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Effect of feeding and season on fleece characteristics of Cheviot, Drysdale and Romney hogget wool

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ABSTRACT

The effect of feed allowance (approximately 150 and 250 g green DM/kg live weight$^{0.75}$/d) and season (sampling at 12-week intervals) on objectively measured wool characteristics of Cheviot, Drysdale and Romney hoggets was examined.

Improved feeding increased wool growth rate, fibre diameter and brightness. Feeding level did not affect fibre diameter variation, loose wool bulk or yellowness.

Wool grew faster and was coarser during summer than during winter. Fibre diameter variation for the Cheviot and Romney was greatest in winter and least for the Drysdale in summer. There was no defined seasonal cycle for loose wool bulk. Colour indices were related to prevailing weather conditions. Maximum and minimum values for each characteristic were strongly correlated for fibre diameter and fibre diameter variation, weakly correlated for loose wool bulk and not consistently related for wool growth rate and colour indices.

INTRODUCTION

New Zealand sheep breeds exhibit an inherent seasonal cycle for wool growth rate with a summer maximum and winter minimum (Sumner and Wickham, 1969; Bigham *et al.*, 1978).

Objective measurement techniques have recently been developed to measure characteristics previously assessed by hand and eye appraisal, namely loose wool bulk, brightness (CIE Y value) and yellowness (CIE Y-Z value). There are no published data of seasonal effects on these characteristics within individual fleeces of grazing sheep.

In 1978 a trial was conducted at Whatawhata Hill Country Research Station to examine the effects of pasture allowance and season on wool growth of hoggets. Objective fleece characteristic data are reported here.

EXPERIMENTAL

Trial Design

Between January 1978 and February 1979 allowances of approximately 150 and 250 g green DM/kg live weight$^{0.75}$/d of pastures with a pre grazing mass of 1400 to 2000 kg DM/ha were offered to groups (n = 32) Cheviot, Drysdale and Romney wether hoggets. Five hoggets died during the trial and their data were rejected from analysis.

Measurements

All hoggets were weighed and a mid side wool sample clipped at approximately 12-week intervals between January 1978 and February 1979. Clean weight, fibre diameter (Lynch and Michie, 1976), loose wool bulk (Dunlop *et al.*, 1974) and Y (brightness) and Y-Z (yellowness) CIE values (Hammersley and Thompson, 1974) of each sample were measured. Wool growth rate was estimated by proportioning clean fleece weight according to the relative weight of clean wool grown on the patch.

Analysis

Breed and allowance effects were analysed by analysis of variance pooled over sampling periods. Seasonal effects were analysed by a split-plot procedure (Gill and Hafs, 1971) using live-weight gain as a covariate.

RESULTS AND DISCUSSION

Live-weight Gain

Initial live weights were 26.5 (± 1.6) kg, 26.6 (± 1.6) kg and 27.1 (± 1.6) kg for the Cheviot, Drysdale and Romney respectively. The high allowance group showed a greater live-weight gain than the low allowance group with the Romney and Cheviot growing faster than the Drysdale (Table 1).

Wool Growth

Wool growth rate of the Cheviot was 40% less than that of the Drysdale and Romney and was less influenced by feed allowance than the other 2 breeds (Table 1). This trend was in contrast to data of Sumner *et al.* (1981) which showed clean fleece weight of Cheviot and Romney hoggets to be equally affected by long term differential feeding.

TABLE 1 Least-square means for live-weight gains and wool measurements pooled over sampling periods.

