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## Wool production from wet and dry ewes on southern North Island hill country

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### ABSTRACT

A replicated trial with 4 stocking rates of 'wet' ewes (9.0, 10.5, 12.0, 13.5 sheep/ha) and 4 stocking rates of 'dry' ewes (11.0, 13.5, 16.0, 18.5 sheep/ha) was established at the DSIR Grasslands 'Ballantrae' Hill Country Research Station to enable hill country farmers to make informed decisions as to the economics of farming breeding or unmated ewes.

Stocking rate had a large effect on liveweight throughout the year with the greatest effect being in winter. Mean weaning weight of lambs was 25.4 kg at 9.0 ewes/ha and 19.7 kg at 13.5 ewes/ha.

Dry ewes grew more greasy wool/ha than wet ewes ( $P < 0.05$ ). Greasy wool production ranged from 41.6 kg/ha at 9 wet ewes/ha to 81 kg/ha at 18.5 dry ewes/ha. At 13.5 sheep/ha dry ewes grew 28% more greasy wool than wet ewes which reared 1.2 lambs to weaning. November/December fleece weight/ha was unresponsive to increasing stocking rate for wet ewes ( $P > 0.05$ ) but increased with increasing stocking rate for dry ewes. May-shorn fleece weight/ha increased with increasing stocking rate for both wet and dry ewes ( $P < 0.01$ ). November/December fleeces were 18.6% heavier from ewes in paddocks having a sunny aspect than in paddocks with a predominantly shady aspect ( $P < 0.001$ ). Slowest wool growth occurred during August, being 5.3 to 8.3 mm/month and maximum wool growth occurred during January within the range 17.3 to 18.5 mm/month.

**Keywords** Sheep, wool, stocking rate, hill country, physiological state.

### INTRODUCTION

To enable hill country farmers to decide with confidence whether an all-wool farming system, a breeding ewe system or a combination of both is more profitable, production models from which the relative performance of each option can be estimated are needed.

Data available in New Zealand comparing wet and dry ewes have often been confounded because treatment groups were formed using pools of sheep which were already pregnant or dry (eg Hight *et al.*, 1976). Sumner and McCall (1989) found in a trial conducted under controlled grazing conditions ewes rearing either single or twin lambs grew 6 and 9% less wool respectively, than dry ewes. The effect of typical seasonal liveweight fluctuations, as experienced in practical farming, on ewe wool production could not be examined.

This paper reports the first two year's data of a three year trial comparing wool production from wet and dry Romney ewes at a range of stocking rates on southern North Island hill country.

### METHODS AND MATERIALS

#### Trial design

One hundred and thirty mixed-age Romney ewes were randomised on a liveweight basis to either wet or dry main treatments in March 1989. Wet ewes were mated to Romney rams and later pregnancy tested before being randomised into one of 4 stocking rate treatments. The trial started after shearing in May 1989. Wet ewe treatments were stocked at 9, 10.5, 12 and 13.5 sheep/ha and dry ewes at 11, 13.5, 16 and 18.5 sheep/ha, chosen to represent realistic stocking rates for the Ballantrae environment. The highest and lowest stocking rate in both wet and dry ewe treatments were replicated 3 times, and the intermediate stocking rates twice. Ewes were not randomised at the beginning

of the second 12 month cycle and were mated in their treatment groups.

Paddocks ranged from 0.6 to 0.9 ha with a minimum of 6 sheep/paddock. Each paddock was classified as being either predominantly sunny or shady. Major pasture species were browntop, crested dogstail, ryegrass, Yorkshire fog, white clover, *Lotus pedunculatus* and a wide range of weeds (eg. thistle, rushes, gorse). Reactive rock phosphate was applied to the area at 250 kg/ha in June 1989 after annual applications of 125 kg superphosphate/ha/yr had been applied for the preceding 15 years.

#### Management

Sheep were set stocked throughout the trial in their respective paddocks. Ewes which died; those culled for exceptionally poor condition; or those which failed to either conceive or produce a live lamb, were replaced with equivalent sheep from the wet or dry reserve flocks. Ewes were drenched monthly to control internal parasites. Lambs were removed at weaning in December. Replacement two tooth ewes were not run on the trial area.

#### Measurements

All ewes were weighed monthly. Lambs were weighed at weaning. Each month wool growth (elongation) rate was estimated by dye-banding (Chapman and Wheeler, 1963). 'Durafur Black R' and 'Nako Yellow 3GA' dyes (alternated between months) were applied with a fine pipette to the skin as a vertical 5 cm line on the mid-side flank of each sheep. Fleeces were shorn and weighed in November 1989, May 1990, December 1990 and May 1991.

