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Nutrition effects on fibre quality in Angora goats during spring.

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ABSTRACT

An experiment was conducted to investigate the effect of nutritional status on fibre quality from Angora goats during spring. Two groups of 28 non-pregnant Angora does were grazed on ryegrass/white clover pasture at one of two pasture allowances; 1.0 kg and >4kg DM/head/day (low and high respectively) for twelve weeks during spring. Groups were balanced for live weight, age, fibre diameter, medullation and kemp measurements and genetic background. Live weight and fibre quality (fibre diameter, % medullation and % kemp) were measured at the start, after 6 weeks and at the end of the experiment. Mean live weight of does at the start of the experiment was 22.6 + 0.20 kg and after 12 weeks 30.9 and 25.2; sed 0.63kg for high and low allowance respectively. Neither mean fibre diameter (35.2 *vs* 34.1; sed 0.66 microns) nor medullation (5.38 *vs* 6.51; sed 1.53 %), was affected by pasture allowance over the experiment (high and low allowance respectively). However, after 12 weeks, there was a trend for % kemp measured in the fleece in does on high pasture allowance to be higher than in does on low allowance (8.16 v.s. 6.52; sed 1.04 %). All does were fibre tested again in March 1989 after grazing at a common allowance, but differences in fibre characteristics between the previous spring pasture allowances treatments were small. It appears that doe nutrition during spring can influence the kemp content in the Angora fleece. The mechanism of this effect is, however, not known.

Keywords Angora, goat, mohair, pasture allowance, nutrition, live weight, fibre diameter, micron, medullation, kemps.

INTRODUCTION

Fibre diameter and the proportions of medullation and kemp are three characteristics which contribute to the value of the mohair fleece. Kemp content is of particular importance as excessive kemp can lower the economic value of the fleece considerably. For example a kid fleece with less than 2% kemps is worth $11.35/kg compared to $7.35/kg for a fleece with 2-4% kemps. Fleeces with greater than 4% kemps are worth $4.81/kg (NZ Mohair Cashmere warehouse, Pool number 1/90, March 1990). Clearly there is an incentive to minimise the kemp content in the mohair fleece.

Currently, the main options to achieve this in NZ are:

(a) genetic selection within New Zealand Angora flocks for low kemp production.
(b) importation of superior animals from overseas for genetic improvement of New Zealand Angora flocks.

However, the heritability of kemp production appears to be low (approx 0.1; Bigham, 1990) and therefore selection for low kemp production will be slow. In addition, importation of livestock into New Zealand is subject to lengthy quarantine procedures (of the order of years) and therefore the introduction of new genes into the New Zealand bloodlines will be slow.

There is, however, evidence that environmental factors can influence mohair production and quality (Bigham and Baker, 1990; Stapleton, 1978, 1985; Winklemaier, 1983). An example is the 1987 Whatawhata Central Performance test for Angora Bucks which revealed a significant interaction between live weight gain and kemp production during spring. Bucks which grew faster during spring had higher kemp levels in their fleeces (Bigham and Baker, 1990). The higher growth rates were caused by feeding concentrate supplements to the bucks over this period which suggests that the nutritional status of the bucks was associated with the increased kemp production.

The present experiment was proposed to investigate, under controlled nutritional conditions, whether the observations from the Whatawhata Central Performance Test were the results of differential nutritional status of the bucks, and to evaluate the effect of pastoral management on fibre quality in Angora goats during spring.

MATERIALS AND METHODS

Experimental design.

The experiment commenced on 16 August 1988 immediately after shearing and concluded after 12 weeks (9 November 1988). This corresponded exactly with the period over which the observations on kemp production were made in the Whatawhata Central Performance Test in 1987.

