The effect of pasture allowance offered for different time durations on the dry matter intake of dairy cows

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Abstract

Milk quota abolition will increase herd size resulting in greater deficits in spring grass availability. 96 early lactation grazing dairy cows were assigned to one of four pasture allowances (PA; 60, 80, 100 and 120% of intake capacity) for either 2 or 6 weeks. All cows were allocated a 100% PA during the carryover period. Dry matter intake (DMI) was estimated during weeks 2, 6 and 13. During week 2, there was no difference in DMI between the 100 and 120% allowances (13.7 kg DM cow^{-1}) but their DMI was significantly greater than the 60 and 80% allowances (10.4 and 11.5 kg DM cow^{-1}, respectively), which were also significantly different to each other. During week 6, there was a significant interaction between PA and duration. Cows assigned to the 2-week treatment had similar DMI (13.9 kg DM cow^{-1}). The 120×6 treatment (14.6 kg DM cow^{-1}) was significantly different to the 60×6, 80×6 and 100×6 treatments (10.7, 12.3 and 13.3 kg DM cow^{-1}, respectively). There was no difference in DMI between the 80×6 and the 100×6 treatments (12.8 kg DM cow^{-1}), which were both different to the 60×6 treatment (10.7 kg DM cow^{-1}). During week 13, there was no effect of treatment on DMI (15.1 kg DM cow^{-1}). Differences in DMI were observed during the experimental period, but there was no effect of treatment on DMI during the carryover period. In conclusion, varying the PA of early lactation dairy cows from 60 to 120% of intake capacity for 2 or 6 weeks produced no carryover effects in terms of DMI.

Keywords: pasture allowance, early lactation dairy cows, dry matter intake, carryover period

Introduction

Grazed grass is the cheapest source of nutrition for dairy cows in Ireland (Finneran *et al.*, 2010), and along with grass silage can account for more than 80% of the diet of Irish dairy cows (Shalloo *et al.*, 2004). The 50% increase in milk production proposed in 'Food Harvest 2020' will be achieved by an earlier spring-calving date, higher stocking rates and increased milk yield per cow (Dillon, 2011). This will lead to increased demand for grass, especially in spring, and will result in greater nutritional deficits as grass supply at this time can be extremely variable (Ganche *et al.*, 2013). The objective of this experiment was to determine the dry matter intake (DMI) of early lactation grazing dairy cows allocated to one of four pasture allowances (PA) for either 2 or 6 weeks, and to establish if any carryover effects of treatments imposed during early lactation exist.

Materials and methods

This full lactation study took place at Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork from 25 March to 27 November 2014. 96 early lactation dairy cows (41 primiparous and 55 multiparous) were blocked by breed (Holstein-Friesian, n=52; Jersey × Holstein-Friesian, n=38; Norwegian Red, n=6), calving date (February 17 ± 15.5 days), parity (2.4±1.61), pre-experimental milk yield (22.6±4.20 kg), body weight (BW) (469±68.2 kg) and body condition score (BCS) (3.09±0.193) and from within block were randomly allocated to one of eight treatments in a randomised complete block design with a 4×2 factorial arrangement of treatments.

The cows were offered one of four PA (60, 80, 100 and 120% of intake capacity) for two durations of time (2 or 6 weeks). Cows were rotationally grazed on a perennial ryegrass (*Lolium perenne* L.) sward on a full-time basis. All cows were offered a grass-only diet for 2 weeks prior to the start of the experiment. The cows in the 100% PA treatment were fed to 100% of their intake capacity and all other treatments were calculated from this (e.g. if the 100% herd were offered 15 kg DM cow^{-1} day^{-1} the 80% herd were offered 12 kg DM cow^{-1} day). Intake capacity was calculated according to the equation of Faverdin *et al.* (2011) and was dependent on age, parity, days in milk, stage of pregnancy, BW, BCS and potential milk yield.

Pasture allocation was measured using pre-grazing herbage mass (>3.5 cm) and area (m^2). Pre-grazing herbage mass was measured by cutting two strips (1.2×10 m) per paddock and per treatment area twice weekly, with an Etesia mower. Ten grass-height measurements were recorded before and after each cut strip using a folding plate meter (diameter 355 mm and 3.2 kg m^{-1}; Jenquip, Fielding, New Zealand). All mown herbage from each strip was collected, weighed and sampled. A sub-sample of 100 g fresh weight of the herbage sample was dried for 16 h at 90 °C for DM determination. Pre- and post-grazing sward heights were measured daily using a rising plate meter.

Cows assigned to the 2-week treatment were allocated a PA of 100% of intake capacity once the 2 weeks had elapsed (PA was the same as the 100×6 treatment); all 6-week cows were offered a 100% PA once 6 weeks of being allocated to their respective treatments elapsed. The cows were offered fresh grass after each milking during the experimental period and on a 24-hour basis during the carryover period. Grass DMI was estimated during weeks 2, 6 and 13 using the n-alkane technique (Mayes *et al.*, 1986; Dillon and Stakelum, 1989).

The data were analysed using covariate analysis and mixed models in SAS v9.3, with terms for allowance, duration, the interaction between allowance and duration and the appropriate pre-experimental covariate.

