ORGANIC FERTILIZER: EFFECT ON YIELD AND QUALITATIVE TRAITS OF *BRACHIARIA BRIZANTHA* CV. MARANDU AFTER THE THIRD HARVEST

Gustavo do Valle Pereira[1], Dayana Cristina de Oliveira Pereira[2], Diego Fontebasso Pelizari Pinto[1], Luiz Carlos Demattê Filho[3], Sérgio Kenji Homma[4], Reinaldo da Costa Botelho[1]

ABSTRACT - This study aimed to evaluate the efficiency of a commercial organic fertilizer on the structural, productive, and qualitative characteristics of *Brachiaria brizantha* cv. Marandu after three consecutive harvests. The experiment was conducted under controlled condition in a greenhouse. A randomized-block design with four treatments, four blocks, and two replications per block was adopted. The following treatments were assessed: T1 – no application of organic fertilizer (Control); T2 – one application of organic fertilizer; T3 – two applications of organic fertilizer; and T4 – three applications of organic fertilizer. The highest number of tillers and leaves was observed in the plants that received two and three applications. Likewise, the shoots fresh and dry masses were statistically higher in the treatments that received more organic fertilizer applications, than the control treatment. As regards the forage quality, the highest percentage of dry matter was observed in control treatment, whereas the lowest result was found in plants that received three applications of the organic fertilizer. This treatment also achieved the highest percentage of fiber and crude protein, as compared with the other treatments. The use of organic fertilizer increased the forage yield and the crude fiber and crude protein rates of the *Brachiaria brizantha* cv. Marandu.

Keywords: animal production, organic fertilizers, pasture.

FERTILIZANTE ORGÂNICO: EFEITO SOBRE AS CARACTERÍSTICAS PRODUTIVAS E QUALITATIVAS DA BRACHIARIA BRIZANTHA *CV. MARANDU, APÓS O TERCEIRO CORTE*

RESUMO - O objetivo desta pesquisa foi avaliar a eficiência de um fertilizante orgânico comercial, sobre as características estruturais, produtivas e qualitativas da Brachiaria brizantha *cv. Marandu após três cortes consecutivos. O experimento foi conduzido em casa de vegetação. Utilizou-se o delineamento em blocos casualizados com 4 tratamentos, 4 blocos e 2 repetições por bloco. Os tratamentos avaliados foram: T1 – sem aplicação de fertilizante orgânico (Controle); T2 – uma aplicação de fertilizante orgânico; T3 – duas aplicações de fertilizante orgânico; T4 – três aplicações de fertilizante orgânico. Maior número de perfilhos e folhas foram observados nas plantas que receberam duas e três aplicações. Da mesma forma, a massa verde e a massa seca da parte aérea foram estatisticamente superiores nos tratamentos que receberam maior aporte do fertilizante, sendo observado no tratamento controle a menor média. Em relação a bromatologia, maior porcentagem de matéria seca foi observada no tratamento controle ao passo que a menor porcentagem foi observada nas plantas que receberam três aplicações do fertilizante orgânico. Este tratamento também obteve maior porcentagem de fibra e de proteína bruta se comparado aos demais tratamentos. A utilização do fertilizante orgânico aumentou a produção e elevou a porcentagem de fibra e proteína bruta da* Brachiaria brizantha *cv. Marandu.*

Palavras-chave: fertilizantes orgânicos, pastagem, produção animal.

[1] Researchers at Mokiti Okada Research Center - CPMO. Estrada Municipal de Camaquã, Km82, Bairro Camaquã, Ipeúna - SP, Brazil.
[2] Researcher at CPMO, Msc. of Sciences - ESALQ-USP. dayana.pereira@cpmo.org.br
[3] General coordinator at CPMO, Dr. in Applied Ecology - CENA/ESALQ-USP.
[4] Coordinator at CPMO, Msc. of Ecology of Agroecosystems - ESALQ-USP

1. INTRODUCTION

The Brazilian cattle raising is mostly undertaken on pastures, where it can be carried out with low investments (Dias-Filho, 2011).

However, this low investment has led to the increase of the degraded pasture areas, directly affecting the sustainability of the livestock system. Consequently, reduction of the land value and delaying of animals slaughter age are occurring (Peron & Evangelista, 2004).