Fifty-six pure-bred, non-pregnant Angora does were randomly allocated to two treatment groups ensuring that the groups were balanced for live weight, age, the most recent measurements of mean fibre diameter, % medullation and % kemps in the fleece (March 1988) and sire (genetic background). One group was grazed at a high pasture allowance (>4.0 Kg DM/head/day) which was intended to provide *ad libitum* access to feed and maximum potential live weight gains (H group). The other group was grazed at a "low" pasture allowance (approximately 1.0kg DM/head/day) which was intended to maintain live weight near to that at the start of the experiment (L group). The pasture mass (kg DM/ha) offered to H and L groups was similar, *per capita* allowances being determined on the basis of paddock area. This was intended to minimise qualitative differences in pasture offered to the two groups. Throughout the experiment pasture allowance was monitored weekly to maintain the desired nutritional differentiation between groups. All animals were treated with anthelminthic at the start of the trial and at 21 day intervals thereafter to minimise the effects of parasitism. Prior to the experimental period all animals had been grazed together.

Measurements

Animals were weighed at the start of the experiment and at 4 weekly intervals thereafter. Mid-side fleece samples were taken from each doe at the start of the experiment (immediately prior to shearing) and at six weekly intervals thereafter. A similar sample was also taken in March 1989, prior to shearing, to evaluate possible long term effects on fleece characteristics of the nutritional treatments. From the end of the trial until the March sampling all does were subjected to common management. Fleece samples were submitted to the Whatawhata Fibre Testing Centre for standardised evaluation of fibre diameter, % medullation and %kemps.

Feed allowance of goats was estimated using calibrated visual assessment of pasture mass before and after grazing. Pasture quality was assessed by botanical dissection of herbage samples taken during the pasture mass assessments. Fractions assessed were % green grass, %green stem, % clover, %weeds and % dead remainder.

Statistical analysis

Analysis of variance was used to analyse all animal parameters. Initial live weight was used as a covariate in all analyses and initial fibre characteristics were used as covariates in the subsequent analyses of fibre characteristics. Results for %medullation and % kemps are based on logarithmic transformations of the data. The results shown in table 1 present the untransformed means; SED's are approximations calculated to give the same Student's t value as for the transformed data.

Analysis of pasture parameters was by analysis of variance adjusted for variation between feed breaks.

RESULTS

Pasture allowances had a large effect on doe live weight over the 12 weeks of the experiment. Mean live weight of does at the start of the experiment was 22.6 *vs* 22.6; sed 0.20 kg and after 12 weeks was 30.9 *vs* 25.2; sed 0.63 kg for H and L groups respectively (Figure 1). Mean feed allowance was 4.23 *vs* 1.03; sed 0.077 kg DM/d for H and L groups respectively. The botanical composition of the pasture on offer was similar for both groups (Table 1).

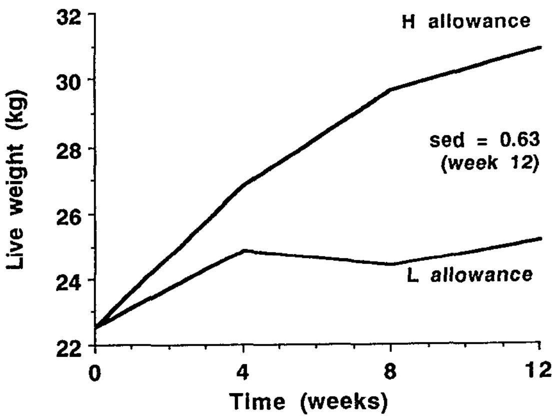

FIG 1 Live weights of Angora does grazed at pasture allowances of approximately 1.0 kg DM/head/day (L allowance) or >4.0 kg DM/head/day (H allowance) over 12 weeks during spring.

TABLE 1 Mean feed allowances (kg DM/head/day) of Angora does together with the mean composition of pasture on offer over the experiment

Treatment group (allowance)	H	L	s.e.d
mean feed allowance (kg DM/head/day)	4.23	1.03	0.077
Botanical composition of herbage offered:			
%green grass	65.7	68.9	2.55
%green stem	4.54	5.16	1.401
%clover	15.1	15.1	2.55
%weeds	8.3	5.2	2.44
%dead remainder	5.98	5.55	1.542

The change in fibre characteristics over the experiment are shown in Table 2. Mean fibre diameter, % medullation and % kemps increased in both H and L groups over the experiment. However, despite an apparent trend for increased %kemp in H group animals, statistically significant differences between H and L groups could not be demonstrated for the fibre characteristics at the 5% level. The statistically non-significant difference in % kemp at week 12 was found, by exclusion, to be due to the influence of two animals in the L group which had kemp levels in excess of 12%. There was, however, no valid reason to exclude these from the final data set. In the succeeding March samples the fibre characteristics of animals which had been in H and L groups during the experiment were similar.

