THE MEASUREMENT OF CASHMERE PRODUCED BY AUSTRALIAN FERAL GOATS

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SUMMARY

Fleece samples were taken from several sites over the body of 23 feral goats. The samples were dehaired and measurements made of down diameter and its distribution. These were compared with measurements made on composite samples drawn from the total fleece of each animal, Samples taken from the hip gave the most accurate estimate of down diameter of the whole fleece at the mean but midside samples were better over the range of diameters exhibited by these goats. None of the sites were very suitable for estimating the diameter of the extreme fibres or fibre distribution. The repeatabilities of the various measurements were generally high indicating that animals raised together could be satisfactorily ranked on down diameter using a sample from any site. Production measurements recorded in two years from 20 of these goats show that diameter, yield and weight of down had high repeatabilities but diameter distribution and length of down were not repeatable over years.

INTRODUCTION

Cashmere is purchased by the major processors on the basis of weight, diameter and colour. Fibre length is also important for processing but at present it does not influence the price paid to growers. Current measurement methods involve the thorough mixing of all fleeces consigned to the buying centre, extraction of a sample for dehairing and yield estimation (content of down), then sub-sampling of the down for measurement of fibre diameter and length. If measurements are required for individual animals, the total shorn fleece is repeatedly mixed and sub-sampled. These methods are satisfactory if the buying organisation does the measurements but if independent testing is to be carried out sampling methods are required which do not involve the consignment of whole fleeces to the testing organisation.

This study was designed to examine the diameter of down at various sites on the body in order to investigate the possibility of developing a simple sampling procedure. An assessment was also made of the reliability of the various measurements used for ranking individual animals on their cashmere production.

MATERIALS AND METHODS

Twenty-three bucks which had been selected at random from the feral population of western New South Wales for the research herd at the Wollongbar Agricultural Research Centre were used. At shearing on 8 July 1981, samples were taken from a square area with side dimensions the width of a normal shearing comb (approximately 75 mm), at each of six sites on the body. These sites were:

Neck - Half-way between the point of the jaw and the shoulder blade.
Shoulder - Over the point of the shoulder blade.
Hip - Immediately below the pin bone.
Midside - 3 sites half way between the shoulder blade and the pin bone:
1 - 50 mm below the back line.
2 - Half-way between the back and belly lines.
3 - 50 mm above the belly line.

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After sampling, each goat was shorn and the fleeces together with the samples were sent to the R & D Centre of Dawson International at Selkirk, Scotland. The samples from each site and a sample from the total fleece were dehaired and the diameters of 100 fibres of down were measured using a projection microscope. Measurements of down fibre length were made with the 'fibre draw' technique commonly used for tops, recording the lengths of the longest and shortest fibres and the fibres at the median. For each fleece the yield of down was estimated from the total fleece sample.

Twenty of the bucks were again shorn on 6 June 1982. Each fleece was mixed, and representativesamples drawn at Wollongbar; the samples were then sent to Selkirk for measurements of diameter, length and yield.

Analyses of variance were used to compare the measurements at the various sites and the differences between years. The between and within animal components of variance were calculated from the analyses and used to estimate repeatabilities by intra-class correlation.

RESULTS

Mean fibre diameter of down estimated from the hip sample was closest to that for the whole fleece (Table 1). The means estimated from all other sites were significantly different from the total fleece although the range was relatively small. In general the neck sample showed the greatest departures from total fleece in the distribution of fibre diameter but the overall patterns for the other sites were similar. The repeatability of mean fibre diameter measured at the various sites was extremely high and had a low standard error. In contrast, the measures of diameter distribution had lower repeatabilities with greater errors.

TABLE 1 Means, residual standard deviations from analyses of variance and repeatabilities of various measures of down fibre diameter and its distribution on each site of sampling for 23 goats

	Diameter (μm)	Thinnest (μm)	Thickest (μm)	Percent fibres in range: <10 μm	10<20 μm	20<30 μm	>30 μm
Neck	16.62*	9.83*	26.00	3.1*	84.1	11.9*	.91*
Shoulder	16.41*	9.91*	26.00	4.3	84.3	11.0	.43
Hip	15.90	9.91*	24.43	3.6*	88.3	8.0	.13
Midside 1	15.50*	9.39	24.17	6.0	87.0	6.7	.26
Midside 2	15.55*	9.41	25.38	6.3	86.3	7.2	.21
Midside 3	15.51*	9.39	24.26	5.0	88.8	5.9*	.26
Total Fleece	15.96	9.04	25.22	5.7	85.6	8.6	.09
Residual Std Deviation	.644	.963	2.300	2.77	5.44	4.40	.831
Repeatability	.87	.49	.74	.66	.63	.79	.51
Std Error	.08	.63	.25	.37	.42	.17	.60

* Significantly different from Total Fleece ($P < 0.05$)

For mean fibre diameter of down the regression of total fleece measurement the Midside 3 sample was the highest of the various sites and the residual standard deviation afterfitting the regression was the lowest (Table 2). The other Midside samples also gave regressions close to 1 with residual standard deviations below average. with the extreme fibres, no regression was close to 1

and the residual standard deviations remained relatively high. For comparison, the standard deviations from the total fleece samples before fitting the regressions were: 1.668, 1.331 and 3.450 for the mean, thinnest and thickest diameters.

