

Effect of Spring Grazing Date and Stocking Rate on Sward Characteristics and Dairy Cow Production During Midlactation

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ABSTRACT

The objective of this study was to investigate the effect of initial spring grazing date and subsequent stocking rate on sward characteristics, grazing behavior, milk yield, and dry matter intake of spring-calving dairy cows during the main grazing season. Sixty-four spring-calving Holstein-Friesian dairy cows (58 ± 9 d in milk) were balanced and randomly assigned to 1 of 4 grazing treatments ($n = 16$) between April 12, and July 3, 2004. Two swards, an early-grazed (E) sward and a late-grazed (L) sward had 2 stocking rates, high and medium, imposed across them. Cows grazing the E swards were stocked at 4.5 cows/ha (E4.5) and 5.5 cows/ha (E5.5), whereas cows grazing the L sward were stocked at 5.5 cows/ha (L5.5) and 6.4 cows/ha (L6.4). Sward characteristics, grazing behavior, and grass dry matter intake (GDMI) were investigated during the second (R2) and fourth grazing rotations (R4). Total dry matter yield was greater on L swards in R2. In R2, the E swards had a greater proportion of leaf as well as a lesser stem and dead dry matter yield. During R2, organic matter digestibility and crude protein content were greater on the E sward than the L sward. Pre- and postgrazing heights were greater for the L swards in R2 and R4. In R4, there was a larger leaf allowance on the E swards. Grazing time was greater and ruminating time lesser for animals grazing the E sward in R2. During R4, intake per bite was greater for the E5.5 and E4.5 treatments. Milk and solids-corrected milk yields as well as GDMI were greater for animals grazing the E sward in both R2 and R4. The results of the present study suggest that early grazing initially had a positive effect on sward quality and structure, which resulted in improved grazing behavior characteristics, increased GDMI, and increased milk production. During R4, sward quality and structure were similar between

swards; thus, differences in grazing behavior were due to divergent daily herbage allowances. These results suggest that sward structure and quality as well as daily herbage allowance are important factors that influence animal performance and grazing behavior.

Key words: dairy cow, spring turnout date, sward profile, grazing behavior

INTRODUCTION

Grazed herbage can supply nutrients to dairy cows at a lesser cost than alternative feeds (Shalloo et al., 2004). Therefore, the objective of pasture-based systems must be to optimize the proportion of grazed grass in the diet of the dairy cow (Dillon et al., 2005). The greatest potential to do this exists in early spring and late autumn.

Allowing spring-calving dairy cows access to pasture earlier in lactation improves milk production (Kennedy et al., 2005). This practice also results in increased sward utilization and sward quality (O'Donovan et al. 2004). If grazing in spring is delayed, high herbage mass (HM) swards result, which are capable of supporting a high stocking rate (O'Donovan et al., 2004; Kennedy et al., 2006). If sward quality deteriorates in these high HM swards, milk production per animal may decrease.

Daily herbage allowance (DHA) is one of the major factors affecting the herbage intake of grazing animals. There is a strong curvilinear relationship between DHA and grass DMI (GDMI; Peyraud et al., 1996). On highly stocked swards, where DHA is restricted, animals are forced to graze deeper into the sward horizon consuming inferior-quality material in subsequent grazing rotations. This may affect the grazing behavior of the animals, as Newman et al. (1994) and McCarthy et al. (2007) concluded that a large component of herbage intake is behavioral. Newman et al. (1994) postulated that grazing behavior may be affected by many physical factors of the environment such as depth of the grazed horizon, sward density, and the vertical distribution of HM. Bite mass, one of the main determinants of intake

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rate, plays an important part in overall daily herbage intake (Phillips and Leaver, 1986) and has been shown to be influenced by sward structure (Laca et al., 1992).

The grazing hypothesis is that a greater stocking rate results in a greater grazing severity (O'Donovan et al., 2004), yet it may also lead to improved sward quality in subsequent grazing rotations. Grassland management for cows in spring is thus a complex interaction between 1) seeking to achieve early turnout so as to maximize annual GDMI, 2) ensuring that HM is not compromised by early turnout such that DHA is insufficient for high animal production, 3) ensuring high-quality herbage at turnout, 4) ensuring a sward structure that facilitates high intake rates by grazing cows, and 5) maintaining midseason sward quality through management in the early grazing season.

