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PRODUCTION AND NUTRITIONAL VALUE OF ELEPHANT GRASS SILAGE CV. BRS CAPIAÇU MANAGED UNDER ORGANIC FERTILIZER

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ABSTRACT: The objective was to analyze the effect of the frequency of use of organic nitrogen fertilizer on the development of elephant grass cv. BRS Capiaçu. The experiment was carried out in a completely randomized design with three replications and two treatments, namely: Poultry litter single dose (PLSD) and Poultry litter fractionated dose (PLFD). The variables were analyzed: height, length and width of the leaf, stem diameter, number of internodes and number of living leaves, total forage biomass and its fractions (leaf blades, green stems and dead material), leaf/stalk ratio, green material/dead material and bromatological silage (dry matter, moisture, neutral and acid detergent fibers, mineral and organic matter, crude protein, ether extract, total carbohydrates and non-fibrous carbohydrates). It was observed that there was no difference in most of the variables analyzed, with only changes identified for the biomass of dead material and the green/dead material ratio, with emphasis on the PLSD treatment which presented, respectively, values of 20,439.84 kg DM ha^{-1} and 5.93, which corresponds to 64.22% higher and 37.57% lower than those found in the PLFD treatment Organic fertilization using poultry litter as a N supplier promotes the intensification of biomass production per hectare, without compromising the nutritional value of the silage produced, and its application in a single dose with a dose of up to 300 kg of N ha^{-1} is a way of reducing operational costs without favoring losses due to N-NH_3 volatilization.

Keywords: poultry litter, forage, intensification, management, sustainability.

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Produção e valor nutritivo da silagem do capim-elefante cv. BRS capiaçu manejado sob adubação orgânica

RESUMO: Objetivou-se analisar o efeito da frequência de utilização da adubação orgânica nitrogenada no desenvolvimento do capim-elefante cv. BRS Capiaçu. O experimento foi desenvolvimento em um delineamento inteiramente casualizado com três repetições e dois tratamento, sendo: Cama de frango em dose única (CFDU) e cama de frango em dose fracionada (CFDF). Foram analisadas as variáveis: altura, comprimento e largura da folha, diâmetro do colmo, número de entrenós e número de folhas vivas, biomassa de forragem total e suas frações (lâminas foliares, colmos verdes e material morto), relação folha/colmo, relação material verde/material morto e bromatológicas da silagem (matéria seca, umidade, fibras em detergente neutro e ácido, matérias mineral e orgânica, proteína bruta, extrato etéreo, carboidratos totais e carboidratos não fibrosos). Observou-se que não houve diferença na maioria das variáveis analisadas, tendo sido identificado apenas modificações para a biomassa de material morto e na relação material verde/morto, com destaque para o tratamento CFDU que apresentou, respectivamente os valores de 20.439,84 kg MS ha^{-1} e 5,93, o que corresponde a 64,22% superior e 37,57% inferior aos encontrados no tratamento CFDF. A adubação orgânica utilizando a cama de frango como fornecedora de N, promove a intensificação da produção de biomassa por hectare sem comprometer o valor nutricional da silagem produzida, sendo a sua aplicação em dose única com dose de até 300 kg de N ha^{-1}, uma forma de reduzir custos operacionais sem favorecer perdas por volatilização do N-NH_3.

Palavras-chave: cama de frango, forragem, intensificação, manejo, sustentabilidade.

INTRODUCTION

The production of forage for animal feed in the Brazilian semi-arid region has still become a challenge to be overcome by breeders, technicians and researchers. This fact is due to numerous factors, among which the following stand out: low or non-existent planning of the activity carried out, high edaphoclimatic variation, inadequate management of areas and crops and the high prices of purchased inputs, which has reduced productive efficiency (CONRADO et al. 2019).

The search for forage species and management that mitigate these problems becomes essential in the search for sustainability of the production systems used. Elephant grass (Pennisetum purpureum Schum), for example, because it produces a high production per hectare, as well as due to the high energy input of this biomass (a reflection of its photosynthetic capacity to fix atmospheric CO_2) (MENEZES et al., 2014), it has proven to be an important alternative that can be used on properties for feeding ruminants. Because of this, the BRS Capiaçu cultivar developed by Embrapa emerged with characteristics capable of further improving production efficiency, due to its high DM production (70 t/ha x year) and flexibility of use (PEREIRA et al. 2016).