One of the main causes of this degradation is the soil fertility declining due to nutrients removal caused by the unsuitable farming process. According to Arruda et al. (2011) besides improving the productivity, the use of organic fertilizers can contribute to amend the soil physical, chemical, and biological attributes, which have a direct impact on the plant growth.

Given these considerations, the present study aimed to evaluate the efficiency of a commercial organic fertilizer on the structural, productive, and qualitative characteristics of *Brachiaria brizantha* cv. Marandu after three consecutive harvests.

2. MATERIAL AND METHODS

The experiment was conducted in a greenhouse located in Ipeúna/SP, Brazil (22°24'5" S and 47°40'58" W).

Experimental plots were performed using plastic pots with 30 cm upper diameter and 10 dm^{-3} capacity. The type of soil utilized was a mixture of 50% Oxisol and 50% sandy soil. Soil chemical fertility properties are shown in Table 1.

No soil-acidity amendments were necessary. Thirty days after seeding, 5 g of the 07-28-16 formulation were applied to each pot.

Brachiaria brizantha cv. Marandu was used as the test plant. Five seeds were sown in each pot. The thinning was performed ten days after seed emergence, leaving three plants per pot. The parameters utilized for thinning were homogeneity, position in the pot, and size.

The experimental period began with a plot-leveling cut made 42 days after seeding, 5 cm above the soil surface. At the occasion, one tiller was identified per plant with a colored ring.

During the experimental period, pots were irrigated according to their field capacity. The commercial organic fertilizer tested in this study contained 1.5% nitrogen, 15% total organic carbon, 1.135 g/L density, 3.8 pH, 13 mS/cm electric conductivity, and 10 salinity index. The input was applied directly on the soil, by 100 $ml.pot^{-1}$ to each application, diluted in 400 mL water.

It was adopted a randomized-block statistical design with four treatments, four blocks, and two replications per block. The treatments was comprised by different amounts of the organic fertilizer applications, as follows:

- T1 – no application of organic fertilizer (Control);
- T2 – one application of organic fertilizer (after the plot-leveling cut);
- T3 – two applications of organic fertilizer (after the plot-leveling cut and the first harvest);
- T4 – three applications of organic fertilizer (after the plot-leveling cut and the first and second harvests).

The plant shoots were harvested by 35-day intervals, totaling three harvests. Before the last one, the number of live tillers was determined by a total count. The number of live leaves was estimated by counting the leaves on the identified tillers, with later extrapolation by the number of tillers.

After the harvest, shoots were sent to the laboratory for fresh mass (g), dry mass (g), dry matter (%), crude fiber (%), and crude protein (%) measurements. For the last three, the methodology described by Silva & Queiroz (2002) was employed.

Table 1 - Soil chemical fertility

pH	P	OM	Ca	Mg	K	H+Al	Al	SB	CEC	BS
$CaCl_2$	——	$mg.dm^{-3}$	——	——	——	——	$mmol_C.dm^{-3}$	——	——	——	%
4.9	23	16	13	9	2	28	1	24	52	46

pH $CaCl_2$: pH in calcium chloride; P: phosphorus (resin); OM: organic matter; Ca: calcium; Mg: magnesium; K: potassium; H: hydrogen; Al: aluminum; SB: sum of bases; CEC: cation-exchange capacity; BS%: base saturation.

Results were subjected to analysis of variance by the F test, and means were compared by the Scott-Knott test at 5% probability.

3. RESULTS AND DISCUSSION

The average temperature registered during the experimental period was 32.0 °C, with absolute minimum of 16.7 ºC and absolute maximum of 50.0 ºC.

The amount of organic fertilizer applications influenced the tillering and number of live leaves on the forage plant (Figure 1). It was observed a higher number of tillers in the plants that received two and three applications. In the same way, the number of live leaves was statistically higher in the treatments that received a larger amount of the organic fertilizer. The control treatment had the lowest number of leaves (Figure 1).

As is known, tillers are considered the basic grow unit of forage plants, and thus management practices that stimulate tillering, such as the use of organic fertilizers, are an important strategy to maintain the grass perenniality. In addition to tillers, an increase in the number of live leaves is also essential to ensure the productivity and perenniality of the grasses (Gomide & Gomide, 2014). Hodgson (1990) stressed that the increased leaf area raises plant's ability to use solar energy to perform photosynthesis. The possibility of forage biomass increase was observed in this study (Figure 2).