The interaction between sward and animal is an integral part of any grassland-based system. To maximize the contribution of grazed herbage to pasture-based dairy systems, a better understanding of the sward and the behavioral response of the animal is needed. The objective of this experiment was to investigate the effect of an early and delayed spring grazing date and subsequent stocking rate on sward structure, grazing behavior, milk yield, and GDMI of spring-calving dairy cows during 2 distinct periods between April and July (the main grazing season).

MATERIALS AND METHODS

The experiment was conducted at Moorepark Research Centre, Fermoy, Co. Cork, Ireland (50°7' N; 8°16' W). The soil type is a free-draining, acid brown earth with a sandy loam-to-loam texture. A grassland site dominated by 2- to 3-yr-old perennial ryegrass (*Lolium perenne* L.) swards was used. A grass seed mixture of 3 late diploid cultivars (Twystar, Cornwall, and Gilford) was initially sown. No clover was present in the sward. Each treatment was applied for four 21-d rotations (84 d) from April 12 to July 3, 2004; thus, each paddock was grazed once every 21 d. This was repeated on 4 occasions over the experimental period.

Treatments and Experimental Design

A grazing area of 14.6 ha was used to compare 4 grazing treatments: 2 swards with different initial grazing dates and 2 stocking rates (Table 1). The grazing area was divided into 4 large grazing plots. Half of each large plot was grazed once between February 16 and April 4 [(49 d) early grazed; **E**] to an average postgrazing rising plate meter height of 4.5 cm (SD 0.49). Surface damage was minimized during this period by removing animals when weather conditions were consid-

ered inclement. The other half remained ungrazed from the previous October (late grazed; **L**). Within the early- and late-grazing-date areas, subpaddocks were allocated to 2 stocking rates (high and medium), which were applied from April 12 to July 3. The experimental treatments were as follows: early medium (**E4.5**): early-grazed sward with a medium stocking rate of 4.5 cows/ha; early high (**E5.5**): early-grazed sward with a high stocking rate of 5.5 cows/ha; late medium (**L5.5**): late-grazed sward with a medium stocking rate of 5.5 cows/ha; late high (**L6.4**): late-grazed sward with a high stocking rate of 6.4 cows/ha. Within this experiment, the swards represented an early and a delayed start to the grazing season.

Animals in each herd were allocated an area allowance of 0.17, 0.14, 0.17, and 0.15 ha/d for the E4.5, E5.5, L5.5, and L6.4 treatments, respectively. Each treatment was allocated an equal number of paddocks within the 4 large grazing plots. In total, 21 paddocks were allocated to each treatment, all of which were grazed consecutively during the experimental period. Residency time in each paddock was 24 h; fresh herbage was allocated after the morning milking. All paddocks had an individual water supply. No concentrate was offered during the experimental period.

This paper is a component of a larger experiment (Kennedy et al., 2006) and will focus on sward structure, milk production, GDMI, and grazing behavior data from the 2 periods when grazing behavior was recorded. The first measurement period (**R2**) coincided with the second grazing rotation (May 2 to 22), whereas the second measurement period (**R4**) corresponded to rotation 4 (June 12 to July 3). The first series of grazing behavior collections commenced on May 5, and the second began on June 12. Production data from the entire experimental period is reported in Kennedy et al. (2006).

The first N fertilization (urea) was applied to all swards in mid-January at a rate of 60 kg of N/ha. Nitrogen (calcium ammonium nitrate) was reapplied to the early-grazed swards at the same rate immediately after their first grazing. No P and K applications were made to either sward because the soil index showed adequate concentrations. Nitrogen was applied at a rate of 60 kg of N/ha to each sward after grazing rotations 1 and 2 of the present study. The application rate was decreased to 40 kg of N/ha for rotations 3 and 4.

Animals

Sixty-four cows were originally selected from the Moorepark general spring-calving herd. Thirty-two animals were primiparous, whereas the remaining 32 animals were multiparous (24 second-lactation animals and 8 animals in their third or greater lactation). The

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