The Grazing Behaviour of Cows Grazing Persian Clover or Perennial Ryegrass Pastures in Spring

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ABSTRACT: To examine the differences in grazing behaviour when lactating cows eat contrasting types of high quality pastures (Persian clover (Trifolium resupinatum L.) or perennial ryegrass (Lolium perenne L.) offered at high or low allowances in spring, the behaviour of cows was recorded both manually by visual observation and automatically using sensors that recorded jaw movements. Cows grazing Persian clover at the high allowance grazed longer than cows at the low allowance (p<0.05). Cows grazing Persian clover ruminated less and spent more time not chewing throughout the day (p<0.05) than cows grazing perennial ryegrass. The times recorded by automatic recorders were similar to those recorded by visual observation. The grazing jaw movement rates of cows grazing both pasture types were similar and remained constant during grazing bouts throughout the day. Cows grazing ryegrass had a higher bite rate than cows grazing Persian clover (p<0.05). High quality grass and clover pastures can be eaten at similar, rapid rates but they are eaten in a different manner.

Key Words: Dairy Cows, Grazing Behaviour, Perennial Ryegrass, Persian Clover

INTRODUCTION

A detailed knowledge of grazing behaviour is important in understanding the factors that affect pasture intake of grazing dairy cows (Hodgson, 1977). The development of solid-state behaviour recorders (Rutter et al., 1997) and software that can distinguish between different types of jaw movements allows detailed analyses of ingestive and ruminative behaviours.

High quality pastures are not uniform entities and intakes of clover-dominant swards are higher than those of perennial ryegrass when pasture allowance is high (80 kg DM/cow.day) (Rogers et al., 1982). Within a pasture type, allowance has a marked effect on DM intake (Wales et al., 1998). There have been several studies on how sward height affects grazing behaviour but there is limited information on the effects of pasture type.

This paper compares the ingestive and ruminative behaviour observed on two contrasting high quality pastures offered at a low and a high allowance.

MATERIALS AND METHODS

The experiment was conducted in spring (October/November) 1998 at Kyabram Dairy Centre (36°20’ S., 145°04’ E.) using 24 lactating Friesian cows (16 rumen fistulated, 8 non-fistulated). There were 4 treatments in a 2x2 factorial design with four fistulated and two non-fistulated cows in each treatment group.

The two non-fistulated cows were used to create a herd size that would facilitate behavioural interactions within each treatment group and were not used for any measurements. The six cows from a treatment group grazed within a common area. Treatments were:

- Clover low - Persian clover-dominant pasture; herbage allowance of 15 kg DM/cow/day;
- Clover high - Persian clover-dominant pasture; herbage allowance of 28 kg DM/cow/day;
- Ryegrass low - Perennial ryegrass-dominant pasture; herbage allowance of 21 kg DM/cow/day; and
- Ryegrass high - Perennial ryegrass-dominant pasture; herbage allowance of 46 kg DM/cow/day.

Pasture allowances were set to achieve similar intakes between pasture types at low and high allowances. The allowances of Persian clover were less than those of the corresponding perennial ryegrass treatments due to the higher utilisation of Persian clover pasture. Pasture allowances for the low allowance treatments were adjusted every three days to maintain about 8 kg less DM intake than that of the respective high allowance treatment. The daily pasture allowance was offered to cows in approximately equal amounts following milking, with the opportunity for cows to back graze the morning area in the afternoon.

The amount of pasture eaten by each grazing group was assessed every day using a sward sampling technique similar to that described by Stockdale and King (1983). A rising plate meter (Earle and McGowan, 1979) was used to estimate pre- and post-grazing pasture heights and masses.

