Effect of cow type and feeding strategy on grazing time in simplified rotational grazing systems

Delaby L.1, Launay F.2, Toutain A.2, Dodin P.2, Delagarde R.1

1 INRA, Agrocampus Ouest, UMR Pegase, 16 Le Clos 35590 Saint Gilles, France

2 INRA, Domaine Expérimental du Pin, Borculo, Exmes, 61310 Gouffern en Auge, France

Abstract

Grazing time (GT) is one component on grass intake and varies with animal and sward characteristics. The objective of this experiment was to describe the effect of breed (Holstein vs Normande) and parity (primiparous vs multiparous) on grazing time within simplified rotational grazing systems. Two groups of cows corresponding to two long-term feeding strategies grazed separately. One group (High - H) received 4 kg of concentrate while the other (Low –L) received only grass. Daily grazing time was measured with Lifecorder technology on 29 dairy cows (14 H and 15 L) during 5 grazing sequences (2 H and 3 L) varying between 7 and 13 days of residence depending on grass availability. On average, the daily paddock access time was 1,155 minutes and grazing time was 530 minutes. Parity had no significant effect on GT. Holstein cows grazed for an additional 27 minutes compared with Normande cows. Grazing time was reduced with concentrate allocation, by 10 minutes for each 1 kg of concentrate intake. Within a paddock, the GT varied with a regular increase during the residency period. This experiment confirms the large variation in GT, probably expressing a behaviour adaptation to maintain DM intake.

Keywords: dairy cow, grazing, grazing time

Introduction

The development of automatic devices able to record animal movements opens a lot of perspectives to understand better animal behaviour notably at grazing. Grazing time (GT) is one component on grass intake and varies with animal and sward characteristics (Bargo et al, 2003). GT is sometimes presented and debated as a potential indicator of good health, welfare quality, and also an opportunity to evaluate intake. The main objective of this paper is to describe the variation of GT between different types of dairy cows managed within a simplified rotational grazing system characterised with long term residency and large variation in grass availability during the grazing sequence.

Materials and methods

The grazing time (GT) measurements, realised in spring 2019, within a long-term experiment named “The cow for the system?” was undertaken at the INRA experimental farm of Le Pin-au-Haras (Normandy - 48.44°N - 0.09° E). This experiment aimed to compare the performance of different types of cows affected in two opposed feeding systems (FS) with a compact calving period in winter. The different types of cows (n= 70) balanced in the two FS are the consequence of breed (Holstein – Ho vs Normande - No), of parity (primiparous vs multiparous), of genetic types (high genetic merit for milk yield or for fat and protein content).

During the grazing season, the low (L) FS was based on grass only with a global stocking rate (SR) of 1.8 cows /ha while in the high (H) FS, with a SR of 3.0 cows /ha, the cows receive 4 kg of concentrate daily and forage supplements as necessary in summer. At grazing, the two groups (High and Low FS) are managed on separate platform applying the principle of a simplified rotational grazing system, as described by Hoden et al (1991). This grazing system is based on three large paddocks (2.4 ha each) grazed in spring and extended to 5 or 6 paddocks in autumn. The main characteristics of the grazing system is the long residence time in a paddock, varying between 8 to 12 days according to the pre grazing height (PreGH). The pastures are composed of perennial ryegrass and white clover, with few others plants. The annual level of N mineral fertilisation applied was fixed at 130 and 200 kg respectively for the L and H system.

At turnout, 30 cows (15 Ho and 15 No with 5 and 10 primiparous and multiparous per breed) have been selected in the both FS (15 H and 15 L) and equipped with Lifecorder devices (LCP, Suzuken Co. Ltd., Nagoya, Japan) fixed on a collar and placed around the cow neck. The Lifecorder technology is based on a uniaxial accelerometer that records physical activity level (range 1–9) for each 4-s period. Lifecorder has been successfully used and validated to record individual grazing time and nycthemeral pattern (Delagarde & Lamberton, 2015).

During the grazing season, GT has been measured during 5 grazing rotations (2 H and 3 L) of duration between 7 to 13 days, in May, June and July. No forage supplement has been fed to the H group during these grazing sequences. The two groups graze day and night except during two milkings. During this experiment, individual milk yield (MY) is measured at every milking and cows are weighed weekly.

Table 1: Pasture characteristics during the 5 rotations of grazing time measurements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| Feeding system | High | High | Low | Low | Low |
| Date | 16 to 28 May | 8 to 17 June | 15 to 26 May | 9 to 18 June | 8 to 14 July |
| PreGH (cm) | 15.4 | 12.5 | 13,2 | 11,6 | 10,0 |
| PostGH (cm) | 6.3 | 5.3 | 5.4 | 4.8 | 4.8 |
|  |  |  |  |  |  |

Because one recorder was dysfunctional, the GT has been recorded on 29 cows. Finally, 704 records have been validated. The mixed model applied on SAS 9.4 release software on GT and MY takes account the parity (n=2), the breed (n=2), FS (n=2); the day in the paddock (n=7 to 13) and the grazing rotation (n=5) within FS. Cows are introduced as random effect.

