The Effects of Post-Grazing Sward Conditions on Herbage Accumulation in Winter and Spring

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THE EFFECTS OF POST-GRAZING SWARD CONDITIONS ON HERBAGE ACCUMULATION IN WINTER AND SPRING

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Abstract

Two on-farm experiments were conducted in the winter and spring of 1998 on a New Zealand seasonal production dairy farm to determine the effect of herbage mass present after grazing on subsequent pasture growth rates. Experiments involved a range of post-grazing levels of herbage mass (870, 1140, 1390, 1640, 1920 kg DM/ha in winter, and 1100, 1420, 1700 and 1910 kg DM/ha in spring) representing a range in cow intakes of 6.1-20.0 and 7.6-18.5 kg DM/cow/day in winter and spring, respectively. In both experiments there was a range of post-grazing herbage mass (1200-1600 kg DM/ha in winter and 1400-1800 kg DM/ha in spring) over which post-grazing residuals had little effect on pasture growth rates. This lack of response was explained by underlying changes in sward components. Grazing residuals of 1200-1300 and 1500-1600 kg DM/ha were recommended to provide an adequate compromise between the pasture and animal requirements of grazing management considered important in winter and spring respectively. This study adds to the growing evidence to support farming systems focused on sward targets in enhancing both pasture and animal performance.

Keywords: Post-grazing residual, pasture growth, herbage mass, animal performance

Introduction

Recent grazing management trends in New Zealand have seen a number of dairy farmers adopting systems based on improving per hectare production through achieving higher per cow production targets (Brander & Matthews 1997). The overall emphasis of these farming systems is to maintain an efficient utilisation of pasture and to overcome the limitations to both animal intake and pasture growth through maintaining higher post grazing residuals.

Results of experiments on the effect of herbage mass on pasture growth are inconclusive, with positive (Brougham 1957), negative (Clark et al 1994), and no effect (Holmes & McLenaghan 1980) being reported. This study was designed to help in the development and understanding of dairy systems focused around the management of appropriate sward targets.

Material and Methods

Two experiments were undertaken in the winter (19 June - 28 August) and spring (18 September - 28 October) of 1998 on a commercial seasonal dairy farm near Dannevirke, New Zealand. Holstein Friesian cows were used to graze to target post-grazing residuals of 900, 1200, 1500, 1800, 2100 kg DM/ha in winter, and 1200, 1500, 1800, 2100 kg DM/ha in spring. All measurements were made during the subsequent regrowth following grazing, at grazing intensities calculated to reach the targeted residuals in 24 hours in winter, and between morning and afternoon milkings in spring. Herbage mass was measured using a calibrated rising plate meter. Tiller density and tiller weight were measured from core samples, with leaf extension rate

(LER) and leaf appearance interval (LAI_{nt}) measurements taken from all plots using tillers identified by a transect technique as described by Hodgson & Ollerenhaw (1969). Botanical composition was determined and NIR analysis made from all treatment swards. Both experiments were designed as a randomised block design replicated three times.

Results and Discussion

In both experiments a range of post-gazing residuals was achieved, but measured herbage was slightly lower than target levels as a result of the higher than predicted levels of cow intakes (Table 1). There were minimal differences between treatments in net herbage accumulation (NHA) rates from grazing until a pre-grazing mass of 2700 kg DM/ha was achieved (Table 2). Grazing residuals of 1394 and 1704 kg DM/ha resulted in the greatest NHA rates in winter and spring, respectively.

The results indicated a range in herbage mass (1200 -1600 kg DM/ha in winter and 1400 - 1800 kg DM/ha in spring) over which post-grazing residuals had little effect on NHA rate. Therefore, to maximise NHA farmers should select grazing residuals within these ranges.

Sward components showed some degree of compensatory effect over a wide range of herbage mass, which accounted for the non-significant results in NHA between treatments. This was largely due to the compensation effect between tiller density and tiller weight (Table 2). Tiller density was significantly correlated ($P<0.01$) with NHA in spring, which suggests that achieving a sufficiently high tiller density in winter is an important basis for spring pasture growth. L'Huillier (1987) showed that the tillers that emerge in winter make up a significant proportion of the total tiller density in spring.