Where replacement sheep were used, their monthly wool growth rate data were omitted from analyses until after a 3 month stabilisation period. Fleece data of replacement ewes were not used until after their first shearing on the trial.

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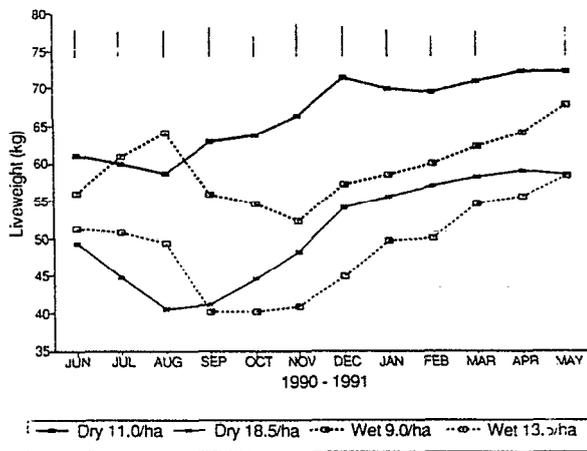
Fleece weight data were analysed by regression analysis using stocking rate as a covariate. Wool growth rate and ewe liveweight data from each sampling date were analysed by analysis of variance. The model included terms for stocking rate, reproductive status and aspect.

## RESULTS AND DISCUSSION

### Liveweight

Ewe liveweight patterns, which indicate changing nutrition throughout the year, were similar in both years. Some of these patterns in year 2 are presented in Fig. 1. Mean liveweight was significantly lower within high-stocked wet and dry treatments than in respective low-stocked treatments in all months ( $P < 0.05$ ). While low-stocked wet ewes gained weight during pregnancy, high-stocked wet ewes did not. Mean liveweights of high-stocked wet and dry ewes were similar in September but, without the stress of lactation, dry ewes recovered more quickly than wet ewes. Both groups were the same weight in May. Low-stocked wet ewes were lighter than low-stocked dry ewes except during late pregnancy.

**FIGURE 1** Mean liveweight of wet and dry ewes in 1990-91 at the respective lowest and highest stocking rates. Vertical bars represent  $LSD_{0.05}$  values.



Mean weaned liveweight of lambs is shown in Table 1. As expected the heaviest lambs were grown at the lowest stocking rate reflecting both better ewe nutrition and heavier ewe liveweight. Between 1.15 and 1.25 lambs were weaned per ewe within each treatment in both years. These ratios, which showed no trends between stocking rates, cannot be interpreted as lambing percentages as replacement sheep were introduced at various times during the trial.

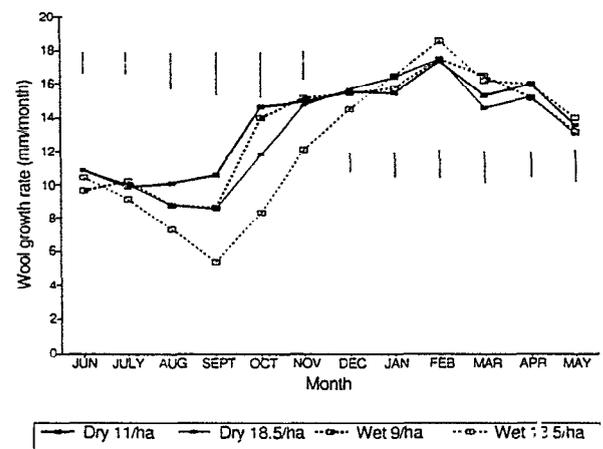
**Table 1** Mean (SE) lamb liveweight at weaning (kg/head).

	Stocking rate			
	9.0	10.5	12	13.5
1989	24.2 (0.8)	20.6 (0.8)	20.6 (1.0)	19.7 (0.6)
1990	25.4 (0.7)	22.4 (0.8)	21.4 (0.6)	19.7 (0.7)