However, in order to provide a greater guarantee of this productive potential, the use of nitrogen fertilizer has been the main tool adopted on properties, with urea being the main fertilizer used. This is due to the ease of manufacturing and purchasing the product, however, the lack of moisture in the soil associated with high ambient temperatures, leads to large losses due to volatilization of the product N-NH_3 (CHAGAS et al., 2017), which ends up making the production system more expensive. Nitrogen-rich organic fertilizer has been a viable and efficient alternative (GONÇALVES et al., 2022). Poultry litter, as it has desirable characteristics, such as its nitrogen content when compared to other sources, has gained prominence. Some studies have already demonstrated its benefits, mainly in increasing the production of leaf biomass per hectare (ARRUDA et al., 2014; GOMES et al., 2018).

This alternative then arises, after its use was directly prohibited in the feeding of ruminants, which makes its use viable as foundation fertilizer or cover in pastures, provided that some requirements are followed. (IN Nº. 15 de 06/05/2009 e IN Nº. 8 de 25/03/2004 do MAPA).

In view of the above, the objective was to analyze the production and structure of the forage biomass produced, as well as the bromatological composition of the elephant grass silage cv. BRS Capiaçu managed under different frequencies of nitrogen-rich organic fertilizer.

MATERIAL AND METHODS

The experiment was conducted at the Faculty of Technology of Sertão Central (FATEC Sertão Central) located in the municipality of Quixeramobim/CE, between the months of January and July 2023. Quixeramobim, is located in the Mesoregion of Sertão Central Cearense, approximately 211 km away from the capital Fortaleza. It has a territorial area of 3,324.98 km² and an estimated population of 82,122 inhabitants (IBGE, 2022), with 39.59% of these living in rural areas (IPCE, 2011). The climatic characterization is semi-arid type BSh'w', according to the Köppen-Geiger classification (PEEL et al., 2007), with a rainy season from January to June and is located at an altitude of 191.74 m, with latitude and longitudes of 05°11'57” and

39°17'34", respectively. Data on the maximum, average and minimum temperatures of the experimental period were collected at the meteorological station of the National Institute of Meteorology (INMET), located 0.1 km from the experimental area (Figure 1).

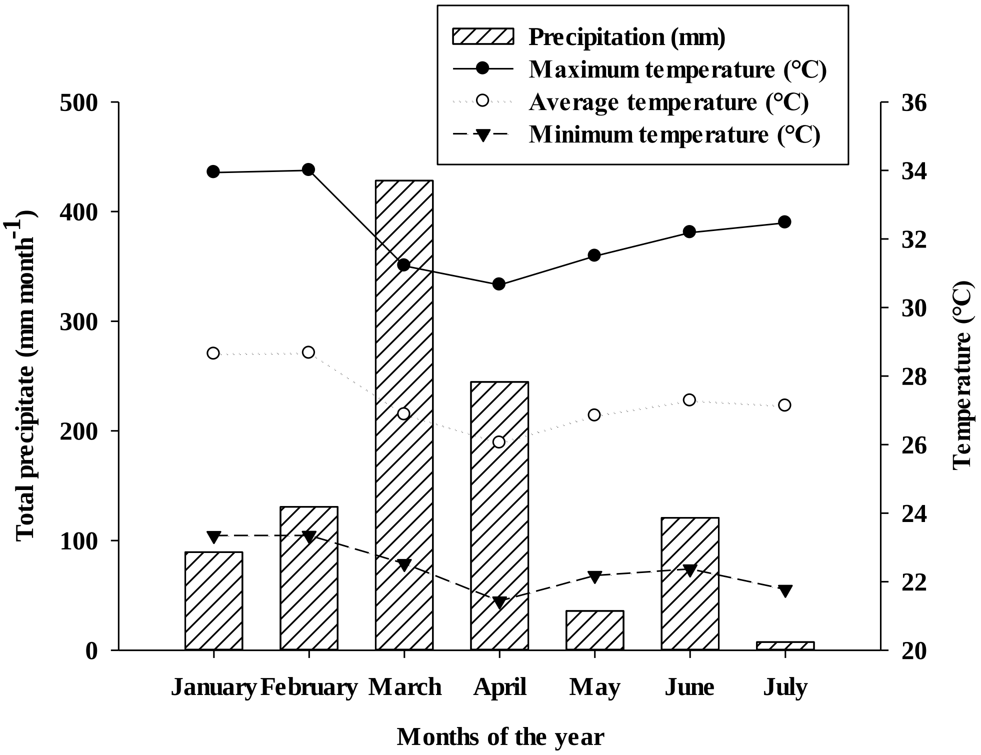


Figure 1. Precipitation (mm), maximum, average and minimum temperatures (°C) of the experimental period

The treatments consisted of evaluating Elephant grass cv. BRS Capiaçu (*Pennisetum purpureum* Schum cv. BRS Capiaçu), managed under two frequencies of organic fertilizer based on chicken litter, namely: poultry litter in a single dose (Treatment 1 - PLSD) and poultry litter in fractionated doses (Treatment 2 - PLFD).

