



Dairy cows increase ingestive mastication and reduce ruminative chewing when grazing chicory and plantain

P. Gregorini,¹ E. M. K. Minnee, W. Griffiths, and J. M. Lee
DairyNZ Ltd., Private Bag 3221, Hamilton 3240, New Zealand

ABSTRACT

Although the nutritive value of chicory (*Cichorium intybus* L.) and plantain (*Plantago lanceolata* L.) has been thoroughly studied, little is known about the grazing behavior of cattle feeding on chicory and plantain swards. The objective of the present study was to assess and describe the grazing behavior of dairy cows as affected by dietary proportions of chicory and plantain fed as monocultures for part of the day. Ninety Holstein-Friesian cows (489 ± 42 kg of body weight; 4.1 ± 0.3 body condition score, and 216 ± 15 d in milk) were randomly assigned to 15 groups (6 cows per group) and grazed according to 7 treatments: control (CTL, 3 groups), perennial ryegrass (*Lolium perenne* L.) dominant sward (24-h pasture strip); 3 chicory treatments comprising 20, 40, and 60% of the diet, strip-grazing a monoculture of chicory to a fixed postgrazing residual before strip-grazing a perennial ryegrass dominant sward (2 groups of cows per treatment); and 3 plantain treatments comprising 20, 40, and 60% of the diet, strip-grazing a monoculture of plantain to a fixed postgrazing residual before strip-grazing a perennial ryegrass dominant sward (2 groups of cows per treatment). Four focal animals per group were equipped with 3-dimensional motion sensors, which provided the number of steps taken at each minute of the day. These cows were also fitted with automatic jaw-movement recorders that identified bites, mastication during ingestion, chewing during rumination, and determined grazing, rumination and idling times and bouts. Daily grazing time and bouts were not affected by treatments but rumination time differed and was reduced by up to 90 min when cows were allocated to chicory and plantain as 60% of their diet. Ruminative chewing was reduced in cows grazing chicory and plantain by up to 20% in cows allocated to the 60% treatments. Compared with perennial ryegrass, as the dietary proportion of chicory and plantain increased, cows spent more time idling and less time ruminating, and increased ingestive

mastications 5 and 3 times for chicory and plantain, respectively. Cows allocated to chicory and plantain reduced bite rate and bites per grazing step linearly, and increased the number of mastications per bite of pasture dry matter intake while grazing pasture after having grazed chicory and plantain. These results indicate that cows grazing chicory and plantain masticate more during ingestion and reduce rumination time and chewing. They also suggest that chicory presents greater constraints to ingestion than does plantain. Thus, although chicory has been considered to have a greater nutritive value than plantain, its overall feeding value may be no greater than that of plantain.

Key words: dairy cow, grazing behavior, chicory, plantain

INTRODUCTION

Maintaining reasonable quality and acceptable production of pasture all year round is becoming more difficult in dairy farms with increasing incidence of high stocking rate, nonpersistent grass cultivars, and dry summers. Under these circumstances, the use of alternative forage species such as chicory (*Cichorium intybus* L.) and plantain (*Plantago lanceolata* L.) has been considered to maintain or increase forage production (Belesky et al., 1999; Sanderson et al., 2003a; Labreuveux et al., 2006). Compared with perennial ryegrass (*Lolium perenne* L.), vegetative chicory and plantain generally have lower fiber and N and greater mineral contents. Chicory has greater OM digestibility and energy (ME/kg of OM) than perennial ryegrass, whereas true OM digestibility of plantain is as high as that of perennial ryegrass (Dryden et al., 1995; Stewart, 1996; Barry, 1998). Although the nutritive value of chicory and plantain has been thoroughly studied and reviewed, only limited data are available on the grazing behavior of cattle feeding on chicory and plantain swards, which ultimately determines their feeding value.

Rumen function in cattle is linked to the ingestive actions of the grazing process, which are mainly determined by sward structure (Laca and Demment, 1991; Demment and Laca, 1994; Gregorini, 2012);

Received April 23, 2013.
Accepted August 24, 2013.

