

# PASTURE MANAGEMENT AND HILL COUNTRY PRODUCTION

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D. A. CLARK, M. G. LAMBERT and D. F. CHAPMAN  
*Grasslands Division, DSIR, P. B., Palmerston North, New Zealand.*

## *Abstract*

Pasture and animal production from farmlets rotationally grazed with sheep (RGS), set stocked with sheep (SSS) and rotationally grazed with cattle (RGC) were compared for 5 years. Herbage accumulation rate, herbage mass, tiller and stolon growth and defoliation and sheep diet selection were measured.

RGC increased perennial ryegrass (*Lolium perenne* L.) and white clover (*Trifolium repens* L.) content. RGS herbage mass was 1000 kg DM/ha greater than SSS by January. Despite differences in ewe liveweight and herbage mass profiles, grazing management had no effect on total wool production. In the first two years SSS had higher weaning weight per ha than RGS. Under high grazing pressure sheep selected a diet ranging from 85% dry matter digestibility in December to 56% in June. Total leaf growth was similar for RGS and SSS pastures because greater leaf extension rates for RGS were compensated for by higher tiller numbers in SSS swards. The total leaf length grazed was the same for RGS and SSS pastures because the greater leaf length grazed per tiller for RGS was offset by more frequent grazing of more numerous tillers in SSS.

Rotational grazing may allow greater conservation in spring and provide extra feed at very high grazing pressures, but at commercial grazing pressures pasture rationing is unlikely to give greater animal production

## INTRODUCTION

Effects of pasture management on animal production from hill country have been investigated at Te Awa (Suckling 1959, 1975) and Tangoio and Waerenga-o-Kuri (Collin 1966). Suckling (1959) concluded that rotational grazing gave more options for pasture management but animal performance was better under set stocking. At Tangoio, animal production from rotational grazing and set stocking was the same, but at Waerenga-o-Kuri rotational grazing increased lambing percentage, weaning weight and wool production when stocking rate was above 16 ewes/ha. These results suggested that grazing management would have little effect on animal production at commercial stocking rates. However, they lacked replication, flock sizes were small and areas were not balanced for slope and aspect. In some cases rigid grazing cycles took little account of pasture and animal requirements.

Rotational grazing on hill country has been advocated by Lamont (1939) and Smith & Dawson (1976). Recently, MAF advisers have promoted the use of 'controlled grazing systems' to ration feed intake and achieve liveweight targets at weaning and mating. However, there has been little detailed research on how pastures and animals react to different grazing

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managements.

This paper discusses results from an experiment comparing rotational grazing (RGS) and set stocking (SSS) with sheep only and rotational grazing with cattle (RGC). In the RGS management ewes were set stocked for 10 weeks over lambing and in the SSS management ewes were rotationally grazed on a 1.5 day grazing cycle for 6 weeks during mating.

#### EXPERIMENTAL

The experiment is at "Ballantrae", the hill country experimental area of Grasslands Division, DSIR, in the southern Ruahine range. Soils, pastures, animals, climate and experimental procedures are described by Grant *et al.* (1978) and Lambert *et al.* (in prep.). The effect of fertilizer is discussed by Lambert *et al.* (1982) at this conference. Fertilizer x management interactions were seldom important and data are averaged over the two fertilizer levels for each management.

Herbage accumulation rate was measured from enclosure cages using a 2.5 cm trim with cutting interval varying inversely with accumulation rate. Botanical composition was estimated from herbage dissection. Herbage mass was measured from either ground level cuts or visual assessment calibrated against such cuts.

Diet selection was studied using oesophageal fistulated ewes in enclosures within the area grazed by experimental ewes. Samples were taken between February 1979 and January 1981 at intervals determined by rotation length. Enclosure areas were adjusted to give equal pasture allowances for experimental and fistulated ewes. Diet botanical composition was estimated by point analysis of washed samples, and *in vitro* dry matter digestibility (DMD) by a fungal cellulase method.

Growth, senescence and defoliation of perennial ryegrass (*Lolium perenne* L.), browntop (*Agrostis* spp.) and white clover (*Trifolium repens* L.) were estimated at weekly intervals from March 1980 to March 1981.

#### GRAZING MANAGEMENT AND PASTURE PRODUCTION

##### HERBAGE ACCUMULATION RATE

Herbage accumulation rate was similar for RGS and SSS. RGC decreased winter, spring and annual rates after 5 years (Table 1). After 12 months legume percentage in RGC was higher than both RGS and SSS.