DISCUSSION

Mohair production has a seasonal cycle which is dependent upon photoperiod and is largely independent of nutrition (Stapleton, 1978; 1985; Winklemaier, 1983). Fibre production increases in early spring when fibre diameter, length growth and the proportion of medullated fibres in the fleece increase to a peak in early summer. Production declines in late summer and through autumn and winter with a concurrent reduction in fibre diameter, length growth and medullation. The present investigation is in agreement with these principles over spring.

There is little published information on the effect of differential nutrition on mohair production and fleece quality. Early studies by Müftüoglü (1962) and Malacheck and Leinweber (1972) found that Angora goats on poor quality feed or low feed allowances had lower fibre production than those on quality feed or higher allowances. This was expressed as a reduction in both fibre diameter and fibre length. Though the live weight data in Figure 1 demonstrate that differential feed intakes were achieved in the present study it was not possible to demonstrate any effect on fibre production.

More recent research has studied the effect of supplementing the diet of Angora goats with concentrate feeds and with feeds with a high proportion of "protected" protein (Shelton and Huston, 1966; Huston and Shelton, 1967a,b; Menzies,1967; Huston, *et al.*, 1971; Stewart, *et al.*, 1971). Increases in fibre production of up to 26% were recorded, mainly a result of an increase in fibre diameter. More recently, Throckmorton *et al.* (1982) found that mohair growth was significantly enhanced by the supplementation of the diet with 5% formaldehyde-treated casein ("protected" protein). Fibre growth was increased from 0.52 to 0.90 mg/cm^2/day. These results suggest that the supply of high quality protein to the. abomasum (i.e. not

TABLE 2 Fibre characteristics of Angora does grazed at pasture allowances of approximately 1.0 kg DM/head/day (L allowance) or >4.0 kg DM/head/day (H allowance).

Fibre trait		Fibre diameter (m)			%medullation			% kemps		
Treatment group (allowance)		H		L	H		L	H		L
Time (weeks):										
	0	30.8		31.1	5.06		4.56	1.59		1.67
			(0.70)			(0.691)			(0.162)	
	6	31.9		31.6	4.73		4.71	5.80		4.35
			(0.63)			(1.023)			(0.905)	
	12	35.2		34.1	5.38		6.51	8.16		6.52
			(0.66)			(1.536)			(1.046)	
March sample		35.0		34.9	4.32		6.32	4.61		3.82
			(0.57)			(1.031)			(0.373)	

Figures in parenthesis are the standard errors of differences between means (sed).

degraded in the rumen) is more important factor than overall nutritional level. This possibly explains the lack of effect of differential feed intake on fibre production in the present experiment. However, this hypothesis can not be confirmed from the present study because it was not possible to measure intake with enough accuracy to predict differential protein flow to the abomasa of these animals.

The above studies, whilst demonstrating the effects of nutrition on fibre diameter and overall fibre productivity, did not report any effects of nutrition on the proportion of medullated fibres in the fleece (including kemps). Lupton *et al.*, (1990), Nicoll *et al.*, (1989) and Bigham and Baker (1990) have shown that the phenotypic correlation between fibre diameter and %medullation is low (0.2-0.4) and between fibre diameter and %kemps is very low (-0.02 to 0.29). Therefore, since the major effect of nutrition on fibre productivity is apparently a result of changes in fibre diameter and length, a lack of effect of nutrition on %medullation and %kemp in the fleece is, perhaps, unsurprising.

The present investigation is not at variance with the results of these previous investigations. However the results of the 1987 Central Performance Test, the apparent trend in the present study for increased %kemp at higher pasture allowances and the lack of phenotypic correlation between kemp and other fleece characteristics suggest that environmental factors have an influence on the expression of kemp levels in the fleece which is independent of fibre diameter.

The present study has not confirmed or discounted the hypothesis that the nutritional status of the Angora goat affects the quality and economic value of the mohair fleece. However, more information is needed to determine the cause of the apparent environmental effects on fleece quality.

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