The effect of pre-graze mowing at different pre-graze masses on cow and pasture performance

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Abstract

Early lactation cows were allocated to one of four treatments in a replicated 2 × 2 factorial study. Treatments were two pre-graze pasture masses: moderate (2,800 kg DM ha^{-1} to ground level; MOD) and high (3,400 kg DM ha^{-1}; HIGH) and two harvesting methods: grazing standing pastures (G), or mowing before grazing (M). Mowing before grazing did not alter milk solids (fat + protein) production, or body condition score. However, M reduced pasture density and pasture harvested. Consistent with this, less silage was conserved and more silage fed in M compared with G. Irrespective of harvesting method, cows in MOD produced 6% more milk solids than cows in HIGH. There were minimal differences in the nutrient composition of pasture from MOD and HIGH, but cows in MOD spent less time grazing than in HIGH. In summary, there was no animal performance benefit from M in either MOD or HIGH; however, M reduced pasture eaten and increased the requirement for imported feed. Furthermore, irrespective of harvesting method, cows offered a MOD pre-graze pasture mass produced more milk solids than those offered a HIGH pre-graze mass.

Keywords: grazing, mowing, pasture mass, milk solids

Introduction

Environmental constraints in grazing systems have added to the challenges of improving farm performance by limiting land area and/or cow numbers. In response, some farmers target higher than recommended pre-graze pasture masses (i.e. > 3,200 kg DM ha^{-1} to ground level), with an associated belief that this will increase pasture grown, but that mowing before grazing is required to harvest this extra pasture. Earlier research indicated little or no benefit of mowing before grazing on milk solids (fat + protein) production, with immediate effects including reduced dry matter intake (DMI), pasture growth and silage conservation (Kolver *et al.*, 1999; Bryant *et al.*, 2016). However, these studies did not investigate the longer-term impact of continuous mowing during spring and summer in systems with greater than recommended pre-graze pasture masses.

Materials and methods

The present experiment was conducted at the Lincoln University Research Dairy Farm, Canterbury, New Zealand (NZ). In October 2016, 136 early-lactation, primiparous and multiparous Friesian × Jersey cows were randomised into eight farmlets for 120 days. Farmlets were randomly allocated to one of four treatments in a replicated 2 × 2 factorial study. Treatments consisted of two pre-graze pasture masses (2,800 kg DM ha^{-1}; to ground level; MOD vs 3,400 kg DM ha^{-1}; HIGH) and two harvesting methods (grazing standing pastures; G vs mowing before grazing; M). Paddocks within each farmlet consisted of perennial ryegrass (*Lolium perenne* L.) and white clover (*Trifolium repens* L.) pastures and were balanced for soil type, pasture age, ploidy and previous management. All farmlets were offered the same daily pasture allowance. Daily area offered (rotation length) varied between MOD and HIGH to achieve target pre-graze masses, target post-graze residual (3.5 - 4 cm compressed height on a rising plate meter; RPM), and cow DMI. Paddocks in M were mown approximately 1 h before grazing using a UFO twin-drum mower (no conditioner) with blade height set to achieve target residuals. If pasture allocation was below target and the area offered could not be increased sufficiently, cows were supplemented with pasture silage to meet intake requirements. If pre-graze pasture mass was greater than 5% above target, paddocks were closed and harvested for silage. Individual milk yields were recorded daily and milk composition determined weekly. Body condition score (BCS) was measured fortnightly. Daily grazing and ruminating times were determined in four cows per farmlet using eartags containing motion sensors (Sensoor). Pre- and post- graze heights were measured for each grazing using an RPM and calibrated equations determined for each treatment (Bryant *et al.*, 2016). Pasture residuals from mown paddocks were collected and weighed weekly. Representative pre- and post- graze pasture samples were collected weekly by cutting standing pastures to ground level and analysed for botanical and nutritive composition (Bryant *et al.*, 2016). All data were analysed with mixed models fitted using REML in GenStat 16.0 (VSN International, 2013). Pre-graze mass, harvesting method and their interaction were included as a fixed effect and week within treatment were included as random effects. Differences were considered significant at $P < 0.05$ and a trend declared at $P < 0.10$.

Results and discussion

Animal and pasture measurements are presented in Table 1. To achieve target pre-graze masses, the rotation length was eight days longer in HIGH compared with MOD. Calibration equations derived for each treatment throughout the experiment indicated that there was less kg DM ha^{-1} available at a given height in M relative to G. This is consistent with Bryant *et al.* (2016) and resulted in a trend ($P = 0.05$) for pre-graze pasture mass to be less in M vs G. Mowing achieved target post-grazing residuals (3.5 - 4 cm) while G had greater residuals (4.5 - 5.0 cm). However, post-mown residuals indicated some mown pasture was not harvested and remained lying in the paddock after the cows had finished grazing (Table 1).