Results and discussion

The daily access time at grazing was on average 1,155 minutes per day and the mean grazing time reaches 530 minutes per day, with a minimum and maximum of respectively 242 and 722 minutes. In average GT represents 46% of the access time and 37% of a full day length. Only 5% of the records are less than 400 minutes and 17% are higher than 600 minutes per day.

Table 2: Adjusted means of daily grazing time and milk yield of different type of cows according to the breed, the parity or the feeding system

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Breed | Parity | Feeding system |
|  | Holstein | Normande | Primiparous | Multiparous | High | Low |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Grazing time (min) | 557 | 523 | 538 | 542 | 519 | 561 |
| Significance (P <) | 0.013 | 0.810 | 0.002 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Milk yield (kg/day) | 23.0 | 18.9 | 17.7 | 24.3 | 23.9 | 18.1 |
| Significance (P<) | 0.001 | 0.001 | 0.001 |
|  |  |  |  |  |  |  |

In this experiment the GT does not differed between primiparous and multiparous (540 min – P=0.81) and is significantly lower of 24 min for the Normande (523 min) than Holstein cows (557 min – Table 2). The cows in the High FS, receiving 4kg of concentrate per cow per day, grazed less per day (519 min) than those in the Low FS (561 min). As expected, the average milk yield produced during the 5 rotations was significantly higher for the multiparous cows (+6.6 kg), for the Holstein breed (+4.1 kg) and in the High FS (+5.8 kg – Table 2). These results are consistent with the values reported in the literature (Pérez-Prieto & Delagarde, 2013). Notably, the negative effect of concentrate on GT (Bargo et al, 2003; Sheahan et al, 2011), which induces a reduction of 10 min per gross kg of concentrate. The absence of a parity effect is more surprising and maybe translates a group behaviour effect. To better explain the variation in GT between cows, the individual MY and BW were unsuccessfully introduced into the mixed model (P > 0.10).

Figure 1: Daily variation of grazing time and milk yield during the grazing sequence in simplified rotational grazing systems.



Grazing time and milk yield are sensitive to the day in the paddock as highlighted in Figure 1. This reflects the grass availability and quality declining during the residence time, as previously described by Hoden et al (1991). The GT is lowest on the second day in the paddock (450 min) and increases each day thereafter to reach 550 min. between days 6 and 10 and 600 min. on days 12 and 13. The milk yield profile is a consequence of the daily decline in grass dry matter intake (DMI) despite GT increasing. The dairy cows try to compensate for the reduction of the intake rate by increasing GT but this is insufficient to maintain GDMI and MY drops (Delagarde et al, 2010).

Conclusion

The dairy cow grazing time is highly variable, partially dependent of the animal characteristics but also sensitive to the grazing system and the level of supplement feeding. The GT associated with the biting rate is one of the adaptation keys uses by the animal to try to maintain the level of DM intake when the level of grass allowance declines as observed during the grazing residency in a paddock.

References

Bargo F., Muller L.D., Kolver E.S. and Delahoy J.E (2003) *Invited Review*: Production and Digestion of Supplemented Dairy Cows on Pasture. *Journal of Dairy Science* 86, 1-42.

Delagarde R. and Lamberton P. (2015) Daily grazing time of dairy cows is recorded accurately using the Lifecorder Plus device. *Applied Animal Behaviour Science* 165, 25-32.

Delagarde R., Peyraud J.L. and Wade M. (2010) Daily pattern of feeding activities of dairy cows in an 8-d rotational grazing system. *Grassland Science in Europe* 15, 931-933.

Hoden A., Peyraud J.L., Muller A., Delaby L. and Faverdin P. (1991) Simplified rotational grazing management of dairy cows: effects of rates of stocking and concentrate. *Journal of Agricultural Science, Cambridge* 116, 417-428.

Pérez Prieto L. A and Delagarde R. (2015) Meta-analysis of the effect of pasture allowance on pasture intake, milk production, and grazing behavior of dairy cows grazing temperate grasslands. *Journal of Dairy Science* 96, 6671-6689.

SAS Institute Inc. (2013). Base SAS 9.4®. SAS User’s Guide: Statistics. Cary, NC: SAS Institute Inc.

Sheahan A.J., Kolver E.S. and Roche J.R. (2011) Genetic strain and diet effects on grazing behavior, pasture intake, and milk production. *Journal of Dairy Science* 94, 3583-3591.