EFFECTS OF GRAZING MANAGEMENT ON PRODUCTIVITY OF PERENNIAL RYEGRASS PASTURES

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Abstract

Upgraded and typical perennial ryegrass/subterranean clover pastures were grazed under continuous stocking (CS) or tactical stocking (TS) for two years with September lambing Border Leicester-Merino ewes to study the effect of these two stocking strategies on pasture and animal productivity. TS involved a combination of autumn deferment, winter and summer rotations and continuous stocking over lambing in spring. Under TS, the pasture grew 38% (600-1000 kg DM/ha) more herbage over the autumn-winter period than CS pasture in both years. In the second year of the experiment, stocking rate was able to be increased by about 10% on the TS pastures and led to an 8% increase in weaning weight per hectare and supplementary feed per ewe was 27% less compared with CS ewes. The results suggest a significant benefit for a TS system compared to CS for the climatic conditions experienced in 1996 and 1997 seasons in the Hamilton environment.

Key words: Perennial ryegrass, grazing management, prime lambs

Introduction

The comparison of rotational versus continuous stocking has always been controversial. Various forms of rotational stocking are very common in New Zealand (5). However, a recent review by Morley (8) suggested that there was little advantage of rotational stocking under Australian conditions. He indicated rotations increased the grazing pressure on one part of the farm while saving the rest of the pasture, and that the saved pasture was likely to have lower nutritive value to the detriment of animal production. The Grasslands Productivity Program (GPP) has rekindled interest in grazing management (7). High quality pastures developed in GPP were often over grazed in summer and autumn leading to loss of perennial species and/or a reduction in herbage accumulation in winter due to low herbage mass. This paper reports on the first 2 years of an experiment investigating the effects of tactical stocking system compared with continuous stocking on the productivity of prime lamb flocks grazed on typical and upgraded perennial ryegrass-based pastures in western Victoria.

Materials and methods

Experimental design and site description

The experiment was a split plot, 2? 2 factorial design with 2 pasture types as main plots and 2 grazing management systems as subplots. The treatments were replicated in 4 adjacent blocks. The experiment was designed to increase precision of estimation of grazing management effects with less precision for the pasture type effect. Each plot was 0.9 ha and was grazed by spring lambing Border Leicester-Merino ewes (terminal meat sire) at stocking rates shown in Table 1.

The experiment was conducted at the Pastoral and Veterinary Institute, Hamilton between May 1996, and December 1997. The site was undulating with gravelly loam to clay loam duplex soils of basalt origin and mean annual rainfall of 700 mm and so was marginal for perennial ryegrass.

Treatments

The two pasture treatments were designated 'typical' and 'upgraded' pasture. Typical Pasture (TP) was a 12 year-old degraded ryegrass pasture with annual fertiliser application of 6 kg P/ha and 8 kg S/ha based

on the district average fertiliser use. Species present were subterranean clover (30%), perennial ryegrass (10%) and silver grass, capeweed, onion grass and fog grass. The Upgraded Pasture (UP) was resown in 1989 to perennial ryegrass (*Lolium perenne* L.) cvv. Victorian, Ellett and Kangaroo Valley, phalaris (*Phalaris aquatica*) cv. Sirosa and subterranean clover (*Trifolium subterraneum* L.) cvv. Trikkala, Larisa and Enfield with 26 kg P/ha and 14 kg S/ha applied annually. UP was dominated by subterranean clover (35%) and perennial ryegrass (25%) with some barley grass and capeweed. Olsen P (mg/kg) was 6 and 11 for TP and UP, respectively. Trace elements, K and S were adequate and pH (H_2O) was 5.5.

