Produção de forragem, composição química e morfogênese de *Brachiaria brizantha* cv. Piatã sob diferentes períodos de descanso

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Resumo: O efeito do período de rebrota (14, 21, 28, 35 e 42 dias) sobre a produção e composição química da forragem e características morfogênicas e estruturais de *Brachiaria brizantha* cv. Piatã foi avaliado em condições de casa-de-vegetação. O aumento do período de rebrota resultou em maiores (P<0,05) rendimentos de forragem e vigor de rebrota, contudo implicou em decréscimos significativos dos teores de nitrogênio, fósforo, magnésio e potássio, enquanto que os de cálcio não foram afetados. O tamanho médio de folhas e suas taxas de senescência foram diretamente proporcionais às idades das plantas, ocorrendo o inverso quanto à taxa de aparecimento de folhas. As maiores taxas de aparecimento e de expansão foliar e o tamanho médio de folhas foram obtidos, respetivamente, aos 41,1; 31,3 e 38,9 dias. A idade de corte mais adequada para pastagens de *B. brizantha* cv. Piatã, visando a conciliar produção, vigor de rebrota e qualidade da forragem, situa-se entre 28 e 35 dias.

Palavras–chave: composição química, folhas, matéria seca, morfogênese

Forage yield, chemical composition and morphogenesis of *Brachiaria brizantha* cv. Piatã at differents rest periods

Abstract: The effects of regrowth period (14, 21, 28, 35 and 42 days) on dry matter (DM) yield, chemical composition and morphogenetic and structural characteristics of *Brachiaria brizantha* cv. Piatã, was evaluated under greenhouse with natural conditions of light and temperature. DM yields and regrowth, blade length, and leaf lifespan rate increased consistently (P<.05) with regrowth period, however the nitrogen, phosphorus, magnesium and potassium contents decreased as regrowth period, while calcium contents were not affected by regrowth period. Maximum leaf appearance and elongation rate, and blade length were obtained with cutting at 41.1; 31.3 and 38.9 days, respectively. These data suggest that cutting at 28 to 35 days were optimal for obtain maximum yields and regrowth of rich forage and pasture persistence.

Keywords: chemical composition, dry matter, leaves, morphogenesis,

Introduction

In the tropical regions, pastures cultivated represent the most economical source for feeding cattle. However, given the climatic oscillations, fodder production during the year has seasonal fluctuations, abundance during the rainy season (October to May) and deficit in the dry season (June to September), which negatively affects the productivity indexes Animal (Costa, 2004). The use of appropriate management practices is an alternative to reduce the effects of seasonality in forage production. The growth stage at which the plants was harvested directly affects the yield, chemical composition, regrowth capacity and persistence. Cuts or less frequent grazing provide greater forage yields, however, concomitantly decreases occur accented in their chemical composition, with greater deposition of fibrous material, decrease in leaf/stem ratio (Costa, 2004). Therefore, one must seek the balance between yield and forage quality, to ensure the nutritional requirements of animals while securing the persistence and productivity of pastures. The productivity of forage grasses stems from the continuous emission of leaves and tillers, important process for the restoration of leaf area after cutting or grazing and ensuring its sustainability. The formation and leaf development are essential for plant growth, given the role of leaves in photosynthesis, starting point for the formation of new tissues (Gomide & Gomide, 2000). Grass morphogenesis during vegetative growth is characterized by three factors: the rate of appearance, elongation rate and longevity of the leaves. The appearance rate and longevity of the sheets will determine the number of living leaves/tiller (Chapman & Lemaire, 1993). These characteristics are determined genetically and can be affected by environmental factors and management practices.

This study evaluated the effects of rest period on the forage production, regrowth, chemical composition and morphogenetic and structural characteristics of *Brachiaria brizantha* cv. Piatã.

