THE SEASONAL LENGTH GROWTH OF WOOL AT PASTURE IN THE MERINO, POLWARTH AND THEIR RECIPROCAL CROSSES IN TASMANIA

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SUMMARY

After their inherent photoperiodic rhythm as hoggets had been measured in a 15 month penfed experiment, the wethers (sampled from 4 Merino and Polwarth based genotypes) were monitored for seasonal periodic staple length growth at pasture as adults. Samples of hoggets of similar breeding but different drops and years were also monitored. The seasonal staple length growth rhythm of the adult wethers was similar to their inherent photoperiodic rhythm. The seasonal rhythms of other hoggets of similar breeding but in different years were also similar to the inherent photoperiodic rhythm.
Keywords: seasonal wool production, photoperiodic rhythm, Merino crossbreds

INTRODUCTION

In a prior penfeeding experiment, Butler and Head (1993) established the amplitude of the inherent photoperiodic rhythm (40%) of a sample of 4 common genotypes (the Merino, the Polwarth and their reciprocal crosses) in Tasmania. In that work, due to the absence of seasonal wool growth data relating directly to the experimental animals, the photoperiodic rhythm was compared with seasonal rhythms from published Tasmanian field work using sheep of different breeding.

This paper provides further information on the seasonal rhythm of wool growth and its relation with the inherent photoperiodic rhythm at Tasmanian latitudes. It reports estimates of the seasonal wool production of the housed animals when run at pasture, but at an adult age, together with estimates from animals of similar breeding, but at hogget age and in different years. The information indicates the sensitivity of the inherent rhythm to seasonal factors, and thus the ease with which it may be manipulated by management in order to reduce seasonal variation in wool growth and, potentially, to improve staple strength.

MATERIALS AND METHODS

In 199 1 (Butler and Head 1993) experimental animals, which had been previously housed, were run together as adults in a small mob at pasture and their fleece growth returned to 12 months. The genotypes involved (Table 1) were the Merino (M), Polwarth (P), and reciprocal first cross (MP, PM) as described by Butler *et al.* (1993). During 1992, when aged 4 years, staple length growth of these animals was monitored at pasture by dyebanding (Wheeler *et al.* 1977) approximately every 6 weeks. At the annual shearing (November), midside samples were collected and staple length and strength measured by the Australian Wool Testing Authority. The position of break (POB) was calculated as described by Butler and Head (1993).

In addition, in each of 2 years (1989 and 1990) groups of 15 hoggets aged 15 months were selected at random from each genotype. The genotypes of the hoggets monitored in 1989 (Table 1) were the same as the housed animals but from a different drop. The genotypes studied in 1990 (Table 2) were extended to include second cross animals (MxMP, PxMP, MPxM, MPxP, and MPxMP). The animals were monitored for staple length growth by dyebanding approximately every 6 weeks.

The staple length growth rate in each period was estimated as % staple length growth per day. The amplitude of the seasonal staple length growth rhythm was calculated according to Hutchinson (1962). Data were analysed by analysis of variance and regression analysis.

RESULTS

The mean periodic staple length growth rates, staple length, staple strength and calculated POB of the fleece wool of the adult wethers at pasture are given in Table 1. The seasonal rhythm of the adult wethers at pasture in 1992 was about 45% with a June/July trough (Fig. 1). There was no significant difference ($P>0.05$) between genotypes for staple strength or POB (average 47.1 N/Ktex and 57.8 respectively; Table 1), but the staple length of the PxM genotype was significantly ($P<0.05$) lower than the other genotypes. The correlation of this rhythm with staple strength of the 1992 fleeces accounted for no more than 2% of the variation.