The two subplot grazing management treatments were the control, Continuous Stocking (CS) year round, and Tactical Stocking (TS) with four seasonal management components. Under TS, a quick summer rotation commenced as the pasture dried off in mid-December to use some dry feed before the quality declined and involved 5 to 6 days grazing and about 40 days spell. From early February, a slow rotation of 10 to 14 days grazing and about 80 days spell was used to reduce herbage mass to 800 kg DM/ha by the opening rains. After the opening rain, ewes were deferred on one eighth of the area for about 2 weeks and fed supplements to allow pasture to come away before commencing the winter rotation. The winter rotation started with about 3 days grazing per plot and increased over the winter to about 9 days grazing depending on herbage accumulation rates, with 30-60 days spell. Target residual pasture height after grazing was 500 kg DM/ha. The paddocks were continuously stocked from the start of lambing through to weaning (September to December).

Flock management and pasture measurements

Initial stocking rates were based on previous carrying capacity of the paddocks. Ewes were weighed and allocated to the 16 paddocks on the basis of stratified liveweight classes. Additional ewes formed a spare flock to replace non-pregnant ewes. Stocking rates were increased in late 1996 in response to higher ewe liveweight and herbage mass in some treatments. Supplementary feeding for individual plots was based on condition scores and herbage mass. Feeding commenced if 30% of sheep in a paddock dropped to a condition score of 2.5 prior to mating or 3.0 pre-lambing. Herbage accumulation rate was determined monthly with exclosure cages (1 m^2) using methods described by Cayley and Bird (4).

Statistical analysis

Analysis of variance was undertaken separately for the two years. Main effects have only been included as interactions were generally not significant. Results have only been presented when significant at the 5% level. Statistical analyses were performed using the Genstat 5.32 (for Windows) software (6).

Results

Late opening rains started the growing season in June 1996, with annual rainfall of 697 mm occurring mainly between June and October resulting in very wet conditions in July-August. 1997 had one of the driest winters on record with total annual rainfall of 497 mm occurring mainly between May and November.

Cumulative annual herbage accumulation was higher on the TS plots ($P< 0.05$) with 1100 and 800 kg DM/ha more growth in 1996 and 1997 respectively (Table 1). This extra growth on TS plots occurred mainly in the autumn-winter period ($P< 0.05$) with 600-1000 kg DM/ha more growth. In August 1997 there was 2300 kg DM/ha on TS plots and only 1000 kg DM/ha on CS plots (data not presented).

Ewe liveweight increased due to higher herbage mass especially with TS and these ewes were significantly heavier ($P< 0.05$) at weaning in November 1996 (Table 1). However, this advantage of TS pasture was not present in 1997 ewe liveweights as herbage mass was much higher on the TS pastures through winter and herbage turned rank and declined in nutritive value. Weaning weight per ewe and per hectare were similar for all treatments in 1996, but weaning weight per hectare was significantly higher for TS in 1997 ($P< 0.05$) due to a combination of higher stocking rates and similar individual weaning weights.

Supplementary feeding on TS was significantly higher in autumn 1996 when the experiment started as there was no carry over feed when the autumn deferment began (Table 1). In 1997, supplementary feeding was higher for CS, i.e. 316 MJ/ewe compared with TS, 230 MJ/ewe. CS ewes had access to all carry over feed and grazed paddocks low earlier in the summer compared with TS ewes. Supplementary feeding was significantly higher ($P< 0.05$) for TP pastures in 1997 where nutritive value of the carry over feed was lower.

Table 1. Effects of pasture type and grazing on herbage accumulation and animal productivity.

Year	Measurement	Upgraded pasture	Typical pasture	Tactical stocking	Continuous stocking	l.s.d. (P=0.05) Main effect for comparison within pasture	l.s.d. (P=0.05) Main effect for comparison within stocking
1996	Stocking rate (Xbred ewes/ha)	13.3	8.9	11.1	11.1		
	Fertiliser (kg P/ha)	26	6	16	16		
	Weaning percentage (%)[a]	100	100	100	100		
	Herbage accumulation (kg DM/ha)						
	Autumn and Winter	1920	1910	2210	1630	n.s.	305
	Spring	4700	3400	4320	3770	n.s.	n.s.
	Annual	6610	5310	6530	5400	n.s.	719
	Supplements (MJ/ewe)	85	104	128	62	n.s.	26.7
	Ewe liveweight (kg) November	55.2	49.2	53.6	50.8	n.s.	2.2

