Dietary selection of heifers in natural grasslands: effect of time of day and phenological stage

Carvalho P.C.F.[1], Bremm C.[1], Gibb M.J.[2], Perez N.[3], Fonseca L.[1] and Amaral G.A.[1]

[1] Grazing Ecology Research Group, Federal University of Rio Grande do Sul, Brazil
[2] Retired, Institute of Grassland and Environmental Research, North Wyke, UK
[3] Brazilian Agricultural Research Corporation (EMBRAPA), Brazil
Corresponding author: paulocfc@ufrgs.br

Introduction

Grazing ruminants exhibit dietary selection. The availability (biomass or sward height) is the main constraint when they graze on short swards, while on taller swards the quality (nutrient content) is the major constraint.

The animals regulate their intake by selecting mixed diets and they may increase consumption of grasses with higher fiber content in the afternoon to maintain rumen fill overnight.

The present experiment was designed to examine the effect of time of day at two phenological stages of tussocks on dietary selection by beef heifers in mosaic natural grassland in southern Brazil.

Methods

Experimental design: The complete set of replicate measurements was conducted during two different tussock phenological stages; green reproductive (GR) and senescent reproductive (SR). Measurements were made at two times of day (during the first and the last grazing meals) that comprised four replicates; two spatial (paddocks) and two in time (measurement dates).

Botanical composition: The grazing paddocks contained equal proportions of shorter inter-tussock and taller tussock areas. The inter-tussocks areas were predominantly composed of *Axonopus afinnis, Paspalum nicorae, Paspalum notatum, Desmodium incanum* and *Andropogon lateralis.* Tussock vegetation was predominantly (>95%) *Eragrostis plana* Nees.

Evaluation period: Paddocks were 368 m^2 and they were grazed between 08:00 and 09:30 hours in the morning and between 16:30 and 18:00 hours in the afternoon, by four crossbred beef heifers (Angus x Brahman). Measurements when tussocks were at the GR stage began in January 2009 with heifers aged 15 months and a mean weight of 198 ± 2.2 kg. At the SR stage of tussocks, the evaluation began in April 2009 with the same animals (226.5 ± 3.5 kg).

Animal measurements: At 1-minute intervals during grazing activity, records were taken whether the heifers were grazing on tussock or inter-tussock areas. The short-term intake rate was measured by weighing the heifers pre- and post-grazing corrected for insensible weight losses. Grazing time and jaw movements were recorded using behaviour recorders (Rutter *et al.*, 1997).

Sward measurements: The sward height was estimated by 150 pre- and post-grazing measurements using a sward stick. To determine the herbage mass six quadrants (0.5 x 0.5 m; three in tussock and three in inter-tussock areas) by paddock were cut at ground level.

Analysis: In all analyses the paddock group of four heifers was used as the experimental unit. A repeated-measures ANOVA with measurement dates as repeated effect was used to test for significant interactions between time of day and tussock phenological stage.

Results

There were neither significant interactions ($P>0.10$) between time of day and tussock phenological stage nor an effect ($P>0.10$) of time of day (morning *vs* afternoon). At both phenological stages heifers showed similar diet selection strategies irrespective of the time of the day (Table 1).

