The proportion of the ungrazed area of the pasture (PUP) determines when forage intake and diet quality decline in grazing systems

Marcelo A. Benvenutti [A], Daniel R. Pavetti [B], Carlos A. Cangiano [B], Dennis P. Poppi [C], Iain J. Gordon [D], Jérôme Bindelle [E], Lucas Zakidalsky [F] and Deli Chen [A]

[A] The University of Melbourne, Australia www.unimelb.edu.au
[B] INTA, Argentina www.inta.gob.ar
[C] The University of Queensland, Australia www.uq.edu.au
[D] James Hutton Institute, UK www.hutton.ac.uk
[E] University of Liège, Belgium www.ulg.ac.be
[F] Universidad del Salvador, Argentina www.usal.edu.ar
Contact email: marcelo.benvenutti@unimelb.edu.au

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Introduction

Grazing management has to deal with the spatial and temporal heterogeneity of pastures. In this context it is desirable to have a grazing management strategy that can be applied in a wide range of pasture conditions to control daily forage intake, diet quality and thus, animal performance. Sward height has been extensively studied and has been found not to be universally applicable to control the animal response as its relationship with intake changes with sward structure (Prache and Peyraud, 2001; Sollenberger and Burns, 2001) . Selective grazing is a universal phenomenon where, independently of pasture condition, cattle prefer the more nutritious and easily ingested top stratum of the pasture before consuming the deeper strata that impose a lower diet quality and greater restrictions on selective grazing. This study tested the hypothesis that forage intake and diet quality significantly decreases when the top selected stratum is removed across the entire area of the pasture (*i.e.* the proportion of pasture ungrazed).

Methods

This research was conducted at INTA Cerro Azul Experimental Station in Argentina on an ultisol soil (287 m of elevation, Latitude: 27º 37' N; Longitude: 55º 26' E). The average annual rainfall and temperature of this location are 2067 mm and 20.8 ºC. Three consecutive 12-days grazing down trials were conducted on pastures of *Axonopus catarinensis* within a silvopastoral system of *Pinus elliottii*. In each trial the same 6 Brahman cross steers of 238 ± 6 kg were allocated to individual paddocks. Residual sward height was assessed every second day within a total of 288 fixed circular quadrats (48 per paddock) of 45 cm in diameter using a double sampling method (Penning, 2004). This assessment was used to calculate daily forage intake and defoliation dynamics. Diet quality was estimated using faecal NIRS. Voice recorders, attached to halters, were used to measure grazing behaviour. Linear and non-linear (quadratic, cubic or exponential) regressions for each trial were used to assess the relationship between residual sward height and other variables such as forage intake, diet quality and grazing behaviour. The regression analyses were performed using GenStat (2003), which uses a maximum likelihood method to fit the best regression models to the data. The significance of the difference in the initial sward height and forage availability between trials was determined by standard analysis of variance using the same software.

Results

The trials varied in the initial sward height (33, 44 and 61 cm) ($P \leq 0.05$) and forage availability (1030, 1740 and 2240 kg/ha) ($P \leq 0.05$). There was an asymptotic relationship ($P \leq 0.05$) between residual sward height measured over the grazing period and forage intake, diet quality and rumination time for all grazing trials. However, the sward height at which forage intake decreased was not the same in all grazing trials (approximately 11, 13 and 17 cm across the 3 initial sward heights). Rumination time and diet quality followed a similar pattern of change with sward height as did forage intake; and grazing time increased as defoliation progressed. The pattern of defoliation was similar between trials as the steers grazed up to four distinctive strata; their use partially overlapped over time. The average depth of the top stratum was at least five times deeper than the lower strata in all trials. This explains why forage intake and rumination time decreased when the top stratum was removed in approximately 95 % of the paddock area in all trials. This is equivalent to 5 % of the paddock area remaining ungrazed.

Conclusion

The proportion of ungrazed pasture, rather than residual sward height, can be used as a grazing management strategy to control forage intake and diet quality in pastures of *Axonopus catarinensis* . This strategy is based on sound plant-animal interaction principles and can be easily applied in rotational grazing systems. More research is required to confirm these results in a wider range of pasture conditions between and within forage species.

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