### Wool growth rate

Mean monthly growth rates averaged over 2 years (Fig. 2) ranged in wet ewes from 5.3 mm/month at 13.5 sheep/ha and 8.6 mm/month at 9 sheep/ha in August ( $P < 0.05$ ), to between 17.3 and 18.5 mm/month in both wet and dry ewes across all stocking rates in January. Significant differences within each year between stocking rates within both wet and dry treatments were found only between July and December ( $P < 0.05$ ), with the stocking rate effect being much greater on wet ewes after lambing. This supports work by Coop (1953) who found that the reduction of wool growth rate in winter and spring was much greater during lactation than pregnancy and by Sumner and Wickham (1969) who reported wool growth rate recovery to be slower at 22 EE/ha than at 11 EE/ha. Wool growth is clearly affected by plane of nutrition which is equivalent to stocking rate except in times of surplus feed (Sumner and Rattray, 1980; Sumner *et al.*, 1981; Geenty *et al.*, 1984). However even at a constant plane of nutrition winter wool growth is 3 to 4 times slower than in summer due to the effect of photoperiod (Geenty *et al.*, 1984). In this trial growth rate was described by elongation rate. Thinning of the fibre is another major factor in lower winter wool growth rates (Horton and Wickham, 1979) resulting in tenderness and break. In this trial pasture availability was very low in winter, particularly at the high stocking rates (K. Betteridge, unpublished data), and would have contributed to the low winter/spring wool growth rates. In November or December wool growth rate differences due to stocking rate disappeared even though the liveweight of most sheep continued to increase over the next few months. Both wet and high-stocked dry ewes reached their lowest monthly wool growth rates during August while the better-fed low-stocked dry ewes reached their slowest growth during the winter solstice in June. Peak wool growth occurred during January (Fig. 2).

**FIGURE 2** Mean wool growth rate (mm/month) averaged over two years for lowest and highest stocking rates of wet and dry ewe treatments. Vertical bars represent  $LSD_{0.05}$  values.



The increasing wool growth rates achieved after lambing in wet ewes occurred without a concurrent increase in liveweight. This is similar to findings by Sumner and Smeaton (1981) where wool growth rates in Romney ewes increased more quickly than liveweight as feed availability increased. In this trial liveweight and wool growth rate increased together in dry ewes during spring.

### Fleece production

Dry ewes grew from 57 kg greasy wool/ha at 11 sheep/ha to 81 kg/ha at the highest stocking rate of 18.5 sheep/ha. This contrasts with wet ewes in which wool production ranged from 41.6 kg/ha at 9 sheep/ha to 51 kg/ha at 13.5 sheep/ha (Fig. 3). Annual per hectare wool production (kg/ha) adjusted for years for dry ewes was defined by:

$$\text{Wool/ha}_{\text{dry}} = 22.86 + 3.170(\pm 0.34) * \text{stocking rate}$$

and for wet ewes by:

$$\text{Wool/ha}_{\text{wet}} = 23.72 + 2.024 (\pm 0.59) * \text{stocking rate}$$

Annual per ewe wool production (kg/ha) adjusted for years for dry ewes was defined by:

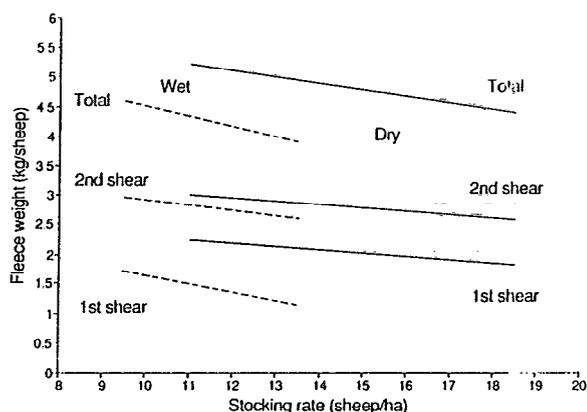
$$\text{Wool/ewe}_{\text{dry}} = 6.45 - 0.112 (\pm 0.012) * \text{stocking rate}$$

and for wet ewes by:

$$\text{Wool/ewe}_{\text{wet}} = 6.07 - 0.164 (\pm 0.042) * \text{stocking rate}$$

As the slopes of the regression lines for total wool production/ha were not significantly different ( $P > 0.05$ ) it was possible to compare between reproductive status treatments. At 13.5 sheep/ha dry ewes produced 28% more wool than wet ewes. This contrasts with Hight *et al.*, (1976) who reported only a 6% lower annual fleece production from wet ewes rearing a single lamb and 9% for ewes rearing twins compared to that from dry ewes. Sumner and McCall (1989) also found, under controlled feeding conditions, a 6 and 12% reduction respectively for single and twin-rearing ewes.

