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The XIX International Grassland Congress took place in São Pedro, São Paulo, Brazil from February 11 through February 21, 2001.
Proceedings published by Fundacao de Estudos Agrarios Luiz de Queiroz

ANIMAL PRODUCTION FROM TROPICAL PASTURES RENOVATED BY SUBSOILING AND FERTILIZATION IN THE CERRADOS OF BRAZIL

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Abstract

A grazing trial was conducted, to study the effects of fertilization on the maintenance of the productivity of four tropical grasses. The paddocks were subsoiled, and dived into halves: one (LF1) received 400 kg/ha of a fertilizer formula 0-20-20.and the other (LF2) 800 kg/ha of the same fertilizers, in january 1995. Annually, 50 kg/ha of N was applied. The productivity on LF2 pastures was greater than that on FL1 pastures, averaging 520 and 410 kg of liveweight gain/ha/year. A double strategy should be followed to sustain animal production in the savanna: maintain soil P over a critical value of 3.0 mg P(Mehlich-1)/dm^3, and annual N application .

Keywords: *Brachiaria*, gypsum, limestone, liveweight gain, *Panicum*

Introduction

Pasture degradation is considered today the most important problem of cultivated pastures in the savanna areas. Trying to cope with this problem, Euclides et al. (1997) showed that it is possible to recuperate degraded pastures of *Brachiaria* and *Panicum* species utilizing limestone and fertilization. However, they observed that stocking rate and liveweight gain per area declined linearly from the first to the third year of grazing. A decrease in soil fertility was also observed three years after fertilization. Thus, the objective of this work was to evaluate the effects of two levels of fertilization (LF) with annual N application on the maintenance of the productivity of four tropical grass species.

Material and Methods

The experiment was carried out on an Oxisol at Embrapa- National Beef Cattle Research Center, Campo Grande, MS, Brazil,from January 1995 to May 1998. All pastures presented signs of early degradation (Euclides et al., 1997). Soil compaction was measured by a penetrographer and soil resistence was over 2 Mpa, between 0–10 cm. In January 1995, pastures of four tropical grasses: *Brachiaria decumbens* cv. Basilisk, *B. brizantha* cv. Marandu, *Panicum maximum* cvs. Tobiatã and Tanzânia were subsoiled down to 35 cm, and simultaneously fertilized, with a subsoiler, in strips 40 cm apart. Paddocks had 0.75 ha each and the treatments were the two levels of fertilizer (LF): treatment LF1 received 400 kg/ha of a fertilizer formula 0-20-20 and 50 kg/ha of FTE; and LF2 800 kg/ha and 50 kg/ha of the same fertilizers. Besides that, 50 kg/ha of nitrogen was applied in all paddocks, annually in February. In November of 1997, 2 t/ha of dolomitic limestone and 500 kg/ha of gypsum were applied since soil base saturation, in the arable layer, declined to less than 30%. These pastures were deferred until June of 1995 when grazing was started. All paddocks were continuously grazed by two tester Nellore yearling steers. Additional steers were used to ensure equal forage availability in all paddocks. Forage availability and liveweight gain were measured at 42-day intervals. Herbage of thirty

1 m^2 samples per paddock were taken to estimate forage on offer. The experimental design was a RCB in a 4x2 factorial arrangement, with three replicates. Data was analyzed according to GLM SAS and averages were compared by the Waller.

