THE EFFECT OF SWARD HEIGHT AND BULK DENSITY ON HERBAGE INTAKE AND GRAZING BEHAVIOUR OF DAIRY COWS

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ABSTRACT

The effects of sward height and bulk density on herbage intake and grazing behaviour of dairy cows during 1 hour grazing periods was investigated. Sward factors had a marked effect on dry matter (DM) intake/bite, which ranged from 0.4 to 1.1 g, and this was reflected in hourly intake rates. Intake/bite was largely influenced by sward height, reflecting increased bite depth in taller swards, with inherent differences between swards at low sward heights largely attributable to differences in bulk density (BD). The results indicate that DM intake rates up to 4.0 kg DM/hour can be achieved in short term grazing studies with dairy cows grazing tall (180 mm+), dense (3.0 kg DM/m^3), leafy perennial ryegrass swards.

KEYWORDS

Cattle, dairy cows, grazing, intake, behaviour, ryegrass swards

INTRODUCTION

A major factor limiting milk production from grazed pasture is low herbage intake, which poses particular problems for management of high genetic merit dairy cows at pasture. Consequently, there is considerable interest at present in developing grazing management systems which facilitate increased dry matter (DM) intake, and this requires a better understanding of the interactions between sward characteristics, grazing behaviour and herbage intake. The aim of this study was to examine the effects of sward height and bulk density on herbage intake and grazing behaviour over short (1 hour) grazing periods.

MATERIAL AND METHODS

Swards of differing bulk density (range 1.74 to 2.95 kg DM/m^3) were produced from a perennial ryegrass sward by imposing a series of pre-conditioning treatments in spring and early summer. In the first year of the study low, medium and high density swards (mean 1.76, 2.06 and 2.95 kg DM/m^3 respectively) were subdivided into 4 blocks, each containing 4 ¥ 200 m^2 plots. Plots within each block were pre-grazed, using dairy cows fitted with faeces and urine collection bags, to achieve four target sward heights (75, 100, 125 and 150 mm). In the second year of the study similar procedures were used, with sward bulk densities of 1.74, 2.30 and 2.46 kg DM/m^3 being pre-grazed to achieve three target sward heights of 170, 200 and 230 mm. Detailed estimates of herbage intake and grazing behaviour were determined over a 1 hour grazing period using 16 lactating, Holstein Friesian dairy cows. Cows were blocked in groups of 4, with the groups rotated so that each group of cows was offered the four (Year 1) or three (Year 2) sward height treatments.

Herbage DM intakes were assessed from changes in pre- and post-grazing liveweight with a correction for insensible weight loss, using the procedures described by Penning and Hooper (1985). Cows were fitted with faeces and urine collection bags during the 1-hour grazing period. Biting rates during grazing were recorded by monitoring the number of bites taken by each animal during a 30 second period, at 3-4 minute intervals. During the experimental period, cows grazed as a single group on an area adjacent to the experimental plots, at a herbage allowance of 15 kg DM/cow/day and received no concentrate supplements. Sward heights were determined on the experimental plots both pre- and post-grazing using a Hill Farming Research Organisation (HFRO) sward stick, pre-grazing herbage mass was estimated by cutting to ground level and a simulated grazing sample was obtained by hand plucking herbage from each plot. Herbage samples were analysed for oven DM, acid detergent fibre (ADF) and crude protein concentrations.

RESULTS AND DISCUSSION

The effects of the pre-conditioning treatments on sward structure and crude protein concentration of simulated grazing samples are presented in Table 1. Major differences in bulk density, measured as herbage mass/(sward height ¥ area) were achieved across the three sward types in each year, with no significant ($P<0.05$) effect of pre-grazing sward height on bulk density within each sward type. Herbage crude protein concentration increased with increasing sward height with the low bulk density sward in Year 1 only, with no significant effect of sward height on protein concentration for the remaining swards.

Sward factors had a marked effect on DM intake/bite, but had little effect on biting rate. For example, DM intake/bite ranged from 0.4 to 1.1 g, with a strong positive correlation between intake/bite and sward height. Furthermore DM intake/hour was strongly correlated with intake/bite indicating that in order to achieve high DM intakes of grazed pasture management strategies should focus on maximising intake/bite.

The effects of sward height and bulk density on DM intake/hour are presented in Figure 1. These relationships indicate that irrespective of bulk density, maximum DM intake rate (3.5 - 4.0 kg DM/hour) was achieved with sward heights of approximately 180 - 200 mm. With tall swards (greater than 150 mm) bulk density had little effect on intake rate whereas in short swards bulk density had a major effect on intake rate. For example, in order to achieve an intake rate of 2.5 kg DM/hour, pre-grazing sward heights of 90, 115 and 125 mm were required with the high, medium and low bulk density swards respectively.

In conclusion, data from the present studies indicate that intake rates up to 4.0 kg DM/hour can be achieved in short term grazing studies with dairy cows offered tall (180 mm+), dense (3.0 kg DM/m^3), leafy perennial ryegrass swards. Whilst further studies are in progress to examine effects on herbage intake over longer grazing periods (e.g. intake rate/day), these sward heights are considerably higher than current recommendations for both rotational and continuous grazing (Hodgson, Mackie and Parker, 1986).