There was no difference in total milk solids production or BCS change between M and G. This is consistent with previous studies (Kolver *et al.*, 1999 and Bryant *et al.*, 2016) that reported little or no improvement in animal performance when mowing before grazing was compared with grazing standing pastures for short periods. In the current study, continuous mowing of pastures reduced pasture performance (Table 1). Pastures that were mown before grazing were less dense (less kg DM ha^{-1} available for a given height) compared with those that were grazed. Although no significant difference was detected in daily pasture growth rates, estimated DMI from pasture was lower (14.3 vs 15.6 kg DMI per cow day^{-1}; $P < 0.05$), and more silage (0.5 vs 0.1 t DM ha^{-1}) was fed to meet allocation targets in M. In addition, less

Table 1. Effect of harvesting method (mowing before grazing; M vs grazing standing pasture; G) at HIGH (3,400 kg DM ha^{-1}) and MOD (2,800 kg DM ha^{-1}) pre-graze pasture mass on farm system variables.

Variable	Treatment				SED	*P*-value		
	HIGH-G	HIGH-M	LOW-G	LOW-M		Mass	Harvesting	M × H
Fat yield (kg d^{-1})	0.99	1.00	1.04	1.07	0.02	<0.01	0.29	0.38
Protein yield (kg d^{-1})	0.76	0.77	0.84	0.83	0.02	0.01	0.82	0.69
Estimated total DMI (kg d^{-1})[1]	15.8	15.7	15.8	15.3	0.6	0.54	0.45	0.68
BCS change (1 - 10 scale)	-0.14	-0.12	-0.13	-0.18	0.08	0.66	0.81	0.55
Rotation length (d)	29	28	21	21	0.3	<0.01	0.59	0.04
Pre-graze mass (kg DM ha^{-1})	3,446	3,156	2,890	2,705	49	<0.01	0.05	0.33
Post-graze mass (kg DM ha^{-1})[2]	1,820	1,499	1,790	1,615	18	<0.01	<0.01	0.04
Post-mow mass (kg DM ha^{-1})[3]		190		143	86.5		0.39	
Silage fed (t DM ha^{-1})	0.07	0.49	0.09	0.48	0.03	0.98	<0.01	0.72
Silage harvested (t DM ha^{-1})	0.55	0.07	0.39	0.00	0.04	0.15	<0.01	0.54

[1] Estimated total DMI = sum of pasture DMI (pre - minus post-grazed and mown mass / area grazed / number of cows) plus silage intake (kg per cow d^{-1}).

[2] Residual mass of standing pasture.

[3] Residual mass of mown pasture.

silage was conserved (0.05 vs 0.5 t DM ha^{-1}) from M compared with G (Table 1). The lower estimated DMI, pasture production and silage conservation is consistent with previous studies (Kolver *et al.,* 1999, Bryant *et al*., 2016) and confirms the negative effect of continuous mowing on pasture performance. There were no consistent differences in botanical or nutrient composition of pasture between M and G (data not presented). Irrespective of harvesting method, cows in MOD produced 6% more milk solids than those in HIGH (Table 1). The lower milk solids production with increasing pasture mass is consistent with previous studies (McEvoy *et al.,* 2009; Curran *et al.,* 2010). These studies attributed the reduced production to a lower pasture quality (increased dead material and fibre and reduced crude protein, digestibility and metabolisable energy; ME) with the higher herbage mass. However, in the current study, there was no consistent effect of pre-graze pasture mass on pasture quality (digestibility, fibre or ME). An alternative explanation may be that there was less pasture available between 2.5 and 5 cm in HIGH. Perez-Prieto and Delagarde (2012) proposed this as a reason for reduced milk yield with increasing herbage mass above 5 cm. In the current study, allocated grazing areas for cows in HIGH were 30% less than for cows in MOD, which would reduce available herbage between 2.5 and 5 cm and may have contributed to the reduced milk production in HIGH. Cows in HIGH also spent an extra 42 mins d^{-1} grazing compared with those in MOD, which is possibly an attempt to counter a reduced intake rate from grazing more mature pastures.

Conclusion

Cows offered a moderate pre-graze pasture mass (2,800 kg DM ha^{-1}) produced more milk solids than those offered a higher pre-graze pasture mass (3,400 kg DM ha^{-1}), and this was not affected by mowing pastures before grazing. Importantly, continuous mowing of pastures reduced pasture performance and increased the requirement for imported feed.

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References

Bryant R.H., Kingsbury L.A. and Edwards G.R. (2016) Does mowing before grazing increase dry matter intake and milk yield? *The New Zealand Society of Animal Production* 76, 73-77.

Curran J., Delaby L., Kennedy E., Murphy J.P., Boland T.M. and O'Donovan M. (2010) Sward characteristics, grass dry matter intake and milk production performance are affected by pre-grazing herbage mass and pasture allowance. *Livestock Science* 127, 144-154.

Kolver E.S., Penno J.W., Macdonald K.A., McGrath J.M. and Carter W.A. (1999) Mowing pasture to improve milk production. *Proceedings of New Zealand Grassland Association* 61, 139-145.

McEvoy M., O'Donovan M., Kennedy E., Murphy J.P., Delaby L. and Boland T.M. (2009) Effect of pregrazing herbage mass and pasture allowance on the lactation performance of Holstein-Friesian dairy cows. *Journal of Dairy Science* 92, 414-422.

Perez-Prieto L.A. and Delagarde R. (2012) Meta-analysis of the effect of pregrazing pasture mass on pasture intake, milk production, and grazing behavior of dairy cows strip-grazing temperate grasslands. *Journal of Dairy Science* 95, 5317-5330.