Samples, cut to ground level, of pasture offered to cows were taken daily and subsampled for botanical composition and quality analyses. Botanical composition samples were sorted by hand into perennial ryegrass, white clover (Trifolium repens L.), Persian clover, weeds and dead material. Samples for quality were dried at 60°C for 72 h and ground through a 1 mm screen and analysed for neutral detergent fibre using a modification of the method described by Van Soest et al. (1991), in vitro DM digestibility by the method described by Clarke et al. (1982) and total nitrogen by the combustion method (Model FP-428 Leco: Australia).
Grazing behaviour while cows were grazing pasture was monitored visually during four 20.5 h periods. The time spent grazing, ruminating, standing and lying was determined by recording the activity of each cow, every 10 minutes, while they were in the pasture plots, with the assumption that the cows undertook the activity for the whole of the 10 minutes (Gary et al., 1970). Any time that was not recorded as grazing or ruminating was described as not chewing. Chewing activity was not monitored whilst cows were out of the plots for milking, between 0500 and 0700 h in the morning and 1400 and 1530 h in the afternoon.

Three fistulated cows in the high allowance treatments were also fitted with solid-state behaviour recorders (Rutter et al., 1997) to record their temporal patterns of grazing, ruminating and not chewing behaviour, over 24 h. Recordings were analysed by the software package 'Graze' (Rutter, 1998), using the bout activity criteria described by Gibb et al. (1998) and Rook and Huckle (1997). The software can distinguish between biting (prehension of pasture) and non-biting (manipulation and mastication of pasture) jaw movements during grazing.

Eating time measurements, averaged for the four fistulated cows, and total group pasture intakes, averaged for 6 cows, were used to calculate rate of intake over the day. Intake rate is defined as the time spent eating per kg of DM consumed.

The experimental unit was a fistulated cow. Treatment means for grazing behaviour visual observations were compared by analysis of variance using GENSTAT V. Statistical analysis of pasture data (quality and intake) was not possible.

### RESULTS

Pastures offered to cows had pregrazing heights of 25 cm for Persian clover and 21 cm for perennial ryegrass and were grazed to residual heights of 5 and 9 cm respectively. Persian clover swards were 76% Persian clover and perennial ryegrass swards were 70% perennial ryegrass with 15% white clover. The balance of each pasture was weeds and dead material. The digestibilities and crude protein and neutral detergent fibre concentrations were 77.3%, 21.6% and 27.5% for Persian clover and 75.4%, 11.3% and 53.5% for perennial ryegrass.

<table>
<thead>
<tr>
<th>Behaviour recorded by visual observation</th>
<th>Persian clover</th>
<th>Perennial ryegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Number of cows</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Grazing (min)</td>
<td>441a</td>
<td>551c</td>
</tr>
<tr>
<td>Ruminating (min)</td>
<td>404a</td>
<td>414a</td>
</tr>
<tr>
<td>Not chewing (min)</td>
<td>393c</td>
<td>288b</td>
</tr>
<tr>
<td>Average Intake (kg DM)</td>
<td>12.2</td>
<td>20.8</td>
</tr>
<tr>
<td>Intake rate (min/kg DM)</td>
<td>36</td>
<td>26</td>
</tr>
<tr>
<td>Rumination rate (min/kg DM)</td>
<td>33</td>
<td>20</td>
</tr>
</tbody>
</table>

### Table 1

Grazing behaviour of cows grazing Persian clover or perennial ryegrass pastures in spring at high or low allowances. Values in rows followed by different letters differ significantly.

<table>
<thead>
<tr>
<th>Behaviour recorded by automatic recorders</th>
<th>Persian clover</th>
<th>Perennial ryegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Number of cows</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Grazing (min)</td>
<td>-</td>
<td>565</td>
</tr>
<tr>
<td>Ruminating (min)</td>
<td>-</td>
<td>338a</td>
</tr>
<tr>
<td>Not chewing (min)</td>
<td>-</td>
<td>314</td>
</tr>
<tr>
<td>Grazing bite rate (/min)</td>
<td>-</td>
<td>46a</td>
</tr>
<tr>
<td>Grazing jaw movement rate (/min)</td>
<td>-</td>
<td>74</td>
</tr>
<tr>
<td>Chews/boli</td>
<td>-</td>
<td>39a</td>
</tr>
<tr>
<td>Total grazing bites</td>
<td>-</td>
<td>26500</td>
</tr>
<tr>
<td>Total grazing non-biting jaw movements</td>
<td>-</td>
<td>16000b</td>
</tr>
<tr>
<td>Total rumination jaw movements</td>
<td>-</td>
<td>19300a</td>
</tr>
<tr>
<td>Total jaw movements</td>
<td>-</td>
<td>61800</td>
</tr>
</tbody>
</table>