REFERENCES

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Penning, P.D. and Hooper, G.E. 1985. An evaluation of the use of short term weight changes in grazing sheep for estimating herbage intake. *Grass and Forage Science*, **40:** 79-84.

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Figure 1

Effect of Sward Height on DM Intake Rate at Different Bulk Densities

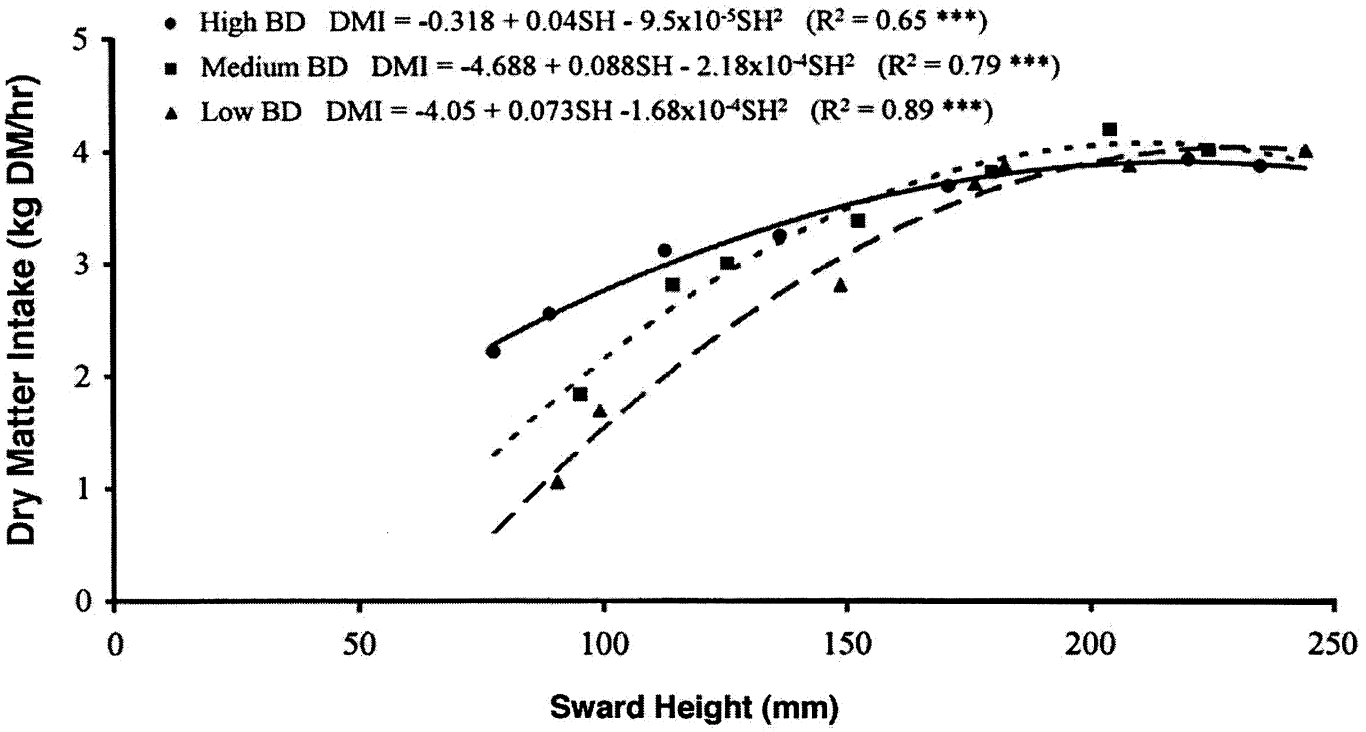

Table 1

The effect of sward surface height and bulk density on sward structure and chemical composition

	Year 1					Year 2			
	Target sward height				s.e.m	Target sward height (MM)			s.e.m.
	75	100	125	150		170	200	230	
Pre grazing sward height (mm)									
Low BD	90	99	149	177	6.6***	183	208	245	12.8 *
Medium BD	98	114	126	153	3.2***	180	204	225	8.2 *
High BD	77	89	113	136	3.7***	171	220	235	11.7 **
Bulk density (kg/m$^{3)}$									
Low BD	1.83	1.73	1.71	1.76	0.067 NS	1.93	1.62	1.68	0.15NS
Medium BD	2.15	2.18	2.11	1.81	0.126 NS	2.69	2.16	2.04	0.20 NS
High BD	3.09	2.60	2.89	3.23	0.205 NS	2.87	2.37	2.14	0.24 NS
Crude protein (g/kg DM)									
Low BD	138	153	164	184	8.1 *	143	160	151	10.0 NS
Medium BD	189	195	187	183	7.5 NS	166	158	147	5.3 NS
High BD	145	172	157	157	10.NS	180	165	161	9.2 NS