Sward Management Targets in Natural Grasslands of Southern Brazil

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Presenter Information

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Introduction

The relationship between environment, plant and animal is one of the most important focuses in the ecological and productive context of natural grasslands. The limited knowledge of the complexity of this environment can lead to inappropriate management strategies, determining degradation, biodiversity and productivity losses. This study is based on the concept that the best way to conserve natural grasslands is through adequate management targets.

This study aimed to identify sward management targets that maximize productivity in natural grasslands of Southern Brazil.

Methods

Area and experimental design

The experiment has been performed since 1986 in the experimental area of the Federal University of Rio Grande do Sul (30°80´50S, 51°84´00W), Brazil, in an area of 60 ha of natural grassland.

The climate at the experimental site is humid tropical, with an annual precipitation of 1440 mm, which is well distributed throughout the year. The experimental unit has been managed under put-and-take stocking and distinct forage allowances (FA): 4, 8, 12 and 16 kg of dry matter (DM) per 100 kg of the animal's live weight (LW) per day (% LW), fixed throughout the year, and variable FAs in the Spring; 8-12% (8% on Spring and 12% in other seasons), 12-8% (12% on Spring and 8% in other seasons) and 16-12% (16% on Spring and 12% in other seasons). The experiment was arranged in randomized blocks with two replicates of area. The data used in this study refer to the period between 2004 and 2011.

Sward and animal measurements

The double-sampling technique was used to estimate the forage mass (FM), and the canopy height (CH) was measured with the use of a sward stick. The actual forage allowance (AFA) was defined as:

$$AFA=([FM/n+DAR]/SR)*100)$$

where n = the number of days in each period evaluated; DAR = the daily DM accumulation rate in kg DM/ha/day; and SR = stocking rate in kg LW/ha. The average daily gain (ADG) was obtained by measuring the initial and the final LW of three tester animals throughout the periods. The crossbred heifers remained in the experiment for approximately one year, when a new group of animals entered the experiment.

Statistical analysis

The data were adjusted for effects of period of year (season), year (2004-2011), blocks and the interactions between these effects and the models were simplified according to the scheme of Pinheiro and Bates (2000). An analysis of variance (ANOVA) was performed and when differences between means were detected, treatments were compared using Tukey's HSD test at a significance level of 5%. Productive data were analysed using linear and non-linear regression models and the equations were compared using the coefficient of determination (R^2), at a 5% significance level. Statistical tests were carried out using JMP software version 10 (SAS Institute Inc., Cary, NC, USA).

Results

Sward characteristics differed among treatments (Table 1).

Table 1. Actual forage allowance (AFA, % LW), forage mass (FM, kg DM/ha) and canopy height (CH, cm) of natural grassland of Southern Brazil managed under distinct forage allowances. Standard errors are in parentheses.

Sward characteristics	Treatments (% LW)							*P* value
	4	8	12	16	8-12	12-8	16-12	
AFA	4.7 f (0.26)	9.5 e (0.59)	14.2 bc (0.67)	18.7 a (0.85)	13.4 cd (0.88)	11.0 de (0.57)	16.7 ab (0.89)	<0.001
FM	694.7 e (39.5)	1212.2 d (46.9)	1622.1 bc (61.9)	1858.6 a (81.8)	1559.9 c (53.7)	1400.5 cd (59.9)	1847.0 ab (68.9)	<0.001
CH	3.95 d (0.14)	5.82 c (0.23)	8.69 a (0.38)	9.51 a (0.34)	7.50 b (0.26)	7.33 b (0.31)	9.51 a (0.32)	<0.001

Values followed by different letters in each row differ significantly according to the Tukey's HSD test ($P < 0.05$).

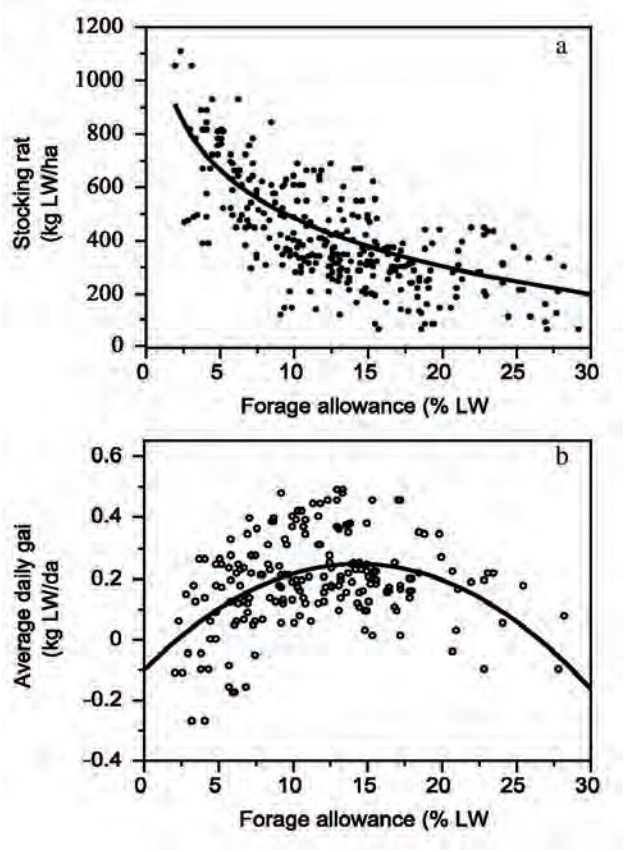

Figure 1. a) Stocking rate (● y= 1082.2 - 260.6 log(x); R^2 = 0.560; *SE* = 124.5; *P*<0.001; n = 245) and b) average daily gain (○ y= -0.100 + 0.049 x - 0.0017x^2; R^2 = 0.218; *SE* = 0.132; *P*<0.001; n = 201) in natural grassland of Southern Brazil managed under distinct forage allowances.

On average of the long-term experiment, the AFA was slightly superior than predetermined values, with higher values obtained in treatments 16 and 16-12% FA. The FM was also superior in treatments 16 and 16-12 and smaller in treatment 4% FA. For CH, higher values were observed in treatments 12%, 16 and 16-12% FA and smaller CH was found in 4% FA.

The variables SR and ADG were adjusted to distinct regression models (Fig. 1). SR decreased with increasing FA, whilst ADG was adjusted to the quadratic regression model.

Discussion

Decisions concerning stocking rate are important because of the close relationship between growth of individual animals and animal production per hectare (Diaz-Solis 2006). The lower the forage allowance, the higher will be the SR (Fig. 1a). However, under lower FAs (inferior to 8%), animals are constrained by the limited FM and CH (Table 1), which results in decreased ADG (Fig. 1b). According to Carvalho and Batello (2009), as stocking rate is increased, individual animal performance decreases, while production/unit-area increases to some maximum and then declines as a result of concurrent process controlling plant production and utilisation by the grazing animal. For ADG, the maximum value (0.253 kg LW/day) was observed at 14.3% FA, similar to the AFA observed in treatment 12 % FA (Table 1). Under higher FAs, the grazing process can be limited by the forage dispersion in the top of the canopy or by the vertical barrier imposed by tussocks (Bremm *et al*. 2012), providing reduced forage intake and consequently, decreasing the individual animal performance.

Conclusion

For maximize productivity in natural grasslands of Southern Brazil, the sward should be managed under approximately 14.3% of forage allowance.

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