dam and sex effects on weaning weight were in reasonable agreement with those in a Turkish study cited by Yalcin (1982). However, age-of-dam effects on yearling fleece weight were considerably smaller, and the effect of sex was larger than those cited by Yalcin (1982).

The relative magnitudes of the effects of age of dam, sex, rearing rank and age on the weaning weight and fleece weights of young Angora goats in the present study suggested that any comparisons among kids for weaning weight or 6-month fleece weight should be based on records adjusted for age of dam, sex, rearing rank and age. For 12-month fleece weight (assuming comparisons were made separately for males and females), only adjustment

for age effects may be necessary. Evaluations on yearling fleece weight would require records to be adjusted for all effects listed in Table 1 (because of the contribution of 6-month fleece weight to this trait).

The estimates of environmental effects on kid weaning weight did not show any close agreement with those that have been reported for Romney sheep in New Zealand (Tait, 1983), nor with the adjustment factors used in Sheeplan (Clarke and Rae, 1976). In developing a Goatplan performance recording system therefore, it may be prudent for adjustment factors for the weaning weights and fleece weights of young Angora goats in the Waitangi flock to be employed independently of those used for sheep.

Genetic Parameters

Preliminary analyses indicated that the heritability estimates for weaning weight, and 6-month, 12-month and yearling fleece weights were higher for females than males. Phenotypic variances were similar between the sexes, but the genetic (sire) variance components were considerably higher in females than in males. The differences were considered important enough to warrant the inclusion of a sire x sex interaction term to account for the differences in genetic variance between the sexes in influencing differences between sires. Baker *et al.* (1979) also reported differences between males and females in the heritabilties (and genetic variance components) of live weights and fleece weights of Romney hoggets.

Workers in Texas (Shelton and Bassett, 1970) and Turkey (Yalcin, 1982) have reported heritabilities of, and genetic and phenotypic correlations among, a number of Angora goat traits. The respective estimates of heritability for greasy fleece weight (yearling?) were 0.40 and 0.13 ± 0.06, the latter being lower than the present estimates for either 12-month or yearling fleece weights (0.40 ± 0.28 and 0.53 ± 0.28 respectively). Yalcin (1982) also reported a heritability of 0.17 ± 0.04 for weaning weight, which was lower than the corresponding estimate in Table 1 (0.28 ± 0.16).

These preliminary analyses indicated that the weaning weights and fleece weights of young Angora goats in the Department of Lands and Survey's Waitangi flock would respond to selection. The heritability estimate of 0.28 for kid weaning weight was close to the value of 0.20 used in Sheeplan (Clarke and Rae, 1976). However, the heritability estimates for 12-month and yearling fleece weights were greater than the value of 0.30 used in Sheeplan for hogget fleece weight. The averages of corresponding heritability estimates from Texas, Turkey and the present study suggest that Sheeplan values may be useful in the development of a pilot Goatplan recording system using the Waitangi Angora flock; at least until more reliable estimates from New Zealand goat data become available.

There were no antagonistic genetic or phenotypic correlations between weaning weight and fleece weights up to 12-months of age, nor between 6-month and later fleece weights. The high heritability estimates for 12-month and yearling fleece weights suggested that selection on greasy fleece weight could be made at the yearling stage. These conclusions may be tempered by the additional requirement to select simultaneously for reproductive and maternal abilities in females as well as for measurable fleece quality parameters such as fibre diameter and degree of medullation. No estimates of the heritabilities of these traits nor of the genetic and phenotypic correlations among them, as yet exist for Angora goats in New Zealand. Such estimates are needed, as well as reliable relative economic values in order to formulate objective breeding programmes for Angora goats.

ACKNOWLEDGEMENTS

To Mr A. Aitken, Superintendent of Land Development and Mr D. and Mrs L. McKenzie, Department of Lands and Survey, Whangarei, for the provision of records and to Mrs C. Cameron and Mr E. Cox for technical assistance.

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