Table 1. Mean periodic staple length growth rates (% per day) by the adult wethers at pasture in 1992, and 1988 drop sheep measured as hoggets at pasture in 1989

Parameter	Genotype					LSD
	M[A]	P	MxP	PxM	Overall	
Adult wethers 1992						
Mean % staple length growth rate per day	0.30	0.30	0.30	0.30	0.30	0.020
Standard deviation	0.041	0.045	0.040	0.038	0.040	
Rhythm (%)	44.4	49.4	43.1	43.0	45.1	10.6
Staple length (mm)	106[bB]	121[b]	111[b]	90[a]	112	16.2
Staple strength (N/Ktex)	44.9	42.2	49.2	51.9	47	11.7
Position of break	61	54	63	53	58	10.3
1988 drop hoggets 1989						
Mean % staple length growth rate per day	0.27	0.28	0.28	0.28	0.28	0.028
Standard deviation	0.019	0.033	0.018	0.021	0.021	
Rhythm (%)	45.6	54.1	42.5	47.7	47.6	12.1

[A]M = Merino; P = Polwarth; MxP = Crossbred (Merino ram x Polwarth ewe) etc.
[B] Within rows values followed by different letters are significantly different (P = 0.05).

The periodic staple length growth of the 1988 drop hoggets is given in Table 1, and that of the 1989 drop hoggets in Table 2. For hoggets at grazing, the seasonal rhythm in terms of staple length growth per day was 48% in 1989 and 39% in 1990 (Tables 1 and 2; Figure 1). There were no significant differences in rhythm between genotypes.

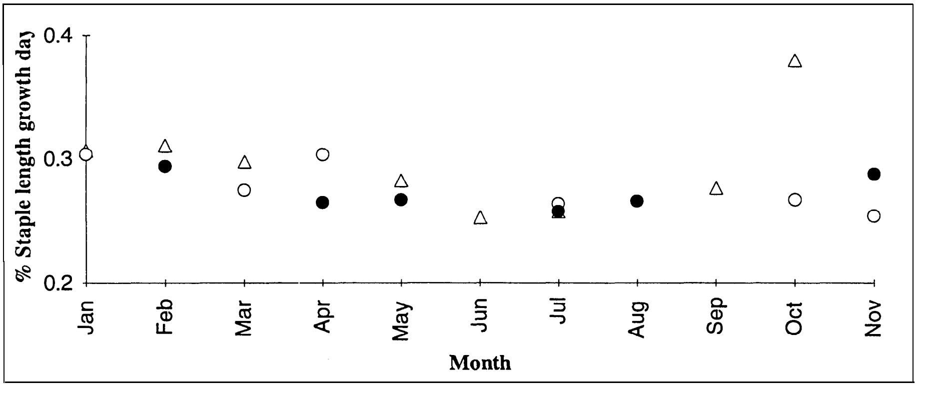

Figure 1. The seasonal pattern of wool growth rate (% staple length growth per day). Data are averaged over all genotypes for hoggets run at pasture in 1989 (o) and in 1990 (•) and for adult wethers at pasture in 1992 (A)

Table 2. Mean periodic staple length growth rates (% per day) for 1989 drop sheep measured as hoggets at pasture in 1990

Parameter	Genotype								LSD
	M[A]	P	MxMP	PxMP	MPxM	MPxP	MPxMP	Overall	
Mean % staple length growth rate per day	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.055
Standard deviation	0.016	0.019	0.014	0.018	0.018	0.013	0.015	0.014	
Rhythm (%)	38.9	40.6	39.1	40.8	43.1	35.6	37.2	39.3	9.2

[A]M = Merino; P = Polwarth; MxP = Crossbred (Merino ram x Polwarth ewe) etc.
Within rows values followed by different letters are significantly different (P = 0.05).

DISCUSSION

The amplitude of the seasonal rhythm of the adult wethers at pasture was similar to that of the inherent photoperiodic rhythm (measured in pens as hoggets by Butler and Head 1993), in contrast to expectations (Hutchinson 1962). A seasonal amplitude greater than the inherent amplitude would be expected, given the additional seasonal influences, such as variation in nutrition and disease/parasite burdens, experienced at pasture. In particular, since the animals were used to graze a variety of small areas, their diet varied through the year.