RGC and to a smaller extent RGS increased ryegrass content more than SSS. The contribution of "low-fertility-tolerant" grasses was decreased most by RGC followed by RGS and SSS respectively.

##### HERBAGE MASS

Herbage mass for RGS and SSS is shown in Fig. 1. In September and October herbage mass was the same on both treatments. From November to January, herbage mass increased under RGS to a maximum difference of

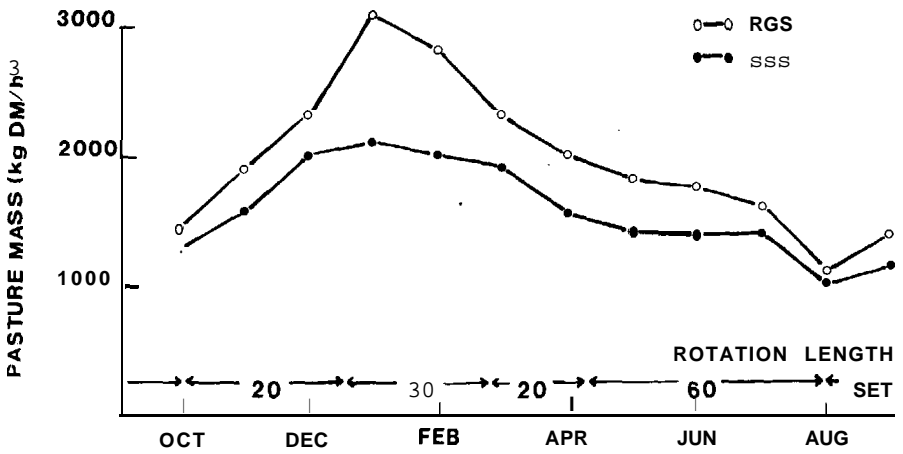


FIG. 1: *Herbage mass (kg DM/ ha) for two sheep grazing managements (mean of 5 years)*

1000 kg DM/ ha. Grazing intervals (Fig. 1) in RGS of 15-30 days in late spring allowed more reproductive tillers to escape grazing. Greater herbage mass developed because reproductive tillers grow faster than vegetative ones (Hunt & Field 1978). The trim technique could not be expected to show this extra growth because it allows equal reproductive development under both managements.

The decline in herbage mass from January to August implies that loss from decay and consumption was greater than new growth and was apparently more for RGS than SSS.

## GRAZING MANAGEMENT AND ANIMAL PRODUCTION

### SHEEP

The increase of stocking rate from 7.6 to 12.0 ewes/ha from 1976/77 to 1979/80 (Table 2), as winter herbage accumulation increased (Table I), increased wool and lamb production per hectare. No decline in per animal production occurred because of favourable weather, and decreased dead matter and patch grazing.

Management had no effect on total wool production in any year. However, in 1975/76 and 1976/77 SSS had higher weaning weight per ha than RGS.

Ewe liveweight (LW) is shown in Fig. 2. From 1976 to 1980 ewe LW for SSS was greater than RGS for 6 out of 20 weighings in the January to April period. SSS ewes were consistently heavier in July with no differences in either June or August. Rationing of RGS in May and June increased LW losses but these were regained in August when grazing intervals were decreased prior to set stocking at lambing. Increased feeding in late pregnancy reduced lambing percentage in RGS because of bearing problems.

TABLE 1: ANNUAL AND SEASONAL HERBAGE ACCUMULATION (kg DM/ha) AND BOTANICAL COMPOSITION (%) FOR RGS, SSS, AND RGC FOR 1976/77 AND 1979/80 (MEAN OF 2 FERTILIZER TREATMENTS)

