SWARD STRUCTURE CHANGES AND PRODUCTION INCREASES FOLLOWING SPRING GRAZING MANAGEMENT

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ABSTRACT

The objective of this experiment was to study sward structure effects on production of perennial ryegrass-white clover swards with and without white clover following lax spring grazing periods of different duration. Two periods of 6 (short release - SR) and 12 (long release - LR -) weeks of lax grazing were compared against a conventional hard grazing throughout (early control - EC). Treatments were arranged in a factorial design with 3 replicates. Changes in sward structure were reflected in herbage production before (spring) and after the control period (summer-autumn). During spring, herbage mass was increased as a consequence of an increase in tiller weight. Evidence for effects on ryegrass tiller densities in summer-autumn period were inconclusive, although, tiller production appeared to be greater in release treatments than under hard grazing. It was concluded that release treatments increase herbage production by increasing both tiller population density and tiller weight.

KEYWORDS

Spring grazing management, perennial ryegrass, sward structure, tiller population density, tiller weight

INTRODUCTION

A grass sward has not only biomass but a highly organized structure which changes with season and management, and which can also vary according to species, variety or genotype being grown. Sward structure is determined by leaf size, tiller density and number of leaves per tiller. Leaf appearance rate plays a central role because of its direct influence on each of the three key sward structural characteristics. Thus, high leaf appearance rate leads to swards with a high density of small tillers and low leaf appearance rate leads to swards with a lower density of larger tillers (Chapman and Lemaire, 1993). The purpose of this study was to determine the importance of the sward structure changes during the reproductive stage, following lax spring grazing periods of different duration, on sward dynamics during late summer and autumn.

METHODS

The experiment was conducted between September 1992 and March 1993 at the Pasture and Crop Research Unit, Massey University, Palmerston North on a sward containing perennial ryegrass (*Lolium perenne*, cv. 'Grasslands Nui') with or without white clover (*Trifolium repens*, cv. 'Grasslands Tahora') as sown species. Plots of 86.5 m^2 were grazed by sheep every 14 (hard grazing) or 21 days (lax grazing) to maintain post-grazing sward surface height at 30-50 mm (hard) and 70-90 mm (lax), respectively. Two periods of lax grazing (short release - SR from 26 October to 8 December and long release - LR from 15 September to 8 December) were compared against a conventional hard grazing (early control - EC). All treatments were grazed to 30-50 mm every 14 days from 8 December until the end of the experiment. Treatments were arranged in a factorial design with 3 replicates. Plots without white clover received 28 kg N ha^{-1} every two weeks as urea.

Ryegrass tiller population density was determined from 30 cores of 53 mm diameter per plot throughout the experimental period. From the three ground level quadrat cuts one pooled sub-sample of herbage from each plot was used to determine tiller weight. Sward structure was determined using the inclined point quadrat technique, before the switch from lax to hard grazing on 6 December; 200 contacts per plot were taken.

RESULTS AND DISCUSSION

Changes in sward structure were reflected in herbage production before and after the control period (Table 1). During spring, the greater herbage production observed in lax treatments appears to be the result of a greater individual tiller weight, as a consequence of the higher percentage of reproductive tillers in these swards (Figure 1), rather than the result of a higher tiller population. In contrast, the greater herbage accumulation rate observed in SR and LR treatments during the summer-autumn period arose from both greater tiller population density and tiller weight (Table 1). Several authors have discussed herbage production in terms of the ensuing trade off between quantity and quality. Further evaluation (Da Silva, 1994) revealed a 3% decrease (from 78% to 75%) in digestibility of the forage consumed by dairy cows grazing late control swards. Despite this, no significant reduction in herbage intake was detected in comparison with animals grazing leafy and vegetative swards.