This result would suggest therefore that the seasonal influences complemented, rather than enhanced, the inherent photoperiodic pattern, resulting in no apparent change in staple length growth amplitude. In terms of nutritional influences the spring flush of feed generally occurs prior to December, before the staple length growth rate appeared to peak. Similarly, the greatest feed deficit period is generally just after the June/July trough in staple length growth rate. Therefore these seasonal nutritional peaks and troughs do not appear to coincide with the photoperiodic peaks and troughs. Rather, they precede and follow the respective inherent photoperiodic peak and trough, and may therefore enhance the "shoulder" segments of the seasonal pattern of staple length growth.

Seasonal rhythms of similar magnitude (48% and 37%) were recorded for the hoggets at pasture in 1989 and 1990. Further, the amplitude of the seasonal rhythm of Tasmanian Polwarth ewes and wethers run together (Butler *et* al. 1994) was about 45% while that for wethers under more extensive (variable) management conditions, involving a number of paddock changes and scavenging roles, was about 70%. In contrast, in a survey of mainly Polwarth hoggets throughout Tasmania, Butler and Head (1992) found a low average seasonal rhythm of 21%. Presumably the low seasonal rhythm of these commercial hoggets at pasture was due to the common practice of preferential management of young animals.

Although the seasonal trough in staple length growth rate of these sheep at pasture was distinct, the peak was not, due to shearing occurring at about that time. This demonstrates that care is needed in designing investigations into seasonal patterns of wool growth, and that it is desirable to accumulate more than a single year of data, particularly if shearing time coincides with a peak or trough. There is no obvious reason for the especially high staple length growth rate in October for the adult wethers.

Figure 2 shows the distinct December/January peak and June/July trough when all available Tasmanian field data are combined. These data include this work and the reports of Butler and Head (1992) and Butler *et al.* (1994a, b). In addition, 3 Departmental reports (Butler and Head, unpublished) of investigations into block grazing, supplementary feeding of ewes, and grazing management for worm control are included. In these experiments, wool growth of Merino and Polwarth sheep was monitored at pasture by dyebanding.

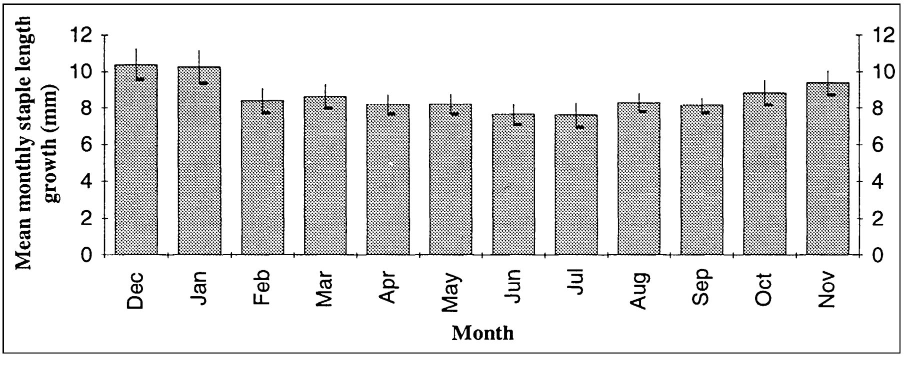

Figure 2. Mean monthly staple length growth rates for all Tasmanian seasonal wool data combined. Vertical bars represent standard deviation

As latitude increases, the amplitude of the photoperiodic rhythm may increase and breed effects may be important (Nagorcka 1979), resulting in more difficulty in manipulating the seasonal rhythm by management. Even at the relatively low latitudes of this work, the rhythm values, together with the low correlation for staple length growth rate with rhythm, indicate that it should be possible to overcome the inherent influence of photoperiod in Tasmanian wool growing sheep and to manipulate their seasonal wool growth pattern. Such manipulation may consequently enable staple strength to be improved. Further work is needed to determine the economics of such nutritional manipulation.

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