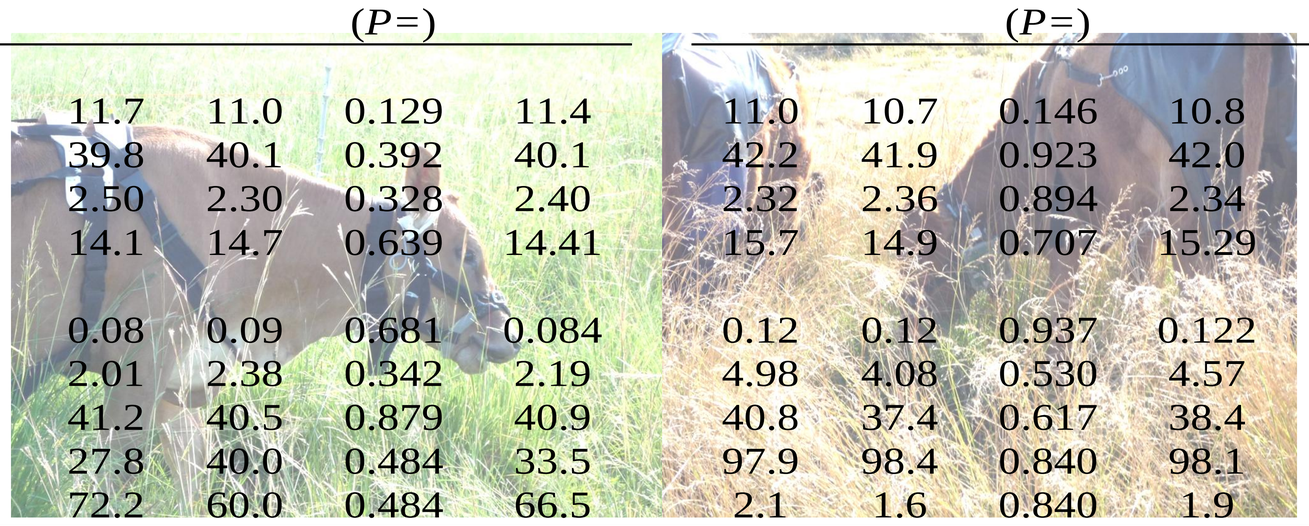
During the GR stage, heifers spent more time grazing the reproductive tissues compared with the inter-tussock areas (67 *vs* 34 % of grazing activity, respectively). In contrast, during the SR stage, virtually all grazing activity was concentrated on the inter-tussock areas (2 *vs* 98 % of grazing activity, respectively). The sward height and herbage mass in the inter-tussock areas and tussocks were similar ($P>0.10$) between the phenological stages. Therefore, probably the change in diet selection was due to changes in chemical composition of the plant species (higher energy and better carbon (C): nitrogen (N) ratio, in earlier than in later phenological stage). Rutter (2006) reported that ruminants adopt diet selection strategies to optimize their intake of nutrients, especially C and N.

During the SR stage, the greater concentration of grazing activity on the inter-tussock areas allowed heifers to increase their bite mass by 108% and, despite a reduction in bite rate, to increase short-term intake rate in 45%. During the GR stage, heifers selected a 'mixed' diet, (from inter-tussock areas and tussocks) compared with the SR stage, when they appear to abandon virtually all interest in the tussocks. Furthermore, bite rate was not adapted to compensate for a low bite mass and, as a result, short-term intake rate was lower than in the SR stage. Probably these smaller bites were due to the selection of green reproductive tissues from the tussocks, characterized by a smaller density and major spatially dispersion. In a mosaic vegetation, ruminants have to choose either small plant parts, which means small bite mass and highly nutritive bites, or large plant parts, which means bigger bite mass but poorer quality (Shipley *et al.*, 1999).

Table 1. Effect of time of day (TD, am *vs* pm) and phenological stages of tussocks (PS, green reproductive *vs* senescent reproductive) on sward structure and grazing behavior in tussock and inter-tussock (IT) areas.

Phenological stage	Green reproductive				Senescent reproductive				PS effect ($P=$)
	am	pm	TD effect ($P=$)	Daily mean	am	pm	TD effect ($P=$)	Daily mean	
Sward characteristics									
Sward height of IT areas (cm)	11.7	11.0	0.129	11.4	11.0	10.7	0.146	10.8	0.388
Sward height of tussocks (cm)	39.8	40.1	0.392	40.1	42.2	41.9	0.923	42.0	0.264
HM of IT areas (Mg DM ha-1)	2.50	2.30	0.328	2.40	2.32	2.36	0.894	2.34	0.691
HM of tussocks (Mg DM ha-1)	14.1	14.7	0.639	14.41	15.7	14.9	0.707	15.29	0.497
Animal characteristics									
STIR (g DM min-1 kg LW-1)	0.08	0.09	0.681	0.084	0.12	0.12	0.937	0.122	0.013
Bite mass (mg DM/kg LW)	2.01	2.38	0.342	2.19	4.98	4.08	0.530	4.57	0.017
Bite rate (per min)	41.2	40.5	0.879	40.9	40.8	37.4	0.617	38.4	0.025
Grazing IT areas (% of total)	27.8	40.0	0.484	33.5	97.9	98.4	0.840	98.1	0.003
Grazing tussocks (% of total)	72.2	60.0	0.484	66.5	2.1	1.6	0.840	1.9	0.003

HM = Herbage mass
STIR = Short-term intake rate



Conclusions

The fact that heifers selected a mixed diet in GR stage may represent a good strategy of control of *Eragrostis plana* Nees in natural grasslands of southern Brazil. However, since bite mass and short-term intake were lower in GR than in SG stage, the use of animals with lower nutritional requirements should be considered.