

EFFECT OF MILK YIELD, SWARD HEIGHT AND CONCENTRATE SUPPLEMENTATION LEVEL ON HERBAGE INTAKE AND GRAZING BEHAVIOUR OF SET-STOCKED DAIRY CATTLE IN SPRING

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ABSTRACT

An experiment was carried out in spring over 42 days, with 48 multiparous Holstein Friesian cows, to examine the interrelationship of milk yield level, sward height and concentrate level. Two initial milk yield groups of 21.3 and 35.5 kg/day, two range of compressed sward heights of 3 to 5 cm, and 7 to 9 cm, and three concentrate levels of 0 and 6 kg/day and *ad libitum* were evaluated in a factorial design. Multiple regression analyses were carried out relating intake and behavioural dependent variables to the independent variables initial milk yield (IMY), sward height (SH) and concentrate intake (CI). Total DM intake was highest for the high yielding group ($P \leq 0.001$) (16.4 and 19.6 s.e.d 0.65), and rate of intake (g DM/min) was higher ($P \leq 0.001$) (21.8 and 27.9 s.e.d. 1.91). Concentrates reduced rate of intake (31.4, 25.8, and 20.7 g DM/min s.e.d. 2.34). The multiple regression coefficients indicated that the herbage intake increased by 0.61 kg/day per 1 cm increase in sward height, reduced by 0.69 kg/day per kg increase in concentrate, and increased by 0.21 kg/day per kg increase in initial milk yield.

INTRODUCTION

A major problem with high yielding cows when grazing is an inadequate herbage intake. There is a low upper limit to herbage intake under grazing (Meijs and Hoeskstra, 1994; Mayne and Wright, 1988), and supplementation is required. Pulido and Leaver (1995a), reported that Holstein Friesian cows on a high sward height (7 to 9 cm, rising plate meter) and 6 kg/day of concentrate (160 g CP/kg, 12.8 MJ ME/kg DM) failed to prevent high rates of milk decline (> 0.19 kg/day). The objective of this experiment was to investigate how the initial milk yield level, sward height and concentrate up to *ad libitum* level influenced intake, grazing behaviour and animal performance.

MATERIALS AND METHODS

A short-term experiment was carried out in spring over 42 days, with 48 multiparous Holstein Friesian cows. Two initial milk yield groups of 21.3 and 35.5 kg/day, were used. The two ranges of compressed sward heights of 3 to 5 cm, and 7 to 9 cm, and the three concentrate (200 g CP/kg DM and 11.4 MJ ME/kg DM kg concentrate) levels of 0 and 6 kg/day and *ad libitum* were evaluated in a factorial design. The cows receiving 6 kg/day concentrate were fed twice daily in individual yokes, and the *ad libitum* group were offered free access to concentrate in the field. The grazing area consisted of 8.53 ha of perennial ryegrass which was set stocked. The herbage intake (HDMI) and total dry matter intake (TDMI) was estimated indirectly from individual cow performance (Leaver, 1982). Grazing time (GT), rumination time (RT), and idling time (IT) were recorded twice for each cow in 24 hour observations. Multiple regression analyses were carried out relating the dependent variables herbage intake and grazing behaviour to the independent variables (IMY, SH, CI).

RESULTS AND DISCUSSION

The main effects of treatments on milk production, grazing behaviour and herbage and total dry matter intake are shown in table 1. There was a significant ($P(0.05)$) increase in milk yield from increasing concentrate intake but there was no response over 6 kg/day. However,

in a previous study Pulido and Leaver (1995a) found a 6 kg/day of concentrate was unable to sustain milk yields even at high sward heights. In this experiment between 6 kg/day and *ad libitum* level of concentrate, a large reduction in grazing time, rate of intake and herbage intake was found. There was no indication that cows of higher milk yield level responded better in milk production to greater sward height or concentrate level. HDMI and TDMI (kg/day) was highest for the high sward height and for high yielding cows ($P \leq 0.001$). Sarker and Holmes (1974), Journet and Demarquilly (1978) and Pulido and Leaver (1995b), reported that increases in herbage intake and total intake from increasing milk yield level is mainly from increased grazing time.

Table 1

: Mean production responses, herbage dry matter intake, grazing time and rate of intake in Spring .

	Milk Yield (kg day ⁻¹)	HDMI kg/day	TDMI kg/day	GT min/day	R.I. g/min
Sward Height					
3 - 5 cm	26.7	11.0	17.2	488	21.5
7 - 9 cm	26.9	14.2	18.8	471	30.4
s.e.d.	1.26	0.72	0.65	13.3	1.91
Sig.	NS	***	***	NS	***
Concentrate					
0	24.0	16.5	16.5	531	31.4
6	28.4	13.6	18.9	526	25.8
<i>Ad libitum</i>	27.8	7.8	18.6	381	20.7
s.e.d.	1.54	0.88	0.80	16.3	2.34
Sig.	**	***	**	***	***
Initial Milk Yield					
21.3	21.2	11.3	16.4	459	24.1
35.5	32.3	14.0	19.6	500	27.9
s.e.d.	1.26	0.72	0.65	13.3	1.91
Sig.	***	***	***	**	*

In this experiment, grazing time increased by 2.45 min/kg milk yield ($P \leq 0.001$) and declined by 11.0 min/kg concentrate ($P \geq 0.05$). Pulido and Leaver (1995b), showed a lower rate of decline in grazing time per kg of concentrates than reported in this experiment. However, in that experiment the maximum level of concentrates was 6 kg/day, compared with 12.2 kg/day for the *ad libitum* level in this experiment. The rate of intake (g DM/min) was higher ($P \leq 0.001$) for the high sward height, for high yielding cows and was decreased by concentrate intake. Similar results were found by Pulido and Leaver (1995b) who suggested that high yielding cows respond to the high demand for nutrients by increasing rate of intake and grazing time. However, there is a limit to which they can compensate (Hodgson, 1990), and high rates of decline in milk yield often occur.

A summary of regression coefficients for food intake and grazing behaviour are presented in the table 2. The coefficients indicated that the HDMI increased by 0.61 kg/day per 1 cm increase the sward height; reduced by 0.69 kg/day per kg increase in concentrate; and increased by 0.21 kg/day per kg increase in initial milk yield. Grazing time, ruminating time and rate of intake were influenced by the three independent variables. There were no significant interactions between

SH and CI, and there was no indication that cows of high milk yield level respond differently to sward height and concentrate variations than lower yielding cows.

We conclude that sward height, concentrate level and milk yield level are significant factors influencing herbage DM intake, grazing behaviour and therefore rate of milk yield decline. However even under high sward height and ad libitum concentrate conditions, total DM intakes are lower than under housed feeding conditions.

Table 2

Multiple regression for milk yield decline, food intake and grazing behaviour.

	Constant	SH	CI	IMY	R ²	Sig.
Spring						
HDMI (kg/d)	7.33	0.607	-0.690	0.205	81.6	0.001
TDMI (kg/d)	7.33	0.607	0.200	0.205	53.6	0.001
GT (min)	541	-10.8	-11.0	2.45	53.7	0.001
RT(min)	249.4	25.0	2.01	-0.2	53.6	0.001
IT(min)	409	-14.1	8.97	-2.21	55.0	0.001
RI(g/min)	10.2	2.12	-1.01	0.322	64.7	0.001

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