Because the shoots fresh and dry mass are composed mainly by leaves and tillers, these variables were higher in the treatments that received two and three applications of the organic fertilizer, and the lowest mean values was observed in control treatment (Table 2).

At field conditions, the increase of the forage availability has great importance to increase voluntary intake by the ruminants, since they find alternatives to select the most digestible portion (Chizzotti & Chizzotti, 2014). Furthermore, it is known that under low forage availability, the low forage intake is the main limiting factor to animal production performance, rather than the nutritional quality (Reis et al., 2009). Thus, it is speculated that the use of organic fertilizers can improve the performance of animals under grazing condition.

Knowing that nutritional value of a grass is as important as determining its productivity, since there are compounds that can limit its intake, such as crude fiber (CF) and crude protein (CP) content, which can redirect the ruminant-diet supplementation practices.

In this research, the highest percentage of dry matter was observed in the control treatment, whereas the lowest one was observed in plants that received three applications of the organic fertilizer. Furthermore, three applications also resulted in a higher percentage of crude fiber and crude protein, compared to the other treatments (Table 2).

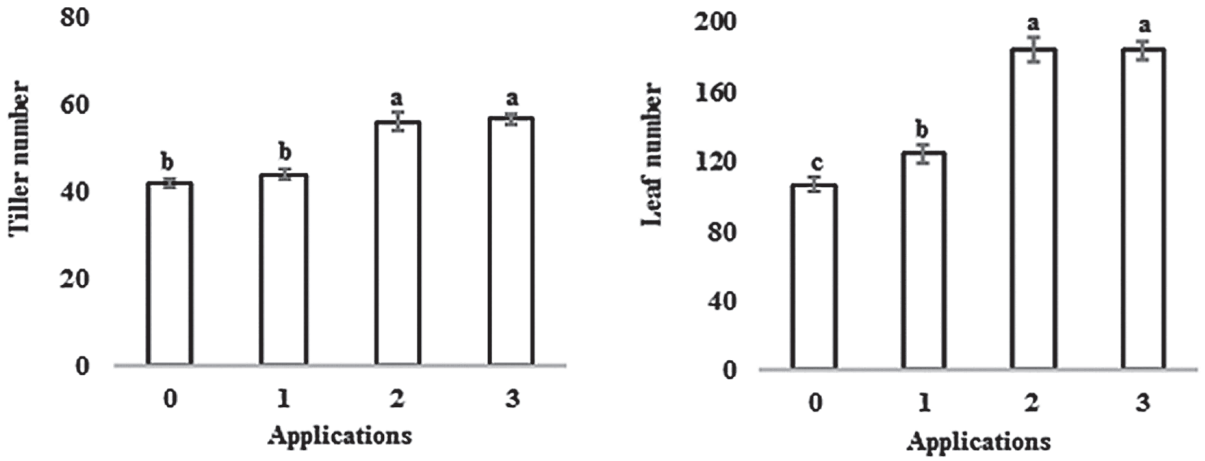

Figure 1 - Effect of the organic fertilizer applications on the structural traits of *Brachiaria brizantha* cv. Marandu. Bars with different letters differ by the Scott-Knott test at 5% probability.