Season	Herbage accumulation							
	1976/77				1979/80			
	RGS	SSS	RGC	Stats. sign.	RGS	SSS	RGC	Stats. sign.
Spring	<b>2870</b>	<b>2930</b>	<b>2590</b>	ns	<b>4550</b>	<b>4390</b>	<b>3450</b>	*
Summer	<b>3070</b>	<b>3160</b>	<b>2510</b>	0.1	<b>4160</b>	<b>4300</b>	<b>3840</b>	ns
Autumn	1110	<b>1260</b>	1110	ns	<b>2400</b>	<b>2390</b>	<b>2460</b>	ns
Winter	<b>750</b>	<b>920</b>	<b>910</b>	ns	1530	<b>1300</b>	<b>1200</b>	0.1
Total	<b>7800</b>	<b>8270</b>	<b>7120</b>	ns	<b>12640</b>	<b>12380</b>	<b>10950</b>	0.1
				<b>Botanical composition</b>				
Legume	13.8	<b>14.0</b>	<b>21.3</b>	**	<b>7.4</b>	<b>8.1</b>	<b>13.0</b>	**
Ryegrass	14.7	11.8	<b>22.2</b>	**	<b>28.0</b>	<b>23.1</b>	<b>32.4</b>	**
'Low-fertility-tolerant' grasses	46.2	<b>49.6</b>	<b>38.2</b>	**	<b>35.8</b>	<b>42.0</b>	<b>28.1</b>	**

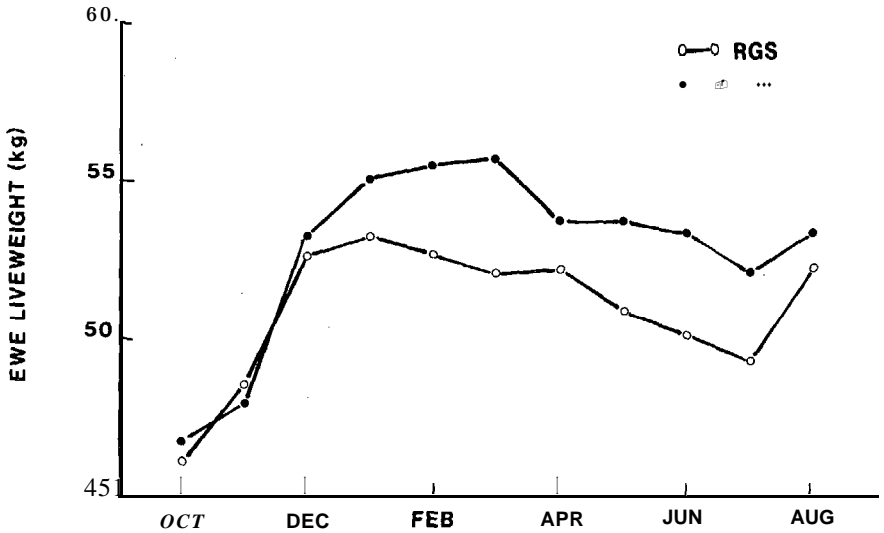


FIG. 2: Ewe liveweight (kg) for two sheep grazing managements (mean of 5 years).

## CATTLE

Stocking rate increased from 1.3 to 2.0 cows/ ha from 1976/ 77 to 1979/ 80 (Table 2). Cattle production was more variable than sheep production because of variation in conception rate (66 to 98%) and calf death rate (4 to 20%). Cow mating LW varied from 395 to 495 kg and weaning weights from 175 to 215 kg. Cows and calves were better able to evenly graze surplus summer herbage than ewes and lambs and no extra stock were needed.

## PASTURE-ANIMAL INTERACTIONS

### DIET SELECTION

As dietary legume was in direct proportion to pasture legume (Fig. 3), it appears that hill country sheep cannot increase the feeding value of their diet by legume selection. Preference for green material and rejection of dead matter justify considering only green material when assessing actively growing pasture.

Green grass always contributed more than 70% of the diet for both RGS and SSS, with maximum levels in winter and minimum in summer. Legume was highest in summer with higher levels for SSS (22%) than RGS (14%). Spring and autumn levels were similar (10%) with only 1-2% in winter because of decreased leaf appearance rates and accessibility. Dead matter was always less than 2% in summer, autumn and spring, with no management effect. Winter levels rose to 7 and 4% for SSS and RGS respectively. Increased moss, soil and flatweeds were noticed in the SSS oesophageal samples.

