Short-Term Milk Yield Response to Changes in Post-Grazing Sward Height

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Introduction

In temperate climates, grazed grass is the cheapest source of nutrients for the dairy cow (Finneran *et al.* 2010), therefore its utilisation should be optimised throughout the grazing season to increase enterprise profitability (Shalloo *et al*. 2004). Within spring-calving systems, energy requirements increase for the post-parturient dairy cow during the spring period. On the other hand, spring grass supply can be limited given low over-winter grass growth rates. The imposition of a lower post-grazing sward height (PGH) during this critical time may be a viable solution to increase grass availability. As the season progresses, PGH may be increased or decreased to adjust the allowance of grass in the dairy cow's diet depending on farm grass supply. Quantifying the variation in animal production with changes in PGH will inform such decisions. Currently, there is no information available on the milk production response to changes in PGH over a short period of the lactation. Therefore, the aim of this experiment was to determine the short-term variation in milk yield (MY) and yields of protein, fat and lactose in response to changes in PGH around the tenth week of lactation of the spring calving dairy cow.

Materials and methods

Ninety spring-calving Holstein Friesian dairy cows (mean calving date February 13, 2011) were balanced in a randomised block design (Ganche *et al*. 2012) and randomly assigned pre-calving to one of 3 PGH treatments (n=30): 2.7 cm (severe - S), 3.5 cm (low – L) or 4.2 cm (moderate – M) from February 14 to April 24, 2011. From April 25, animals were re-randomised within each treatment to graze across two PGH: 3.5 cm (low-L) or 4.5 cm (moderate – M). Animal production was measured within two periods: from April 4 to 24 (period 1; P1) and from April 25 to May 15 (period 2; P2). Consequently, the six treatments (n=15) of P2 were as follows: S-L, S-M, L-L, L-M, M-L and M-M. Each treatment herd was managed independently. Herbage was allocated daily; compressed pre- and post-grazing heights were measured daily, using a pasture plate meter (Jenquip, Fielding, New Zealand). Milk yield was measured daily; milk composition was measured weekly. Animals were in week 10 of the lactation, on average within each PGH treatment when the change in PGH treatments occurred on April 25.

Data on animal variables were analysed by covariate analysis using the SAS PROC MIXED statement with terms for parity, treatment and the interaction of parity and treatment. Days in milk and pre-experimental milk data were used as covariates for the analysis of P1 variables. Days in milk and the averaged P1 milk production were used as covariates for the analysis of P2 variables. The variation in milk, milk protein, fat and lactose yields between P1 and P2 were calculated per cow, by the difference of mean P1 yield and P2 yield. Because PGSH treatments in P1 and P2 are two quantitative factors, the model predicting the variations in MY, yields of milk protein, fat and lactose between P1 and P2 was rewritten with one factor (parity) and three covariates: (1) PGSH in P1; (2) PGSH in P2; and (3) the respective milk yield or milk component yield prior to P2 (*i.e.* during P1). The analysis of covariance on individual MY variations between P1 and P2 showed no interaction between P1 and P2 PGH treatment effects.

Results and Discussion

During P1, the S, L and M cows grazed to 2.7, 3.6 and 4.4 cm (s.e.d. 0.07 cm), respectively. Increasing PGH from S to L to M linearly increased (P<0.001) daily MY (21.5, 24.6 and 25.8 kg/cow/day; s.e.d. 0.59 kg).

During P2, average MY (P<0.001) were 21.7 and 22.9 kg/cow/day (s.e.d. 0.29 kg), respectively for cows grazing to the actual PGH of 3.6 (L) and 4.7 cm (M).The MY variation associated with each treatment during P2 were as follows: S-L, -1.03 kg/cow/day; S-M, +0.68 kg/cow/day; L-L, -2.56 kg/cow/day; L-M, -1.11 kg/cow/day; M-L, -4.17 kg/cow/day; M-M, -2.39 kg/cow/day. Independent of P2 treatment effect, the higher PGH in P1 resulted in greater (P<0.001) average MY loss in P2 of 3.28 kg milk/cow/day for the M treatment cows in P1, compared to an average loss of 1.83 kg/cow/day and 0.17 kg/cow/day for cows in the L and S treatments in P1. Independent of PGH imposed in P1, cows grazing to 3.6 cm (L) during P2 suffered a greater (P<0.001) reduction in MY (-2.59 kg/cow/day) during P2 compared to cows grazing to 4.7 cm (M) (-0.94 kg/cow/day). The equations established to predict the variations in MY and protein,

Table 1. Equations for predicting milk yield variation (Δ) to changes in post-grazing sward height (PGSH) between P1 (April 4 to 24) and P2 (April 25 to May 15): equations coefficients.

	Intercept	Slope 1 P1_PGH	Slope 2 P2_PGH	s.e.d.	R^2
Milk yield Δ (kg/cow/day)	- 1.27	- 1.9	+1.5	0.31	0.64
Milk protein yield Δ (g/cow/day)	- 2.24	- 76.1	+53.6	11.23	0.68
Milk fat yield Δ (g/cow/day)	+2.73	- 103.4	+75.0	23.44	0.55
Milk lactose yield Δ (g/cow/day)	- 49.89	- 82.6	+61.8	16.81	0.54
Milk solids yield Δ (g/cow/day)	-2.21	-179.4	+129.2	29.07	0.67

s.e.d = SE of the difference

fat and lactose yields in response to changes in PGH between P1 and P2 are presented in Table 1.

Peak milk yield had already been achieved for the majority of the cows, and daily MY was expected to decrease as the lactation progressed (Wood 1977). Olori *et al*. (1997) reported a decrease of 0.047 kg milk per cow per day between lactation weeks 8 and 13. The MY losses to changes in PGH in the present experiment were substantially larger. This may be explained by the dramatic change in grazing regime that occurred between the end of P1 and the start of P2. The M-L cows reduced MY as they were offered in P2 1.6 kg less pasture than in P1. Conversely, MY of the cows on the S-M treatment increased in P2, due to the large increase in PGH following P1. This indicates that cows greatly restricted during the first 10 weeks of lactation were able to adjust production thereafter in accordance to the greater PGH imposed.

Conclusions

This experiment quantified the milk production variation resulting from a change in PGH around the tenth week of the lactation. The present findings provide a practical decision tool for dairy farms with fluctuations in grass supply during this specific period. The present findings also confirm that dairy cows are highly responsive to an increase or decrease in the quantity of feed offered and change their milk yield accordingly.

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