Material e Methods

The trial was conducted under greenhouse conditions, using a Yellow Latosol soil, clayey, which had the following chemical characteristics: pH = 5.1; Al = 1.1 cmol/dm^3; Ca + Mg = 2.3 cmol/dm^3; P = 3 mg/kg and K = 87 mg/kg. The experimental design was a randomized block with three replications. The treatments consisted of five rest periods (21, 28, 35, 42 and 49 days). The fertilization of establishment consisted of the application of 40 and 44 mg/dm^3 of phosphorus and nitrogen in the form of urea and triple superphosphate, respectively. The uniformization cut was performed at 35 days after the grinding plant at a height of 10 cm above the ground. The parameters evaluated were dry matter (DM), nitrogen, phosphorus, calcium, magnesium and potassium contents, leaf appearance rate (LAR), leaf expansion rate (LER) and leaf blade length (LBL). The LAR and the LER were calculated by dividing the total length of leaves and the total number of leaves on the tiller, respectively, by the regrowth period. The LBL was determined by dividing the total leaf elongation of the tiller by number of leaves. The leaf senescence rate (LSR) was obtained by dividing the length of the sheet showed that necrotic yellow color with age or plant cutting. The grass regrowth vigor was evaluated through the production of MS at 21 days after the first cut.

Results and Discussion

The DM yields were significantly (P<0.05) enhanced with plant regrowth age and the highest values were obtained with cuts at 42 (9.46 g/pot) and 35 days (8.53 g/pot) (Table 1). The relationship between regrowth periods and DM production was exponential, being described by the equation $Y = 1{,}87.1{,}043^x$ ($R^2 = 0.96$). Similar results were reported by Costa (2004) evaluating different genotypes of *Brachiaria brizantha* at different plants ages cuts. The regrowth vigor was significantly (P<0.05) affected by the regrowth period, with higher DM yields obtained with cuts at 28, 35 and 42 days, which did not differ (P>0.05). The effect of regrowth plant age was adjusted by quadratic regression model and described by the equation $Y = -3.25 + 0.4317\ X - 0.0054664\ X^2$ ($R^2 = 0.96$) and the maximum DM production of regrowth estimated at 33.8 days. Costa (2004) noted that the maximum regrowth vigor of *B. humidicola* occurred between 28 and 35 days after cutting the plants.

Table 1. Dry matter (DM) yield, regrowth vigor, concentrations of nitrogen, phosphorus, calcium, magnesium and potassium of *Brachiaria brizantha* cv. Piatã, as affected by rest periods.

Rest period (days)	DM (g/pot)	Regrowth vigor (g DM/21 days)	Nitrogen	Phosphorus	Calcium	Magnesium	Potassium
			g/kg				
14	2.91 d	1.84 c	21.68 a	1.62 a	4.98 a	3.73 a	17.33 a
21	4.53 c	3.11 b	20.16 a	1.58 ab	4.92 a	3.53 ab	16.98 a
28	7.72 b	4,61 a	17.33 b	1.54 b	4.81 a	3.17 bc	16.54 a
35	8.80 ab	5.19 a	14.88 c	1.51 b	4.77 a	2.89 c	15.22 b
42	9.11 a	4.37 a	11.93 d	1.47 c	4.70 a	2.83 c	14.09 c

- Means followed by the same letter do not differ (P>.05) by Tukey test.

The calcium contents were not affected (P>0.05) by the regrowth period, while the N, P, Mg and K decreased with the advance of the grass growing stage. The effect of regrowth period was linear and negative, being described by the equation $y = 27.11 - 0.3539\ x$ ($r^2 = 0.98$); $y = 1.69 - 0.005285\ x$ ($r^2 = 0.97$); $y = 5.12 - 0.01014\ x$ ($r^2 = 0.98$); $y = 4.20 - 0.03486\ x$ ($r^2 = 0.96$) and $y = 19.32 - 0.117\ x$ ($r^2 = 0.94$), respectively to the levels of N, P, Ca, Mg and K. In general, higher concentrations were recorded with regrowth periods between 14 and 28 days (Table 1).