TABLE 2: STOCKING RATE (SU/HA), WEANING WEIGHT (kg), WOOL PRODUCTION (kg), LAMBING AND CALVING PERFORMANCE (%) AND EXTRA GRAZING DAYS (STOCK UNIT) FOR RGS, SSS, AND RGC FOR 1976/77 to 1979/80 (MEAN OF 2 FERTILISER TREATMENTS)

Parameter	RGS	sss	Stats.	sign.	RGC
				1976/77	
Stocking rate	7.6	7.6		7.6†	
Weaning weight (per lamb/calf)	21.0	22.2		181	
Weaning weight (per ha)	128	178		209	*
Greasy wool (per ewe)	5.50	5.38			ns
Greasy wool (per ha)	42.2	41.1			ns
Lambing/ Calving	80.2	105.5		91.3	
Extra grazing days‡	1164	908		0	
			1979/80		
Stocking rate	12.0	12.0		12.0	
Weaning weight (per lamb/calf)	27.3	25.7		183	ns
Weaning weight (per ha)	307	324		325	ns
Greasy wool (per ewe)	6.30	6.39			ns
Greasy wool (per ha)	75.4	76.7		—	ns
Lambing/ Calving	94.1	105.6		88.7	ns
Extra grazing days	0	0		0	

† 1 breeding cow = 6 stock units.

‡ Extra grazing days account for the stock required to remove surplus herbage in autumn.

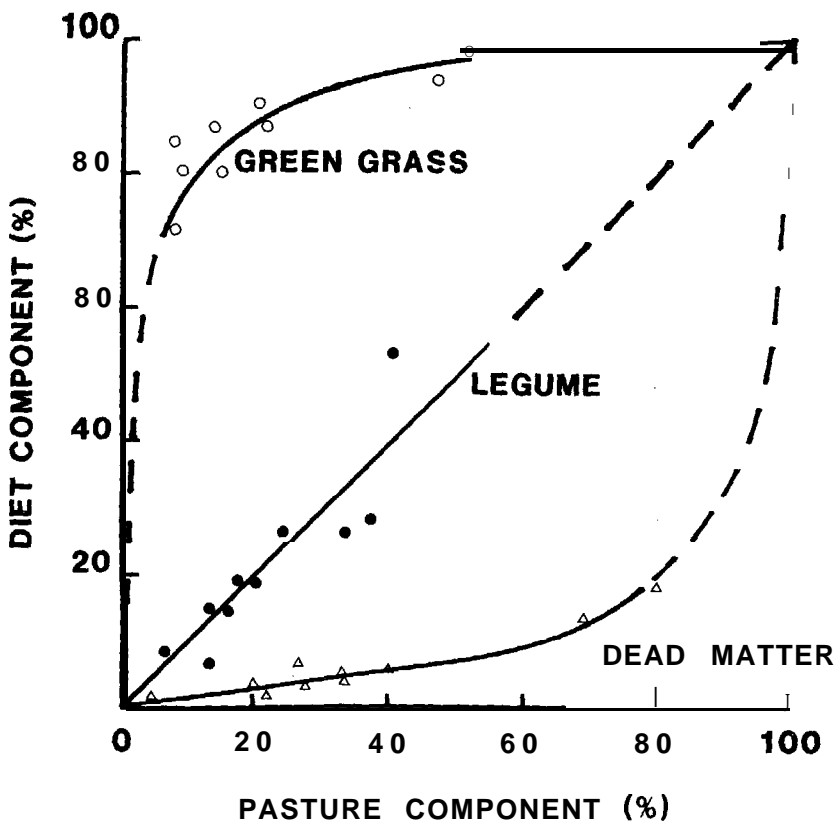


FIG. 3: The relationship between diet and sward composition (%) for green grass leaf (○), dead matter (△) and legume (●).

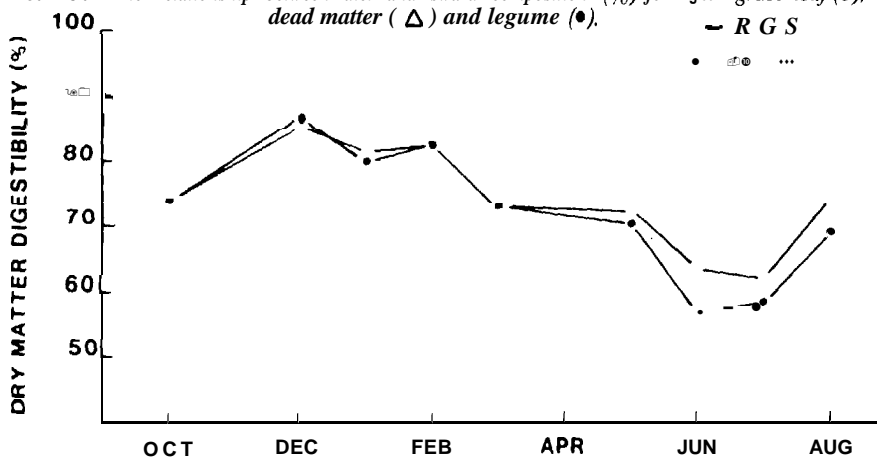


FIG. 4: Annual curve of in vitro dry matter digestibility of diet for two sheep grazing managements (mean of 2 years).

