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Structural characteristics of Puerto Rico stargrass (*Cynodon nlemfuensis*) pastures under different frequencies and severities of defoliation

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Introduction

An understanding of the effects of frequency and severity of defoliation on the sward structure of pastures is essential for identifying pasture management strategies that are more efficient in forage usage in tropical environments (Da Silva and Nascimento Jr 2007; Euclides et al. 2010). Some pasture species have not yet been investigated in this way, e.g. cultivars of *Cynodon.* The potential of this grass in tropical environments suggests that it should be given priority (Pedreira 2010). This study was designed to evaluate the effects of 2 frequencies (90 and 95% light interception) and severities (20 and 30 cm residue) of defoliation on the structural characteristics of Puerto Rico stargrass pasture (*Cynodon nlemfuensis*) during 3 seasons (fall, winter and spring).

Materials and Methods

The experiment was carried out at Pesagro-Rio, Seropédica, RJ, Brazil (22°45' S, 43°41' W; 33 m asl). The climate is type AW (Köppen), with a dry season from April to September and wet season from October to March. The experimental area consisted of 16 plots of 300 m² each (experimental unit) of Puerto Rico stargrass (*C. nlemfuensis*) arranged under a randomized complete block design in a 2 x 2 factorial arrangement with 4 replications. The treatments were a combination of 2 intervals (90 and 95% light interception − LI) and 2 severities (20 and 30 cm residue) of defoliation. The trial started on March 26, 2012 and lasted until December 27, 2012, including fall (March 26−June 20), winter (June 21−September 22) and spring (September 23−December 21) seasons. Grazing of pastures commenced when the canopy reached 90 or 95% LI and continued until the residual height was 20 or 30 cm, using crossbred Holstein x Gir animals (average weight 450 kg).

A day before the start of grazing, the height (HEI) of pastures was evaluated (40 measurements per plot), and 4 samples per paddock were collected to estimate herbage mass, through cuts made close to the ground, using a circular frame of 0.20 m^2. The samples were weighed, before sorting into leaf blade, stem and dead components, which were weighed and dried in a fan-forced oven at 55 ºC for 72 hours to obtain their dry mass. Based on these data and the heights of pastures, forage bulk density (FBD) was calculated by dividing the herbage mass by the average height of the grass, and leaf blade:stem ratio (LB:S) was determined. Tiller population density (TPD) and leaf area index (LAI) were estimated by cutting a forage sample, contained within a 0.3 x 0.3 m frame, a day before the entry of animals to paddocks, and measurements made of leaf blades with a leaf area meter (LI-COR LI-3100).

Data were analyzed by PROC MIXED of SAS®, version 9.0, and variance analysis was based on the following sources of variation: LI, residue height, season and their interactions, which were considered as fixed effects, and the effect of blocks as a random effect. The treatment means were estimated and compared by the "LSMEANS" and by the PDIF ($P<0.05$), respectively.

Results and Discussion

Tiller population density differed with severity of defoliation and with season ($P<0.05$) (Table 1). Highest TPD occurred at the heavier defoliation level (20 cm) in winter and lowest at 30 cm defoliation in the fall ($P<0.05$)

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with remaining values intermediate. LAI reached its highest levels at 20 cm defoliation in the fall and lowest levels at 20 cm defoliation in spring (P<0.05), with remaining values intermediate.

Table 1. Tiller population density (TPD) and leaf area index (LAI) of Puerto Rico stargrass (*Cynodon nlemfuensis*) pastures under 2 severities of defoliation during the fall, winter and spring.

Season	Severity of defoliation		s.e.
	20 cm	30 cm	
	TPD (no. of tillers/m^2)		
Fall	1189 bc[1]	992 c	74
Winter	1583 a	1287 b	74
Spring	1194 b	1183 b	74
	LAI		
Fall	4.0 a	3.4 b	0.2
Winter	3.3 b	3.4 b	0.2
Spring	2.7 c	3.7 ab	0.1

[1]Means followed by the same lower-case letters within parameters do not differ (P>0.05).

There were significant interactions between season, frequency and severity of defoliation for HEI, LB:S and FBD (Table 2). There was a trend for swards grazed when they reached 95% LI to have greater HEI at this time than those grazed at 90% LI. The lowest heights at the commencement of grazing were in pastures grazed at 90% LI to either 20 or 30 cm residue. LB:S varied between 0.61 and 0.37, both values being for pastures grazed at 95% LI to 30 cm. There was a tendency for LB:S to be highest in the fall but results were inconsistent. There was no consistent pattern for FBD with the highest recording being for pasture grazed at 90% LI to 20 cm in winter and the lowest in pasture grazed at 95% LI to 30 cm in the fall (P<0.05). There was a trend for pastures to be shortest and densest in winter. These findings suggest that pastures of Puerto Rico stargrass can be grazed at 90% LI and to 20 cm without jeopardizing LB:S, a good indicator of forage quality, or FBD, which has a significant impact on the ability of animals to select a high quality diet.

Table 2. Effects of 2 frequencies and 2 severities of defoliation on height (HEI), leaf blade:stem ratio (LB:S) and forage bulk density (FBD) of Puerto Rico stargrass (*Cynodon nlemfuensis*) pastures prior to grazing during fall, winter and spring.

Season	Light interception (%)				s.e.
	90		95		
	Residue (cm)		Residue (cm)		
	20	30	20	30	
	HEI (cm)				
Fall	47 cd[1]	47 cde	50 ab	48 bc	1
Winter	30 g	36 f	47 cd	47 cd	1
Spring	46 de	46 de	51 a	44 e	1
	LB:S				
Fall	0.54 b	0.49 d	0.54 b	0.61 a	0.01
Winter	0.47 de	0.49 d	0.43 ef	0.60 a	0.02
Spring	0.48 de	0.51 cd	0.46 de	0.37 f	0.02
	FBD (kg/ha/cm)				
Fall	122 de	155 bc	129 de	116 e	7
Winter	215 a	176 bc	181 b	126 de	11
Spring	129 de	133 d	129 de	156 c	3

[1]Means followed by the same lower-case letters within parameters do not differ (P>0.05).

Conclusions

It seems that pastures of Puerto Rico stargrass can be grazed at frequent intervals and to a residue of 20 cm without any significant detriment. Data on dry matter yields and crude protein concentrations with this management strategy would provide greater confidence in adopting such a regime.

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