Results and discussion

The PA for the 100% treatment during week 1 of the experiment was 13.4 kg DM cow^{-1} day^{-1}; this increased to 15.5 kg DM cow^{-1} day^{-1} by week 7 (Table 1). During week 13 the PA was 16.0 kg DM cow^{-1} day^{-1} for all cows. During week 2 there was an effect of PA on DMI. The 100 and 120% allowances were similar (13.7 kg DM cow^{-1}) but their DMI was significantly greater than the 60 and 80% allowances (10.5 and 11.5 kg DM cow^{-1}, respectively), which were also significantly different to each other. Post-grazing sward heights (PGSH) across all treatments were significantly different during this period (P<0.001). The 120% treatment had a higher PGSH (4.3 cm) than the 100, 80 and 60% treatments which were also significantly different to each other (3.7, 3.1 and 2.5 cm, respectively). During week 6, there was a significant interaction between PA and duration (P<0.01). Cows assigned to the 2-week treatment were offered a 100% PA. They had similar DMI (13.9 kg DM cow^{-1}) to the 100×6 cows, but the DMI of these treatments was significantly different to the DMI of 120×6, 80×6 and 60×6 treatments. There were, therefore, no carryover effects in terms of DMI for cows on the 2-week treatment. A 2-week period of restriction or surplus PA had no impact on the DMI of cows 4 weeks later. This was reflected in their PGSH as the 100×6 and 2-week treatments had similar PGSH during this period (3.8 cm), which was different to the 60×6, 80×6 and 120×6 treatments (2.8, 3.3 and 4.3 cm, respectively; P<0.001). During week 6 the DMI of the 120×6 treatment (14.6 kg DM cow^{-1}) was significantly different to the 60×6, 80×6 and 100×6 treatments (10.7, 12.3 and 13.3 kg DM cow^{-1}, respectively). Differences in DMI between the 100×6 and 120×6 treatments resulted from the 20% higher PA offered to the 120×6 cows. These cows had a greater ability to select pasture which was higher in organic matter digestibility (OMD) and UFL (Unité Fourragère Lait) value, and lower in fill value, enabling a greater DMI. Although the 120×6 cows had a 20% higher PA compared to the 100×6 treatment they only had a 9% higher DMI. Providing a PA of 120% of intake capacity for 2 or 6 weeks resulted in poorer sward utilisation when compared to 100% (PGSH increase of 0.6 cm and 0.4 cm during weeks 2 and 6, respectively) which may have consequences for grass quality in subsequent rotations. There was no difference in DMI between

Table 1. Effect of pasture allowance offered for different time durations on the dry matter intake of early lactation dairy cows.[1]

	60×2	80×2	100×2	120×2	60×6	80×6	100×6	120×6	SED	PA	D	PA×D
Wk2	10.6	11.6	13.4	13.9	10.3	11.4	13.2	14.2	0.58	***	NS	NS
Wk6	14.2^{ad}	14.1^{ad}	13.4^{ac}	13.8^{ad}	10.7^{b}	12.3^{c}	13.3^{ac}	14.6^{d}	0.60	***	***	***
Wk13	15.2	16.1	14.6	14.5	14.6	15.4	14.8	15.8	0.67	NS	NS	NS

[1] SED = standard error of the difference; PA = pasture allowance; D = duration, PA×D = pasture allowance × duration, Wk = week; *** = $P<0.001$.

the 80×6 and 100×6 treatments (12.8 kg DM cow^{-1}) which were both different to the 60×6 treatment (10.7 kg DM cow^{-1}). During week 13, there was no effect of treatment on DMI (15.1 kg DM cow^{-1}) indicating that there was no carryover effect of treatment.

Conclusions

The quantity of pasture offered to dairy cows in early lactation significantly affected their DMI. However, when they returned to being offered 100% of their intake capacity no differences in DMI were observed indicating no carryover effects of previous treatments on this factor; however, there may be possible effects on body weight, behaviour, reproduction and milk production.

References

Dillon P. (2011) The Irish Dairy Industry – planning for 2020. In: Teagasc National Dairy Conference, Cork & Athlone, Ireland, pp. 1-24.

Dillon P. and Stakelum G. (1989) Herbage and dosed alkanes as a grass measurement technique for dairy cows. *Irish Journal of Agricultural Research* 28, 104.

Faverdin P., Baratte C., Delagarde R. and Peyraud J.L. (2011) GrazeIN: a model of herbage intake and milk production for grazing dairy cows. 1. Prediction of intake capacity, voluntary intake and milk production during lactation. *Grass and Forage Science* 66, 29-44.

Finneran E., Crossan P., O'Kiely P., Shalloo L., Forristal P.D. and Wallace M. (2010) Simulation modelling of the cost of production and utilizing feeds for ruminants on Irish farms. *Journal of Farm Management* 14, 95-116.

Ganche E., Delaby L., O'Donovan M., Boland T.M. and Kennedy E. (2013) Direct and carryover effect of post-grazing sward height on total lactation dairy cow performance. *Animal* 7, 1390-1400.

Mayes R., Lamb C. and Colgrove P.M. (1986) The use of dosed and herbage n-alkanes as markers for the determination of herbage intake. *Journal of Agricultural Science* 107, 161-170.

Shalloo L., Dillon P., O'Loughlin J., Rath M. and Wallace M. (2004) Comparison of a pasture-based system of milk production on a high rainfall, heavy-clay soil with that on a lower rainfall, free-draining soil. *Grass and Forage Science* 59, 157-168.