Breed	Allowance (kg DM/kg $LW^{0.75}$/d)	Live-weight gain (g/d)	Wool growth (g/d)	Fibre diameter Mean (μm)	Fibre diameter CV (%)	Loose wool bulk (cm^3/g)	CIE value Y	CIE value Y-Z
Cheviot	154	29	4.4	32.8	22.4	24.9	54.7	2.1
	250	49	4.8	34.7	22.0	25.6	56.4	1.9
Drysdale	161	23	7.2	31.2	37.9	18.6	61.2	1.8
	250	46	8.6	33.2	34.7	18.7	61.7	1.6
Romney	155	32	6.5	31.6	23.7	18.9	56.6	2.5
	240	52	8.8	33.2	23.9	18.5	57.1	2.4
Breed effect		*	***	*	***	***	***	***
Allowance effect		***	***	***	ns	ns	**	ns
B × A effect		ns	**	ns	ns	ns	ns	ns

Each breed exhibited a marked seasonal cycle of wool growth with a difference between the winter minimum and following summer maximum of 1.9 ± 1.9 g/d, 5.7 ± 2.8 g/d and 5.2 ± 3.5 g/d for the Cheviot, Drysdale and Romney respectively. These seasonal amplitudes are comparable to Cheviot and Romney hogget data reported by Bigham *et al.* (1978).

Fleece Characteristics

Cheviot wool was both coarser and bulkier than Drysdale or Romney wool. Drysdale wool was brighter with a higher within-sample variation in fibre diameter than Cheviot or Romney wool. Romney wool was yellower than Cheviot wool, which in turn was yellower than Drysdale wool (Table 1). These breed rankings for each fleece characteristic are consistent with data previously reported by Sumner *et al.* (1981).

Improved feeding resulted in coarser, brighter wool but did not affect other measured characteristics (Table 1). Sumner *et al.* (1981) reported a similar effect of feed allowance on fibre diameter, with no effect on loose wool bulk. In contrast they also reported yellowness to increase with improved feeding while brightness was unaffected. Staple length is one of several characteristics considered to be associated with yellowing in wool (Wilkinson, 1982). Whereas Sumner *et al.* (1981) measured full length hogget wool, clipped patches were measured in this trial. The type of yellow colouration present in the 2 trials may therefore be different (Wilkinson, 1982).

All characteristics showed a significant time effect and, except for wool growth rate and yellowness, a significant time × breed interaction of limited practical significance (Fig. 1).

The difference in fibre diameter between the winter minimum and following summer maximum was 8.9 ± 4.2 μm, 8.9 ± 3.2 μm and 11.4 ± 3.7 μm for the Cheviot, Drysdale and Romney, respectively. The Drysdale showed a reversed seasonal trend in fibre diameter variability compared to the Cheviot and Romney, indicating possible seasonal differences in the growth rate and fibre diameter of primary and secondary fibres in this breed.

There was no definitive seasonal trend for loose wool bulk. The range observed during the sampling period was 2.5 ± 3.2 cm^3/g, 1.3 ± 2.1 cm^3/g and 1.0 ± 3.0 cm^3/g for the Cheviot, Drysdale and Romney respectively. This observed range is insufficient to be of manufacturing significance (Carnaby and Elliott, 1980). The biological factors contributing to loose wool bulk are not sufficiently well understood to confirm whether this lack of a seasonal trend in loose wool bulk is a real effect. If it is, however, it may be inferred that loose wool bulk is unlikely to be affected by the time of shearing.

Brightness and yellowness both showed marked seasonal trends influenced by prevailing moisture and temperature conditions rather than the wool growth cycle. Yellow discolouration developed during periods of warm autumn and spring rains which depressed brightness. Fleece yellowing in long wool is likely to be more pronounced than in frequently clipped patch samples due to the effects of the micro-climate within the longer fleece and the accumulated effect of previous yellowing. With current price differentials between style grades of crossbred wool being approximately 2.5 c/kg (clean) (Wiggins and Beggs, 1979) and style grades varying by between 1.0 and 1.5 Y-Z CIE units (M. K. Corrigan, unpublished data), the increased colour resulting from delayed spring shearing could be of considerable economic importance. Likewise delayed autumn shearing may also result in increased fleece discolouration though the effect is unlikely to be as severe as in the late spring.