*Behaviour recorded when cows were out of plots for milking is not included to enable comparison with data from visual observations.*
Cows grazing Persian clover at the high allowance spent more time grazing than cows at the low allowance (p<0.05). There was no effect of allowance on grazing time of cows grazing perennial ryegrass. Cows grazing Persian clover spent less time ruminating (p<0.05) and more time not chewing (p<0.05) than cows grazing perennial ryegrass. Cows grazing at high allowances spent less time not chewing than cows at low allowances (p<0.05) (table 1). Grazing, ruminating and not chewing times obtained from automatic recorders appeared to be similar to those obtained from visual observations (table 1).

The grazing jaw movement rates of cows grazing both pasture types were similar (p>0.05) and remained constant during grazing bouts throughout the day (figure 1). The grazing bite rate of cows grazing perennial ryegrass was higher than that of cows grazing Persian clover (p<0.05) (table 1).

**DISCUSSION**

Pasture intake of a grazing animal can be defined by the product of time spent grazing, rate of biting during grazing and bite size (Allden and Whittaker, 1970). The similarities in intake and the lack of difference in grazing time between cows grazing Persian clover and perennial ryegrass, within an allowance treatment, suggests that both pastures were eaten at similar rates. However, there appears to be a difference in the way cows grazed the grass and clover swards. This is indicated by the difference in partitioning of jaw movements between biting and non-biting while grazing. The non-biting movements are probably mostly manipulative movements required to get pasture into the mouth. Clover may require more of these movements because its large, leafy structure is more difficult to get into the mouth than that of perennial ryegrass or that a greater length of material is removed with each bite. The bite rate on perennial ryegrass pastures was consistent with values reported previously (Rook et al., 1994; Gibb et al., 1999). Since intake rate is defined by bite rate x bite size, then the lower grazing bite rate by cows on Persian clover pasture may imply that their bite size is larger than that of cows grazing perennial ryegrass. Unfortunately the estimation of intakes in this experiment was for groups not for individual cows.

Under strip grazing conditions, the structure of the sward changes throughout the day as cows graze into it. Sward structure affects bite size which will affect intake rate (Chacon and Stobbs, 1976; Laca et al., 1992). Variations in intake rate across the day due to changes in pasture defoliation have not been determined for strip grazed pastures.

Grazing jaw movement rates tend to decrease as sward height increases (Gibb et al., 1997). In this experiment, the grazing jaw movement rates are slightly lower than those recorded previously on perennial ryegrass pastures. This is most likely due to the pastures being taller in this experiment than those used elsewhere (25 cm vs 9 cm). A reduction in sward height as cows graze into the sward does not appear to have altered grazing jaw movement rates throughout the day in this experiment. Gibb et al. (1998) also reported that grazing jaw movement rates did not alter significantly over the day when studied in four one-hour periods, although this was under continuous grazing conditions.

In a strip grazing system, where new breaks of pasture are offered to cows twice daily, the majority of grazing occurs within three hours of cows being offered a new break. Bouts of grazing that occur after these main grazing meals are usually shorter. Visual observations indicate that cows grazing at high allowances may graze more during the night than cows at low allowances.

Perennial ryegrass requires more chewing to break down than legumes (John et al., 1988). The observation that cows grazing perennial ryegrass spent...
more time ruminating than cows grazing Persian clover is consistent with this. Cows grazing perennial ryegrass did not appear to ruminate any more boli per day than cows grazing Persian clover but they did chew each bolus more. It is unknown what the stimulus is for a cow to stop ruminating a bolus and swallow it.

To summarise, high quality grass and clover pastures can be eaten at similar, rapid rates but they are eaten in a different manner.

ACKNOWLEDGEMENTS

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