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Annual DMD means for green grass, legume and dead matter were 73, 85 and 30% respectively. The annual curve of dietary DMD (Fig. 4) declines in autumn as legume percentage decreases. The minimum in June and July coincided with maximum dead matter and minimum legume. Dietary DMD increased to a December maximum of 85% as legume increased and leaves rather than reproductive stems and stolons were grazed. Under high grazing pressure hill country pastures with a major component of 'low-fertility-tolerant' grasses can have similar DMD values to lowland swards (Clark & Brougham 1979). Under low grazing pressure increased leaf sheath, stem and dead matter will reduce DMD values (Lancashire & Ulyatt 1974).

Differences in herbage mass, DMD and legume percentage are not sufficient to explain why ewes gained weight rapidly in spring but not in autumn. Factors warranting further investigation are: herbage accumulation rate differences, spatial distribution of herbage, daylength and grazing behaviour and compensatory replacement of body reserves.

#### **GROWTH and DEFOLIATION**

Tiller appearance rate, leaf appearance rate and number of leaves per tiller were unaffected by grazing management. Total leaf growth per unit area is a function of these factors plus tiller number per unit area and leaf extension rate. On average there were 13.4% more ryegrass and 64.6% more browntop tillers under SSS than RGS. However, the greater leaf extension rates for RGS completely compensated for the increased tiller numbers to give no difference in total leaf grown.

Total leaf length grazed per unit area is a function of leaf length grazed per tiller, grazing frequency and number of tillers per unit area. In RGS leaf length grazed per tiller was greater, but grazing frequency and tiller number were less than SSS. This resulted in no differences between the two managements for total leaf length grazed.

#### **PRACTICAL CONSIDERATIONS**

##### **SPRING PASTURE SURPLUS**

At average grazing pressures set stocking should be used in spring and summer to maintain legume content, decrease dead matter and increase lamb growth. The role of cattle in removing surplus pasture has long been accepted. At high grazing pressures rotational grazing from October to December may increase herbage accumulation rate and hence the opportunity for conservation.

The need for a high quality supplement to give autumn liveweight gain is obvious from Fig. 2 and fine-chop, wilted silage may achieve this (Rattray 1980). The benefits of conservation have yet to be demonstrated for North Island hill country farming.

## LEGUME DOMINANT PASTURES

The superior feeding value of legumes compared with grasses is well known (Ulyatt *et al.* 1976; Jagusch *et al.* 1979). Preparation of pastures with cattle grazing in the preceding winter and spring can increase legume (Table 1) to 40-50% in summer. A greater contribution may require oversowing or fertilisers (Lambert *et al.* 1981) to provide pastures for classes of stock that need to gain liveweight.

## PASTURE RATIONING

A major advantage claimed for 'controlled grazing systems' is the ability to control animal intake by pasture rationing. Despite significantly higher herbage mass (Fig. 1), rotational grazing gave reduced animal production on occasions. This result is due to the many compensatory mechanisms that exist in pasture-animal interactions. We have not reached a stocking rate where the benefits of rationing are obvious. From lambing to mid-summer rationing will lead to lower liveweight gain of ewes and lambs and excess herbage accumulation. Therefore, set stocking or very rapid rotational grazing is recommended.

## CONCLUSIONS

Within a basic farm management of rotational grazing or set stocking there should be scope to alter management for specific purposes. For example, mob stocking for weed control or to create legume dominant pastures can be achieved in both managements. The conservation of surpluses and use of N fertilizer (Ball *et al.* 1976) are also possible. Specific targets for ewe liveweight, lambing percentage and wool production can and should be set for either management.

High production per farm requires high stocking rate, pastures high in green leaf and legume and low in dead matter, and ewes of high genetic merit. Grazing management can complement these factors but will in no way substitute for any of them.

## ACKNOWLEDGEMENTS

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