¹Corresponding author: Pablo.Gregorini@dairynz.co.nz

these include ingestive mastication, particle breakdown kinetics and size swallowed, and fermentation in the rumen. Derrick et al. (1993) reported that the chewing rate of cows fed fresh plantain was greater than that for perennial ryegrass, which may lead to the ingestion of smaller particles of forage. Dryden et al. (1995) and Kusmartono et al. (1996) measured faster particle breakdown kinetics for chicory, which allowed for faster digesta outflow from the rumen. These 3 studies, however, were conducted using either deer or sheep grazing artificial swards for only 1.5 min. Although Clark et al. (1990) and McCoy et al. (1997) reported grazing behavior data of cattle feeding on chicory, these studies were conducted with bulls grazing reproductive chicory in a leader-follower system and tethered beef cows grazing for only 1 h, respectively. Thus, studies comparing the grazing behavior of dairy cows feeding on vegetative chicory and plantain monocultures compared with perennial ryegrass dominant swards are lacking. Such studies will provide better understanding of cattle's ingestive and potentially digestive responses to chicory and plantain swards, and assist in the design of specific grazing management procedures when including herbs in the diet of dairy cows.

The objective of the present study was to assess and describe the grazing behavior dynamics of dairy cows as affected by proportions of chicory and plantain in the diet fed as monocultures under field conditions. At the same time, this study also tested the hypothesis that dairy cows grazing chicory or plantain increase ingestive mastication and reduce bite rate compared with those grazing perennial ryegrass swards.

MATERIALS AND METHODS

This study was approved by the Committee of Animal Care and Use from AgResearch, #12548 (Hamilton, New Zealand).

Research Site, Treatments, and Experimental Procedures

The study was conducted at Scott Farm, DairyNZ, Hamilton, New Zealand (37°47'S, 175°19'E, 40 m above sea level) during February and March 2013.

Ninety Holstein-Friesian cows [489 ± 42 kg of BW; 4.1 ± 0.3 BCS (scale 1–10), 216 ± 15 DIM, 13.2 ± 1.1 kg/d of milk production] were allocated to 15 herds each with 6 cows, balanced for milk yield, age, and BW. These 15 herds were randomly allocated to the following treatments: control (CTL), strip-grazing a perennial ryegrass (*Lolium perenne* L.) dominant sward (24-h pasture break allocated at 0800 h); chicory as 20, 40, and 60% of the diet, strip-grazing a monocul-

ture of a second-year chicory crop (fixed postgrazing residual and crop strip allocated at 0800 h) and then strip-grazing a perennial ryegrass dominant sward; and plantain as 20, 40, and 60% of the diet, strip-grazing a monoculture of a second-year plantain crop (fixed postgrazing residual and crop strip allocated at 0800 h) and then strip-grazing a perennial ryegrass dominant sward. Three groups of cows were allocated to CTL, whereas 2 groups of cows were allocated to each of the 6 chicory and plantain treatments.

Cows in all treatments grazed the same perennial ryegrass dominant sward for a 2-d preadaptation period and were then adapted to the treatments for a period of 4 d, during which the daily allocations of chicory and plantain were gradually increased to the desired proportion. Measurements took place during the next 4 d of the following week.

The daily target of forage intake (chicory or plantain plus pasture or pasture alone) was 15 kg of DM/cow per day for all treatments. Mean (\pm SD) pregrazing herbage mass of CTL swards and chicory and plantain monocultures were $2,930 \pm 336$, $2,710 \pm 364$, and $2,620 \pm 240$ kg of DM/ha, respectively. The pregrazing herbage mass of the perennial ryegrass sward grazed after chicory and plantain was $3,160 \pm 179$ kg of DM/ha. We aimed for residuals of chicory and plantain and perennial ryegrass swards of between 700 and 800 and 1,500 kg of DM/ha, respectively. Areas of chicory and plantain pastures were adjusted accordingly to meet the desired proportion of chicory and plantain in the diet.

Cows were milked at 0700 h and 1500 h. Cows were not fed supplements and had ad libitum access to fresh water during grazing.

Measurements and Calculations

All the measurements were taken during the 1-wk measurement period and the specific calculations presented below refer to that period. Four random cows per group (focal animals) were equipped with IceTags 3D motion sensors (Ice Robotics Ltd., Edinburgh, UK) for the duration of the study. This device provided the number of steps taken by the cow at each minute of the day. IceTags 3D motion sensors have been previously used in a similar grazing context as that in the present study (Gregorini et al., 2011). The sensors were attached during milking on the left hind leg. On 4 occasions (dates), 1 focal cow from each treatment and 2 from CTL were monitored for grazing behavior. Different cows were measured on each of the 4 dates. These dates are referred to as measurement groups in the statistical analysis. Measurement group was included as a blocking factor to remove differences due to

Download English Version:

<https://daneshyari.com/en/article/10977324>

Download Persian Version:

<https://daneshyari.com/article/10977324>

[Daneshyari.com](https://daneshyari.com)