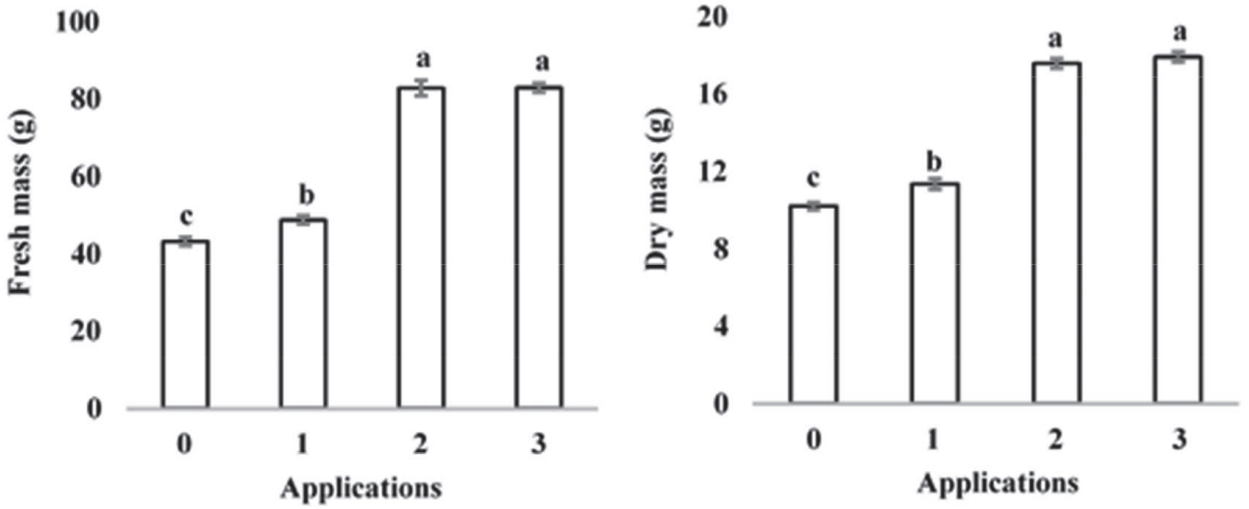

Figure 2 - Effect of the organic fertilizer applications on the yield of *Brachiaria brizantha* cv. Marandu. Bars with different letters differ by the Scott-Knott test at 5% probability.

Table 2 - Chemical analysis (mean ± error): dry matter (DM), crude fiber (CF), and crude protein (CP), under different treatments

Number of applications	DM (%)	CF (%)	CP (%)
0	22.47 ± 0.47[a]	27.93 ± 0.29[b]	5.37 ± 0.10[b]
1	21.37 ± 0.58[b]	28.87 ± 0.62[b]	5.66 ± 0.12[b]
2	20.39 ± 0.31[b]	29.13 ± 0.35[b]	5.70 ± 0.13[b]
3	17.70 ± 0.47[c]	31.20 ± 0.57[a]	8.19 ± 0.28[a]
CV (%)	5.32	4.80	6.42

Means followed by a different letter in the column differ by the Scott-Knott test at 5% probability. CV (%): coefficient of variation.

It is believed that the lower percentage of dry matter in the treatments that received the organic fertilizer, if compared with control treatment (Table 2), is mainly due to the larger number of leaves present in these treatments, since they have a higher moisture content (Pereira & Reis, 2001). These results attributes an important role to the organic fertilizer, since the priority for animals is to consume greater nutritive leaves (Stobbs, 1978).

The treatment with three applications of the organic fertilizer (T4) reached a higher percentage of crude fiber (Table 2), probably due to the greater ratios of structural carbohydrates, such as cellulose, hemicellulose, and pectin, which are important constituents for ruminant nutrition (Norton, 1982). This theory is based on the fact that this treatment showed the most reproductive tillers. According to Santos et al. (2010), reproductive tillers usually have higher neutral detergent fiber contents, due to the higher stem elongation. Thus, in practice, it is believed that the use of the organic fertilizer may reduce the interval between grazing sessions.

The number of applications of the organic fertilizer also changed the crude protein content; the highest percentage was obtained in the treatment that received three applications. According to Santos et al. (2014), the crude protein contents are highly influenced by the nitrogen doses, applied after each harvest or grazing. This result indicates that there was a greater supply of nitrogen in this treatment, although the content of nitrogen in the organic fertilizer was only 1.5%.

According to Van Soest, (1994), crude protein intake lower than 7% of the dietary dry matter leads to lower animal performance. Thus, the application of three doses of the organic fertilizer is the best alternative, considering that it was the only treatment that showed a crude protein content above this percentage (Table 2).

4. CONCLUSIONS

The organic fertilizer was effective to improve yield and qualitative traits of the *Brachiaria brizantha* cv. Marandu, providing higher fresh and dry mass production. There was also increase of fiber and crude protein contents.

5. ACKNOWLEDGMENTS

The authors thank Korin Agropecuária for the supply of the organic fertilizer.

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Recebido para publicação em 19/05/2016 e aprovado em 27/09/2016