The spatial distribution of the sward components before the control grazing in December differed according to the management (Figure 1). Thus, all components in EC swards occurred below 15 cm, with more than 80% of the total contacts within the first 5 cm layer. By comparison in the SR treatment foliage was distributed over a greater range: around 75% of the contacts were below 10 cm, but there were contacts above 30 cm. All sward components in LR occurred in a greater range than EC and SR. Early control presented more other grass leaf and stem than SR and LR treatments, especially in the lowest 4 cm. Penning *et al*. (1991) Showed that sward surface height had a direct effect on tiller number, mass and leaf area. They found that as stem elongation occurred in late spring, there were a greater number of tillers and a lower proportion of reproductive tillers in the swards maintained at 30 mm and 60 mm than in the sward maintained at 90 and 120 mm. On the taller swards, structure was inferior, becoming sparsely tillered, open and stemmy. Roggero *et al*. (1993) studying three sward surface heights of 100, 150 and 200 mm in annual ryegrass (*Lolium rigidum* Gaudin) observed that cutting when the sward reached a height of 100 mm resulted in significantly lower yields but a better canopy structure (denser sward, higher percentage of leaves in the bottom layers, higher leaf:sheath ratio) than the other swards.

White clover leaf and petiole were greater in SRW and LRW treatments than ECW (Figure 1). LRW had a higher leaf component than ECW and SRW, and clover leaves were found in all layers between 0 and 12 cm. In SRW and ECW, however, they were recorded only below 9 cm and 6 cm, respectively. White clover stolon occurred in the 0-4 cm layer and was more frequent in EC than SR and LR treatments. Dead material comprised 9%, 10.6% and 10.9% of the total contacts in EC, SR and LR swards, respectively, distributed in the first 4 cm.

Based on these findings, the mechanism whereby more severe defoliation produced a better sward canopy and reduces herbage accumulation in the reproductive period is through decreasing tiller weight, and during summer-autumn by reducing both tiller population density and tiller weight.

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Table 1.
Tiller population density (TP, tillers m^{-2} from tiller cores) and mean dry weight (TW, mg) of perennial ryegrass growing either with white clover or fertiliser nitrogen under contrasting spring grazing managements.

Treatment[1]	20 Oct		2 Dec		1 Jan		28 Jan		23 Mar	
	TP	TW	RG	TW	RG	TW	RG	TW	RG	TW
ECW	4700	15.9	3830	15.7	6990	13.3	7760	17.4	5050	8.4
ECN	4540	14.3	4370	15.6	7000	16.2	9910	17.7	10500	9.3
EC	4620	15.1	4100	15.7	7000	14.8	8830	17.5	7770	8.7
SRW	4530	13.1	3280	36.5	5840	19.0	8820	19.9	8050	11.4
SRN	5100	12.3	5030	48.1	10330	18.0	11700	21.0	9770	9.2
SR	4810	12.7	150	42.3	8090	18.5	10260	20.5	8910	10.3
LRW	4770	22.3	3740	29.0	7070	12.2	11800	16.3	7210	11.7
LRN	4200	25.8	5100	42.5	9340	19.3	12120	15.8	7970	9.1
LR	4490	24	4420	35.8	8210	17.8	11960	16.0	7590	10.4
W	4660	17.1	3620	27.1	6640	16.2	9460	17.9	6770	10.5
N	4610	17.4	4830	34.4	8890	17.8	11240	18.4	9410	9.2
SEM+	310	2.8	490	4.3	1120	2.4	1680	2.1	1090	0.6
Effect of:										
Treatment	ns	**	ns	***	ns	ns	ns	ns	ns	*
W vs Nns	ns	**	*	*	ns	ns	ns	**	*	
Interaction[2]	ns	ns	ns	ns	ns	ns	ns	ns	ns	*

*:P<0.05; **:P<0.01; ***:P<0.001; ****:P<0.0001; ns:no significant differences

+ = Standard error of least square means.

[1] EC = Early Control, SR = Short Release, LR = Long Release, W = Ryegrass and white clover sward, N = Ryegrass sward with fertiliser nitrogen.

[2] = Interaction tests for differences between W and N swards in treatment responses {(EC/SR/LR) * (W/N)}.