Results and Discussion

There were no interaction involving the main effects (P > .05) for average daily gain (ADG), stocking rate (SR) and liveweight gain (LWG) per area. The ADG on LF1 was similar to that observed on LF2 pastures (P > .31),ADGs were greater (P <.01) during the wet period, and difference (P < .04) was observed among grasses (Table 1). During the wet season, the pastures sustained higher (P < .01) SR, and pastures under the LF2 treatment showed a greater SR (P < .01) than those under LF1 (Table 1); however the SR were similar (P > .15) among grasses. There were also differences among experimental years for SR (P < .01), averaging, 3.67, 3.27 and 3.45 steers/ha for the first, second and third year, respectively. The *P. maximum* cultivars resulted in greater (P < .01) LWG/ha than *Brachiaria* species (Table 2), regardless the level of fertilization. All grass pastures under LF2 treatment had higher (P < .04) gain per area than those under LF1. There were also differences (P < .01) in productivity among experimental years. The first and third years had higher productivity than the second one (Table 2). In part, that might be explained by lack of rain observed in the second experimental year. The total annual rainfall averages about 1500 mm, of which 1220 falls during the 7-month rainy season. In the second experimental year (96-97), not only the annual precipitation but also the rainfall registered during the wet season were bellow normal, 1277 and 1085 mm, respectively. Such a water deficiency might have had a direct impact on pasture growth and consequently on carrying capacity and productivity. On the other hand, precipitation in the third year (97/98) approached normal, and had a better distribution between dry and rainy seasons, 288 and 1244 mm, respectively. Another factor to consider was the application of limestone and gypsum, in June of 1997. Which had a positive effect on soil fertility, and improved pasture and animal productivity. There was an increase in soil base saturation from 1997 to 1998, from 26 to 34% and from 32 to 40%, for pastures under LF1 and LF2 treatments, respectively. Soil available P(resin) also increased in the same period from 4.9 to 6.2 mg P/dm^3 for the LF2; however, in LF1 soil the P level was kept constant, 3.2 mg P/ dm^3. Grass root system, presumably, went down deep in the soil profile due to the calcium from limestone and gypsum application in 1997. Also, limestone application possibly helped to increase soil P linked to labile organic and inorganic soil P fractions, specially throughout the process of organic matter mineralization. Even adjusting the SR throughout the years, the forage availability on *P. maximum* pastures declined from 2.32 to 1.87 t/ha, whereas on *Brachiaria* pastures they kept constant. This suggests that *P. maximum* cultivars needs greater amounts of N fertilizer maintenance, over 50 kg/ha/year, to sustain pasture and animal production. According to previous studies (Macedo, 1997) soil available P (Mehlich-1) is the most limiting nutrient in the Cerrados soils. However, once it is over 3,0 mg P/ dm^3, in the arable layer, N becomes the most critical element to pasture and animal production, specially for responsive species such *Panicum maximum*. In this study, despite the decline from the first to the third year, soil P (Mehlich-1) was kept over 3.0 mg P/ dm^3 on the average. Thus, to sustain or increase animal production in this region, a double strategy is recommended: maintain soil P over a critical value and manage annual N application for responsive species.

References

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Table 1 - Least square means for average daily gain and for stocking rate on continuously stocked *P. maximum* and *Brachiaria* pastures at two levels of fertilization (LF), over a period of 3 years

	Wet period		Dry period	
	LF1	LF2	LF1	LF2
	Average daily gain (g/steer)			
P. maximum cv. Tanzânia	680 [a]	700 [a]	121 [a]	122 [a]
P. maximum cv. Tobiatã	600 [b]	595 [b]	101 [a]	95 [ab]
B. decumbens	520 [c]	565 [b]	78 [ab]	142 [a]
B. brizantha	530 [c]	570 [b]	35 [b]	55 [b]
	Stocking rate (250 kg LW/ha)			
P. maximum cv. Tanzânia	3.60 [B]	4.35 [A]	2.55 [B]	3.21 [A]
P. maximum cv. Tobiatã	4.00 [B]	4.84 [A]	2.58 [B]	3.20 [A]
B. decumbens	3.79 [B]	4.06 [A]	2.70 [B]	3.27 [A]
B. brizantha	3.46 [B]	4.00 [A]	2.74 [B]	3.04 [A]

Means in the same column, within year period, bearing different superscript small letters are different ($P < 0.05$), by Waller-Duncan.
Means in the same row, within year period, bearing different superscript capital letters are different ($P < 0.05$), by Waller-Duncan.

Table 2 - Least square means for average liveweight gain (kg/ha/year) on continuously stocked *P. maximum* and *Brachiaria* pastures at two levels of fertilization (LF), over a period of 3 years

	Year 95/96	Year 96/97	Year 97/98	Means
	Live weight gain (kg/ha/year)			
NF1				
P. maximum cv. Tanzânia	439	433	490	467 [B]
P. maximum cv. Tobiatã	429	415	505	450 [B]
B. decumbens	444	379	339	387 [C]
B. brizantha	354	309	338	333 [C]
Means	416 [a]	384 [b]	428 [a]	
NF2				
P. maximum cv. Tanzânia	546	496	594	579 [A]
P. maximum cv. Tobiatã	555	495	595	545 [A]
B. decumbens	496	412	493	467 [B]
B. brizantha	570	391	463	475 [B]
Means	556 [a]	458 [b]	535 [a]	

Means in the same column, bearing different superscript capital letters are different ($P < 0.05$), by Waller-Duncan.
Means in the same row, bearing different superscript small letters are different ($P < 0.05$), by Waller-Duncan.