TABLE 2 Regressions of individual site measurement on total fleece measurement for fibre diameter and the extreme fibres together with residual standard deviations in the total fleece measurement for 23 goats

	Neck	Shoulder	Hip	Midside 1	Midside 2	Midside 3
Diameter						
regression	.598	.706	.908	.946	.967	.980
residual σ	1.094	.606	.849	.786	.799	.565
Thinnest						
regression	.382	.426	.505	.532	.514	.637
residual σ	1.190	1.186	1.192	1.219	1.247	1.081
Thickest						
regression	.301	.292	.294	.175	.222	.361
residual σ	3.181	3.184	3.286	3.447	3.237	3.127

There were significant increases in mean diameter and the diameter of extreme fibres in the second year (Table 3). These increases were associated with a significantly greater weight of down but average fibre length decreased slightly. The repeatabilities of down diameter, yield and down weight were high but those for the different measures of diameter distribution and length were generally low and variable.

TABLE 3 Cashmere production of 20 goats measured in two years together with between animal repeatabilities

	1981		1982				Standard
	Mean	Std dev.	Mean	Std dev.		Repeatability	Error
Diameter (μm)	15.9	1.67	17.2	1.89	*	.67	.15
Thinnest (μm)	9.2	1.39	12.2	1.58	*	-.02	.04
Thickest (μm)	25.6	5.32	28.8	3.24	*	.17	.24
% <10 μm	5.9	4.09	2.1	5.73	*	.35	.29
% 10<20 μm	85.6	9.66	82.8	8.51		.20	.25
% 20<30 μm	8.4	10.13	14.6	10.00	*	.59	.20
% >30 μm	.15	1.05	.60	.67		-.12	.31
Longest (mm)	77.6	18.78	78.4	18.03		.34	.29
Median (mm)	34.7	7.38	30.7	9.81		.23	.27
Shortest (mm)	13.8	4.41	13.0	3.66		.20	.25
Yield (%)	33.4	14.7	29.8	10.96		.64	.16
Down wt (g)	108.5	68.1	136.6	38.3	*	.62	.18

* Significant differences between years ($P < 0.05$)

DISCUSSION

Breeders require measurements of individual fleeces to determine the value of down produced and to rank animals for selection. Valuation requires accurate and precise estimates of the total fleece measurement from the samples used, while selection does not require accuracy as long as the estimates are sufficiently precise for animals to be ranked in the same order from a sample as they would from a measurement of the total fleece.

The mean diameter of down from several of the sites studied here was sufficiently different from that of the total fleece to cause either under- or over- valuation. At the mean, the hip sample was most accurate but the regressions of total fleece on site measurement and the residual standard deviations indicate that this site may not hold its accuracy over the range of diameters in this herd as well as would the midside sites. None of the sites appeared to give very accurate estimates of extreme fibres or diameter distribution, a feature that may be associated with the relatively small number of fibres measured in each sample.

The pattern of down diameter over the body did not follow a continuous gradation from forequarter to hindquarter as is common with wool diameter of sheep. With these goats the finest down occurred at the midside with coarser fibres occurring towards the extremities of the down bearing surface. As many goats differ considerably in the extent of down bearing skin this may be a feature to consider in future work on sampling sites.

Where goats are to be ranked on mean diameter of down for selection, the variation in accuracy between sites does not appear to be a problem as the repeatability is very high. This means that for practical purposes, goats that have been raised together can be compared conveniently on the basis of samples taken from a specific site on the body. Although lower repeatabilities were recorded for the extreme fibres and for the distribution classes, in general they were still high enough for ranking animals into fibre diameter classes.

Between-animal repeatabilities over years for the different measurements of cashmere production varied considerably. Animals could be ranked satisfactorily using single measurements of down diameter, yield and down weight which are the most important from the breeder's point of view. However the measurements of diameter distribution and length were not consistent and could not be used to rank animals on their true production levels. At present no meaningful comments can be made about the increases in diameter and down weight in the second year as the effects could be due to age, season or both.

We can conclude from these studies that mean down diameter measured on samples taken from a specific site can be used to rank goats that are raised together. However for accurate valuation it seems that a sample would have to be drawn from the total mixed fleece; a procedure that is still needed for estimating yield because of the considerable variation between goats in extent of down bearing skin. Using such a sample, animals can be ranked efficiently on one measurement of mean down diameter, yield and down weight.

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