Short Communication: Effect of Postgrazing Residual Pasture Height on Milk Production

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ABSTRACT

In grazing systems, dry matter intake (DMI) and milk production have been reported to increase with increasing pasture allowance (PA). This has often led to greater postgrazing residual heights being associated with a well-fed cow. However, in previous studies pastures were often managed to be homogeneous pretreatment, confounding the effect of postgrazing height and PA because high PA led to high postgrazing height. The objective of this study was to determine whether postgrazing height affects milk production if cows are offered the same PA. Before the study, perennial ryegrass (Lolium perenne L.) dominant pastures were randomly allocated to 1 of 3 grazing treatments and defoliated to 4.1 ± 0.3 (low), 5.1 ± 0.3 (medium), or 5.9 ± 0.3 (high) cm compressed postgrazing residual pasture height. When a minimum of 2 new leaves had emerged on the majority of ryegrass tillers, 30 multiparous dairy cows were randomly assigned to 1 of the 3 treatments and grazed their respective pastures over a 10-d period. Cows were offered a similar PA above the preexperimental postgrazing residual (17.1 ± 2.9 kg of dry matter/cow per d). Pasture disappearance per daily grazing area (estimated DMI) was similar across treatments (14.8 kg of dry matter/cow per d). Milk yield was negatively correlated with postgrazing height, but postgrazing height had no effect on milk component yield. Although the reason for this reduction in milk yield remains unclear, data indicate that low postgrazing heights do not adversely affect milk production.

Keywords: milk production, pasture postgrazing residual, grazing

In grazing systems, DMI, the main determinant of milk production (Holmes et al., 2002), is primarily controlled by pasture allowance (PA; Nicol and Nicoll, 1987). It has been reported that large amounts of pasture must be offered to achieve high DMI and milk production (Stakelum, 1986; Stockdale, 2000). Pasture allowance is affected by both the pregrazing mass of the pasture and the area allocated to the cows for grazing. In previous studies, when pretreatment pastures were homogeneous (Le Du et al., 1979; Wales et al., 1998), decreasing PA (i.e., providing smaller grazing areas) lowered milk production. It also reduced the postgrazing residual or height. This has contributed to the belief that low postgrazing heights (more intensive grazing) reduce milk production (Mayne et al., 1987), when in fact the effect of grazing intensity cannot be separated from the confounding effect of PA in those studies.

One of the consequences of increasing PA to raise milk production is a corresponding rise in the postgrazing pasture residual. This is likely to decrease the quality of the pasture in subsequent rotations because of increased stem production and accumulation of dead material (Michell and Fulkerson, 1987; Stakelum and Dillon, 1990; Lee et al., 2007) and may reduce pasture production/ha (Lee et al., 2008; Macdonald et al., 2008) and pasture consumed/ha (Dalley et al., 1999; Wales et al., 1999; Macdonald et al., 2008), which are both important determinants in the profitability of grazing farms (Dillon et al., 2005). To determine the real effect of grazing intensity on milk production, it must be separated from the confounding effect of PA.

The objective of this study was to determine whether previous postgrazing height affects milk production if cows are offered the same PA.

The experiment was conducted at Elliott Research Station, Burnie, Tasmania, Australia (41.1°S 145.8°E; elevation 130 m) over a 10-d period in October 2006. The animal ethics committees of the Tasmanian Department of Primary Industries and Water and the University of Tasmania approved all procedures.

Before the experimental period, 12 grazing areas were randomly allocated to 1 of 3 grazing treatments (low, medium, or high postgrazing residual height), ensuring treatment areas were balanced for botanical composition and walking distance to the milking parlor. Over a period of 13 d during early spring (preexperimental period), pastures were grazed to 4.1 ± 0.3 (low),
The nutritive characteristics and botanical composition of the pasture offered are presented in Table 1.

Individual milk yields were recorded daily, and p.m. and a.m. milk samples were collected from individual cows on each of the last 2 d of the treatment period. Fat, protein, and lactose concentrations of milk were determined by MilkoScan 133 (Foss Electric, Hillerød, Denmark). Mean group DMI was estimated as the product of the difference between the pre- and postgrazing pasture yield and area grazed, as outlined by Roche et al. (1996).

All data were analyzed using the statistical procedures of GenStat 10 (VSN International Ltd., Hemel Hempstead, UK). Data were analyzed by ANOVA with cow as the random effect and linear contrasts of postgrazing residual height as a fixed effect. Treatment effects on estimated group DMI were compared with sampling day as a replicate. Preexperimental data were included as a covariate in the analysis of milk production and composition.

Pasture accumulation since the previous grazing increased linearly with postgrazing height ($P < 0.001$). This is consistent with previous research (Lee et al., 2008), but the positive effect of grazing residual on subsequent pasture growth has been shown to be transitory, with postgrazing heights in the range investigated here having no effect on pasture grown over several grazings. Altering the size of the grazing area ($P < 0.01$; 137, 112, and 89 m$^2$/cow per d for low, medium, and high, respectively) ensured a similar PA, both above the preexperimental postgrazing residual (16.9 ± 3.07, 17.3 ± 2.11, and 17.2 ± 3.71 kg of DM/cow per d for low, medium, and high, respectively) and to ground level (37.8 ± 7.41, 37.3 ± 5.71, and 34.7 ± 7.27 kg of DM/cow per d for low, medium, and high, respectively).

Postgrazing heights during the experiment were greater than during the preexperimental period, but a similar difference between treatments was maintained (4.8, 6.2, and 6.9 cm for low, medium, and high, respectively). Therefore, despite grazing to different postgrazing heights, pasture disappearance per daily grazing area was similar across treatments (estimated DMI; 14.7 ± 3.0, 14.7 ± 1.6, and 15.0 ± 2.9 kg of DM/cow per d for low, medium, and high, respectively).