In winter, average LAI_{nt} was shortest at a moderate grazing residual of 1394 kg DM/ha, and in general increased as grazing residuals both increased and decreased respectively (Table 2). Treatments 1 and 2 had a significantly slower ($P<0.01$) average LER than the other treatments in winter (Table 2).

Intensely grazed plots had a significantly ($P<0.05$) greater proportion of leaf and clover, and lower proportion of dead material in winter. In spring this trend was similar but not significant. NIR results in general reflected changes in botanical composition. In spring, all quality indicators started to decline at herbage mass levels greater than 3000 kg DM/ha.

Having identified a range in post-grazing residual in winter and spring over which there is no detrimental effect on NHA rate, the actual grazing residual chosen will depend on a number of factors and the objectives of the farmer at that specific time of the year. In winter this study identified that the important aspects to grazing management were:

1) To achieve a high NHA rate;
2) To achieve a high level of pasture utilisation;
3) To achieve a high tiller density so spring pasture production is not unduly compromised, and
4) To achieve the desired animal intake level.

Given these objectives a grazing residual of 1200-1300 kg DM/ha is recommended to provide the optimum compromise between the four winter management objectives. In spring, the grazing management objectives identified as being of importance were the same, except that maintenance of pasture quality is of higher priority than tiller density. A post-grazing residual of 1500-1600 kg DM/ha is recommended to obtain the best compromise between these management objectives in spring.

Results illustrate that grazing residuals associated with high intakes for high cow production lie within a range that does not have a detrimental effect on pasture productivity, and that the benefit being captured in systems focusing on sward conditions are more likely to be the result of sward quality, animal intake and animal production advantages rather than any specific advantage in pasture production.

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Table 1 - Pre and post-grazing herbage mass (HM), dry matter intake (kg/cow/day) and estimated level of pasture utilization (%) as affected by herbage mass availability in winter and spring experiments.

	DM herbage availability (kg/ha)					
	900	1200	1500	1800	2100	SEM
Winter						
Pre-grazing HM (kg/ha)	2864	2881	2793	2915	2778	59.0 ns
Post-grazing HM (kg/ha)	870[a]	1140[b]	1390[c]	1640[d]	1920[e]	87.2
Intake (Kg/ha)	6.1[a]	11.6[a]	16.3[b]	20.0[b]	20.0[b]	2.7
Utilisation (%)	81	70	58	46	36	-
Spring						
Pre-grazing HM (kg/ha)	-	2534[a]	2769[b]	2889[b]	2695[b]	104.3
Post-grazing HM (kg/ha)	-	1100[a]	1420[b]	1700[c]	1910[c]	185.0
Intake (kg/ha)	-	7.6[a]	11.2[a]	18.5[b]	18.2[b]	3.6
Utilisation (%)	-	67	57	48	34	-

Note: mean values in the same row followed by different letters are significantly different, lsmeans ($P<0.05$).

Table 2 - Average net herbage accumulation (NHA) rate, final tiller density, final tiller weight, leaf appearance interval (LAI_{nt}) and leaf elongation (LER) in winter and spring as affected by herbage availability.

	Available herbage mass (kg/ha)					
	900	1200	1500	1800	2100	SEM
Winter						
NHA rate (kg DM/ha/day)	15.0	16.0	16.3	16.2	15.6	1.96 ns
Final tiller density (tillers/m^2)	12413[a]	9064[b]	7487[c]	5994[d]	5484[d]	582
Final tiller weight (mg/tiller)	11.6[a]	18.9[ab]	25.6[bc]	34.5[c]	40.6[d]	2.3
Average LAI_{nt} (days)	17.5[a]	18.2[ab]	17.1[a]	19.6[ab]	20.7[b]	1.1
Average LER (mm/leaf/day)	3.26[a]	3.35[a]	4.34[b]	4.17[b]	4.12[b]	0.21
Spring						
NHA rate (kg DM/ha/day)	-	75.8	72.6	81.7	73.5	4.92
Final tiller density (tillers/m^2)	-	4154	3530	3793	3842	423
Final tiller weight (mg/tiller)	-	69.8[a]	94.2[b]	93.2[b]	92.3[b]	11.1
Average LAI_{nt} (days)	-	14.7[ac]	13.2[a]	16.9[c]	13.0[a]	1.3

Note: mean values in the same row followed by different letters are significantly different, lsmeans ($P<0.05$).