There was a strong within-breed correlation between maximum and minimum values for mean fibre diameter and coefficient of variation of fibre diameter, a weak

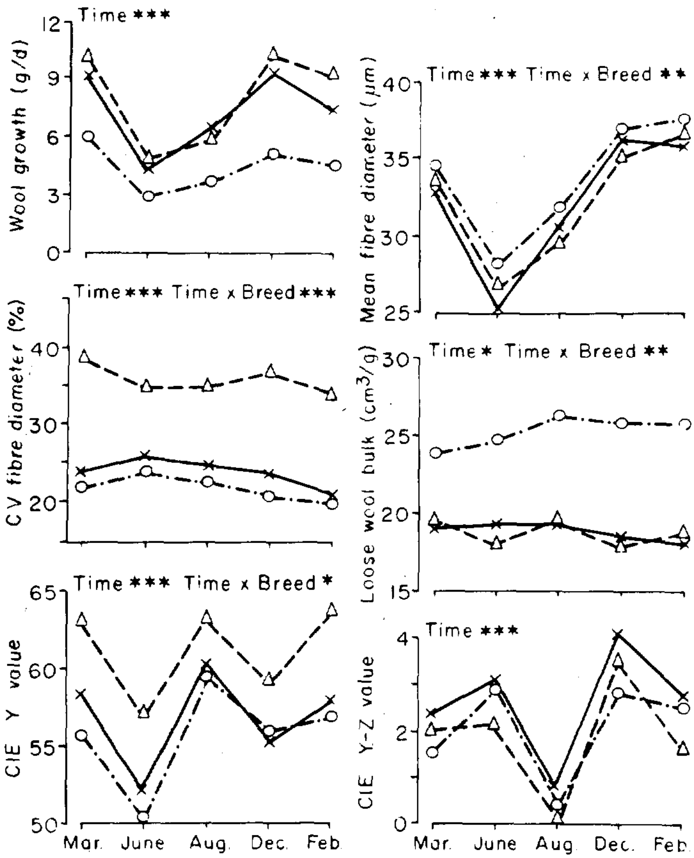

FIG. 1 Least-square means for wool measurements at each sampling adjusted for live-weight gain (○— Cheviot, △— — Drysdale, × — Romney).

TABLE 2 Within-breed correlation coefficients between maximum and minimum values for measured wool characteristics.

Breed	Wool growth (g/d)	Fibre diameter Mean (µm)	Fibre diameter CV† (%)	Loose wool bulk (cm³/g)	CIE value Y	CIE value Y-Z
Cheviot	-0.06 ns	0.68***	0.57***	0.36*	0.52**	0.12 ns
Drysdale	0.01 ns	0.55***	0.81***	0.30 ns	0.07 ns	0.02 ns
Romney	0.38*	0.60***	0.40*	0.70***	0.05 ns	-0.08 ns

† Rank correlation coefficient.

correlation for loose wool bulk and no consistent significant correlation for wool growth rate, brightness or yellowness (Table 2). It is therefore likely to be more accurate to select young second-shorn sheep for wool production on the basis on their total annual wool production rather than individual spring or autumn shorn fleece weights. Wilkinson (1982) has also shown, on the basis of *in vitro* testing of wool samples, that it is not possible to rank sheep as to their likelihood of future yellow discolouration according to their yellowness in winter.

It is apparent from the measured seasonal trends for the objective fleece characteristics measured in this trial that while loose wool bulk is not influenced by feeding or season and yellowness is not influenced by feeding, yellowness is strongly influenced by season. Price penalties for yellow discolouration can however be minimised by the judicious choice of shearing times. Shearing either pre or immediately post lambing is likely to result in wool with minimal yellowing. This wool is also likely to be relatively sound as any tensile weakness in the wool due to the winter reduction in fibre diameter will be near the base of the staple and therefore of limited manufacturing significance.

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