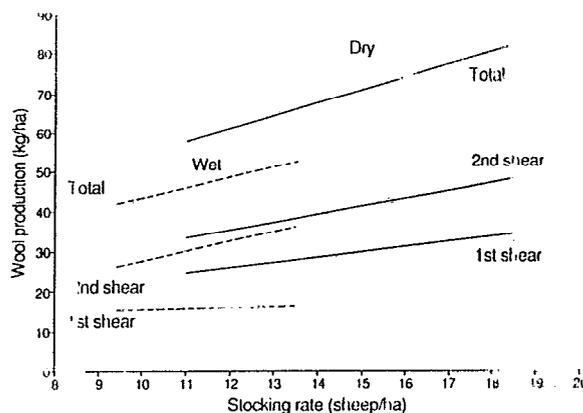
**FIGURE 3** Mean adjusted greasy fleece weight (kg/ewe) of wet and dry Romney ewes. First shear was in late November 1989 and early December 1990 and second shear was in May 1990 and 1991.



During the winter/spring period wool production/ha from wet ewes was unresponsive to stocking rate (slope =  $0.10 \pm 0.19$ ;  $P > 0.05$ ; Fig. 3) because of the large decline in per sheep production (slope =  $-0.12 \pm 0.02$ , Fig. 4) as stocking rate increased. In contrast, dry ewe wool production/ha responded positively to stocking rate increase (slope =  $1.24 \pm 0.19$ ;  $P < 0.001$ ; Fig. 3) because increasing stocking rate had less effect ( $P < 0.001$ ) on per sheep production (slope =  $-0.05 \pm 0.01$ , Fig. 4). The pattern of slow winter wool growth rates of high-stocked wet ewes (Fig. 2) is also reflected in the slow recovery of liveweight following lambing, compared to the lower-stocked ewes.

During the autumn/summer period a different situation occurred: wool production/ha response to stocking rate was similar for wet and dry ewes (common slope =  $2.06 \pm 0.14$ ; Fig. 3) although dry ewes grew significantly more wool than wet ewes ( $P < 0.01$ ).

**FIGURE 4** Mean adjusted greasy wool production (kg/ha) by wet and dry Romney ewes. First shear was in late November 1989 and early December 1990 and second shear was in May 1990 and 1991.



Adjusted mean wool production/ha from sheep on paddocks which had a predominantly sunny aspect (30.7 kg/ha/shearing) was 6.9% greater than that from sheep on paddocks having a shady aspect (28.7 kg/ha/shearing;  $P < 0.001$ ). This effect was due to the difference occurring during winter and spring where sheep on sunny paddocks produced 18.6% more greasy wool than on shady paddocks. This is the first report of an influence of aspect on wool production and is almost certainly a reflection of less available pasture during the winter/spring period on shady aspects (K. Betteridge, unpublished data).

A simple economic analysis was carried out using 14 February 1992 wool (NZ Wool Board, personal communication) and lamb (Feilding saleyard report) prices and assuming: a su equivalence for dry ewes of 0.7 (Sumner and McCall, 1989); 90 lambs weaned per 100 ewes mated; 1 kg wool/lamb; a marginal cost of \$3.50/lamb for animal health and shearing; and interpolating to a "sustainable" stocking rate of 11 su/ha. This showed wet ewes were \$81.50/ha more profitable than dry ewes. Similar results were obtained in favour of wet ewes at each of the stocking rates used in the trial. From this an allowance for labour must be made. However Lambert and Guerin (1989) reported that su equivalence varies across stocking rates and seasons and we believe dry ewes may have a su equivalence of only about 0.5 during winter and early spring in a practical farming situation. If so, the economic advantage to wet ewes would be reduced. A further minor adjustment must be made for the running of ewe replacements within the system.

The highest stocking rate in this trial was lower than that required to result in a decline in per hectare wool production with increasing stocking rate, as was seen in the work of Suckling (1964) where maximum wool production was greater at 15.1 su/ha than at 17.3 su/ha. At the highest stocking rate in our trial, wool break was seen in the wet ewes after lambing. Therefore it is probable that profitability would increase no further with increasing stocking rate, even if per hectare wool production from wet ewes continued to rise. Both our trial and that of Suckling's (1964) showed similar patterns of declining ewe liveweight, lamb weaning weight and ewe fleece weight as stocking rate increased.

Under present economic conditions a breeding ewe system appears to be substantially more profitable than a dry ewe system. However labour cost will have a profound effect on the final economic analysis. Further, dry ewes offer the farmer feed flexibility and the potential to control weeds. Each of these

factors will need to be considered when choosing between running breeding or dry ewes on the farm.

### ACKNOWLEDGEMENTS

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