In comparison with other studies that reported a positive effect of postgrazing height on milk production (Mayne et al., 1987; Gibb et al., 1997; Maher et al., 2003), a negative effect was observed in the current study, with milk yield declining ($P < 0.05$) with increasing postgrazing height (Table 2). Milk protein percent increased with increasing postgrazing height, but yield of milk constituents or FCM were not affected.
by treatment. Results indicate only a minor effect of postgrazing height on milk production when PA was similar across treatments.

In previous studies, the different postgrazing heights resulted from offering different PA from homogeneous pastures. Therefore, the lower milk production was probably a result of cows being offered less pasture, and consequently eating less (due to lower PA, but also reduced bite mass as cows grazed lower to the ground; Bargo et al., 2003). Due to the reduced PA, it is also likely that cows would have grazed lower than the previous postgrazing height, thus consuming older, and less nutritious, pasture. This reduced DMI and poorer quality feed (lower digestibility, higher fiber; Holmes and Hoogendoorn, 1983; Michell and Fulkerson, 1987; Holmes et al., 1992) would be expected to reduce milk production (Holmes et al., 2002), and are more likely the contributing factors toward the decline in milk production following intensive grazing (<5 cm postgrazing height; Mayne et al., 1987; Gibb et al., 1997; Maher et al., 2003), rather than the assumption that severe grazing directly reduced milk production per se.

In comparison, in the current study when cows were offered the same PA above the preexperimental postgrazing height.

### Table 1. Mean (±SD) nutritive characteristics and botanical composition of pasture offered to dairy cows during the experimental period following grazing to low, medium, or high postgrazing heights

<table>
<thead>
<tr>
<th>Item</th>
<th>Nutritive characteristics</th>
<th>Botanical composition</th>
<th>Postgrazing height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP, % of DM</td>
<td>NDF, % of DM</td>
<td>OM digestibility, % of DM</td>
</tr>
<tr>
<td></td>
<td>22.3 (2.0)</td>
<td>45.5 (3.7)</td>
<td>85.0 (3.4)</td>
</tr>
<tr>
<td></td>
<td>22.7 (1.7)</td>
<td>45.4 (2.0)</td>
<td>85.8 (3.3)</td>
</tr>
<tr>
<td></td>
<td>22.5 (1.9)</td>
<td>44.1 (3.4)</td>
<td>87.1 (4.0)</td>
</tr>
</tbody>
</table>

1Dairy cows grazing pastures to 4.8 (low), 6.2 (medium), or 6.9 (high) cm compressed postgrazing height during the experimental period.

2Of pasture above the preexperimental postgrazing height.

### Table 2. The effect of postgrazing pasture height1 on average daily milk production and milk composition of dairy cows offered a similar pasture allowance

<table>
<thead>
<tr>
<th>Item</th>
<th>Postgrazing height</th>
<th>SED</th>
<th>P-value, linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production, kg/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>23.4</td>
<td>23.1</td>
<td>26.8</td>
</tr>
<tr>
<td>FCM</td>
<td>23.5</td>
<td>24.7</td>
<td>21.3</td>
</tr>
<tr>
<td>Fat</td>
<td>0.95</td>
<td>1.02</td>
<td>0.87</td>
</tr>
<tr>
<td>Protein</td>
<td>0.73</td>
<td>0.74</td>
<td>0.68</td>
</tr>
<tr>
<td>Lactose</td>
<td>1.15</td>
<td>1.16</td>
<td>1.07</td>
</tr>
<tr>
<td>Fat</td>
<td>4.09</td>
<td>4.36</td>
<td>4.22</td>
</tr>
<tr>
<td>Protein</td>
<td>3.10</td>
<td>3.18</td>
<td>3.30</td>
</tr>
<tr>
<td>Lactose</td>
<td>5.00</td>
<td>5.02</td>
<td>5.05</td>
</tr>
</tbody>
</table>

1Dairy cows grazing pastures to 4.8 (low), 6.2 (medium), or 6.9 (high) cm compressed postgrazing height during the experimental period.
grazing residual, the yield of FCM or milk components was not affected by the lower postgrazing height, supporting the hypothesis that the negative effect of postgrazing height in the previous studies was PA-related. Furthermore, consistent with the presented results, Holmes et al. (1992) observed an increase in per cow production when cows grazed pastures of a lower pre-grazing mass to a lower postgrazing residual when PA was similar across treatments. The increase in milk production in that study was a result of improved nutritive value of the pasture fed. However, pastures with a low pre-grazing mass were created by shorter regrowth periods during the preceding winter. This may explain the improved nutritive value in the low grazing residual treatments in that study when compared with the current study, where only pasture that had grown since the previous rotation was being consumed, and that was likely to be of comparable nutritive value to the other treatments because it was of similar age.

The reason for the increase in milk yield with decreasing postgrazing height in the current study is not clear. Severe defoliation has been reported to decrease proportions of stem and dead material, thereby reducing the fiber content and increasing the digestibility and ME content of the pasture (Holmes and Hoogendoorn, 1983; Michell and Fulkerson, 1987; Holmes et al., 1992). However, these effects were not observed in the current study, possibly because it was too early in the season, or just that it was conducted over a single grazing rotation.

Data from the current study indicate that pastures can be grazed to a low postgrazing residual pasture height during spring without adversely affecting milk production. However, further research is required to fully understand the impact of low postgrazing heights on milk production over multiple rotations.

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REFERENCES