	Weaning weight (kg/ewe)[b]	33.6	30.4	33.1	31.0	n.s.	n.s.
	Weaning weight (kg/ha)[bc]	446	269	359	335	n.s.	n.s.
1997	Stocking rate (Xbred ewes/ha)	13.9	8.4	11.7	10.6		
	Fertiliser (kg P/ha)	26	6	16	16		
	Weaning percentage (%)[a]	107	107	108	108		
	Herbage accumulation (kg DM/ha)						
	Autumn and Winter	3590	2480	3540	2540	564	563
	Spring	4620	4890	4680	4840	n.s.	n.s.
	Annual	8210	7370	8210	7380	n.s.	752
	Supplements (MJ/ewe)[c]	231	314	230	316	*	n.s.
	Ewe liveweight (kg) November	67.3	62.0	63.8	65.6	n.s.	n.s.
	Weaning weight (kg/ewe)[b]	40.4	40.3	39.9	40.8	n.s.	n.s.
	Weaning weight (kg/ha)[bc]	558	336	450	415	n.s.	*

[a] Adjusted to a common lambing percentage after marking. [b] Adjusted to 100 days growth. [c] Log_e transformations were carried out on this data and back transformed figures are shown in the means columns, means that differ significantly ($P< 0.05$) are denoted by *.

Discussion

In the first 2 years of this experiment, we measured a significant increase in herbage accumulation on TS pastures (600-1000 kg DM/ha) in the autumn-winter period. This increase in herbage accumulation and mass was similar to the findings of Morley *et. al.* (9) where rotationally grazed pastures showed large increases in amounts of herbage present during winter. We believe the TS pasture reached the rapid

'Phase 2' period of herbage accumulation earlier in the season compared to the CS paddocks. Brougham (3) and Bircham and Hodgson (2) characterised perennial herbage growth phases, a slow increase in total herbage at low herbage mass, a rapid increase in herbage accumulation as leaf area approaches optimal size (Phase 2) and a declining rate of herbage accumulation as senescence increases.

In both years, the opening season rains were late (June 1996 and May 1997) so that the CS pastures were grazed very short in late summer-autumn compared to the TS pastures. Ewes were deferred from grazing at the opening rains on the TS pastures allowing herbage mass to reach 800-1000 kg DM/ha before being grazed. Morley *et al.* (9) found, when low pasture residues coincided with good opening rains, liveweights of rotationally grazed ewes were heavier throughout the growing season. However, in a season with much carry over feed and poor autumn-winter rainfall, continuously stocked ewes were heavier than rotationally grazed ewes. Their experiment did not use a summer rotation. We used a summer rotation to ensure a ration for the TS ewes through to the opening rains which may overcome the feed shortage problem found by Morley *et al.* (9).

Stocking rates were adjusted to maintain sheep at similar liveweights across all treatments. In practice, it has proved difficult to maintain the liveweight of the TP ewes similar to the UP ewes. This was due to the poor nutritive value of the TP herbage (11). TS carried higher stocking rates in the second year compared with continuously stocked pastures due to higher herbage accumulation as found in other experiments (1, 10). However, TS ewes were lighter in the early winter due to restricted access to herbage and insufficient supplementary feeding over the deferment period.

There was less need for supplementary feeding with TS in 1997 due to the summer rotation providing some herbage feed till the end of April whereas the CS had consumed all paddock feed by mid-March. Beattie *et al.* (1) have shown that supplementary feeding can be substantially reduced by rotationally stocking from April to August, through forcing ewes to eat carry-over feed and ration the intake of new growth thereby transferring some autumn grown pasture to late winter. Summer rotations offer potential to reduce supplementary feeding to spring lambing ewes.

Conclusion

Tactical stocking increased herbage production over autumn-winter. This enabled significantly higher animal production in both years and lower rates of supplementary feeding in the second year. Ongoing studies will characterise tactical stocking effects on perennial ryegrass persistence and longer-term effects on pasture and animal production.

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