The relationship between regrowth periods and the LAR, LER and LLB was adjusted to quadratic regression model, defined respectively by the equations: $Y = 0.27 - 0.005153089\ X + 0.0000626826\ X^2$ ($R^2 = 0.98$); $Y = 1.11\ X + 0.093937\ X - 0.001501429\ X^2$ ($R^2 = 0.96$) and $Y = 4.38 + 0.4510157\ X - 0.005797727\ X^2$ ($R^2 = 0.97$). The maximum values for LAR, LER and LLB were obtained at 41.1; 31.3 and 38.9 days, respectively (Table 2). In pastures of *B. humidicola and B. dictyoneura*, Costa (2004) found higher LER in the period between 21 and 28 days of regrowth. The LAR, LER and LLB obtained in this study, regardless of the regrowth periods were higher than reported by Difante et al. (2005), evaluating *B. brizantha* cv. Marandu in field conditions under different intervals between cuts, estimated average values of 0.083 leaves/tiller/ day; 1.61 cm/day/tiller and 18.59 cm for LLB.

Table 2. Leaf appearance rate (LAR), leaf elongation rate (LER), leaf blade length (LBL) and leaf senescence rate (LSR) of *Brachiaria humidicola* cv. Tupi, as affected by rest periods.

Rest period (days)	LAR (leaves/daytiller)	LER (cm/day/tiller)	LBL (cm)	LSR (cm/day/tiller)
14	0.214 a	2.13 a	9.8 c	--
21	0.190 b	2.45 a	11.2 b	--
28	0.178 c	2.52 a	13.1 a	0.074 b
35	0.171 cd	2.61 a	13.8 a	0.087 a
42	0.166 d	2.43 a	14.0 a	0.098 a

- Means followed by the same letter do not differ (P>.05) by Tukey test.

The LER, due to its high correlation with biomass production, has been used as a criterion for the selection of forage germplasm (Chapman & Lemaire, 1993). In this study, the correlation between DM yield and LER was positive and not significant ($r = 0.77$; $P>0.05$), whereas with the LAR has significant negative correlation ($r = -0.93$; $P<0.01$). The LER and the LAR explained in 59 and 86%, respectively, increments in DM yields, depending on the age of the plants. The LAR directly affects the three structural characteristics of turf: leaf size, tiller density and number of leaves/tiller (Zarrough et al., 1984). The correlation between LAR and LER was negative and significant ($r = -0.82$; $P<0.05$). According Chapman & Lemaire (1993), LAR and the LER have a negative correlation, indicating that the higher the LAR, the less time is available for plant alongation. LSR was affected ($P<0.05$) by resting period; the senescence process only occurred after 21 days of regrowth, with the highest rates observed at 42 and 35 days resting period (Table 2), which were lower than those reported by Difante et al. (2005) for *B. brizantha* cv. Marandu, who obtained LSR of 0.102; 0.109 and 0.170 cm/day/tiller, respectively for plant cuts with three, four and five leaves emerged, which had an average leaf lifespan of 65.1 days. Gonçalves (2002) estimated at 34.4; 43.1; 45.5 and 48.4 days leaf lifespan of *B. brizanta* cv. Marandu, respectively managed at 10, 20, 30 and 40 cm above soil ground level. Leaf senescence is a way for a plant to recycle some of the valuable and often scarce mineral nutrients, such as N and P.

Conclusions

The increase in the rest period resulted in higher yields of DM and plant vigor regrowth, however caused significant decreases in N, P, K, Mg contents, while Ca content was not affected. The average size of leaves and senescence rate were directly proportional to the rest period, while the opposite occurred on the leaf appearance rate, while the leaf expansion rate was not affected by rest period. In the management of *B. brizantha* cv. Piatã pastures, in order to obtain higher DM production, plant regrowth vigor and forage quality, it is suggested rest periods between 35 and 42 days.

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