The grass was managed in 4 m² plots with three replications, totaling 6 experimental units, in a completely randomized design for 120 days after the standardization cut, according to Pereira et al. (2016). In order to maintain constant growth, additional irrigations were carried out during the rainy season, with a depth of 7 mm dia^{-1}.

In the PLSD treatment, 8 kg of PL was used in a single application, while in the PLFD the 8 kg were divided into two applications, 4 kg being on the first day after the uniformization cut (15 cm) and 30 days after the first application. This amount of PL corresponds to the equivalent of 300 kg of N ha^{-1} $year^{-1}$, recommended for systems of higher technological level (CANTARUTTI et al., 1999), taking into account the composition of 3% N with a rate of 50% mineralization (GONÇALVES et al. 2022).

Before conducting the research, the soil was collected at a depth of 0-20 cm from the surface and sent to the UFC Soil Science Laboratory, in order to know its chemical composition, following the recommendations of Alvarez et al. (1999) for grasses. The results of the analysis were pH = 8,3; OM = 7,65 g kg^{-1}; P = 167,00 mg kg^{-1}; Ca^{+2} = 14,70 $cmol_c$ kg^{-1}; Mg^{+2} = 5,00 $cmol_c$ kg^{-1}; Na^{+2} = 0,06 $cmol_c$ kg^{-1}; K^+ = 0,06 $cmol_c$ kg^{-1}; $H^+ + Al^{3+}$ = 0,00 $cmol_c$ kg^{-1}; Al^{3+} = 0,00 $cmol_c$ kg^{-1}; SB = 19,8 $cmol_c$ kg^{-1}; CEC = 19,8 $cmol_c$ kg^{-1}; V = 100%.

Soon after reaching cutting age, the plants within the experimental plots were cut and evaluated for structural and productive variables, and the chemical composition of the silage after 30 days of storage.

The following structural variables were evaluated: stem diameter (SD, cm), plant height (PH, cm), leaf length (LL, cm), leaf width (LW, cm), number of internodes per tiller (NIN/tiller) and number of living leaves per tiller (NLL/tiller). To quantify SD, LL, LW and PH, a measuring tape in cm was used, with 9 tillers chosen per experimental unit. For SD, the initial 10 cm of the stem base was quantified, for LL and LW, the average of three different locations (beginning, middle and end) of the last newly expanded leaf was used, while for PH it was counted from the stem surface. soil up to the curvature of the last newly expanded leaf. For NLL, all leaves with exposed ligules that were still 50% green were considered, and for those that were not exposed, 0.5 leaves were counted.

For the productive variables, plants within a 0.25 m² frame were cut maintaining a residue height of 15 cm. After that, they were divided, weighed and taken to the ventilation oven with forced air circulation at 55° C until reaching a constant weight, and weighed again to obtain the dry weight. Given this information, the total forage biomass (TFB, kg DM ha^{-1}), and its fractions green leaf blade (GLB, kg DM ha^{-1}), green stem (GSB, kg DM ha^{-1}) and dead biomass (DFB, kg DM ha^{-1}), in addition to the green material/dead material (G/D) and leaf blade/stem (L/S) ratios.

To evaluate the bromatological composition through chemical analysis of the silage, the material remaining in the experimental plots and which was not within the 0.25 m² frame was cut into particles of 10 to 30 mm with the aid of a stationary forage harvester. After that, the biomass was stored in six mini PVC silos equipped with lids, a Busen-type valve (which prevented the entry of air and favored the exit of gases) and sand with an exclusion screen (whose function was to absorb the effluents produced). Each tube had a capacity of 0.00241 m³, calculated according to equation 1.

Equation 1. V = $\pi \, . r^2 . h$

Being:

V = Volume (m³); π = 3.1416 (Pi); r² = radius squared; h = height.

The dimensions of the cylinder were: Width = 10 cm and height = 26 cm, with 1.22 kg being stored in each tube, equivalent to a compaction density of 600 kg/m³ for 30 days (Santana et al., 2020). After that, the variables dry matter (DM, %), moisture (M, %), organic matter (OM, %), mineral matter (MM, %), crude protein (CP, %) and ether extract (EE, %) (AOAC, 1990), detergent fiber neutral (DFN, %) and acid detergent fiber (ADF, %) (Van Soest et al., 1991), and total carbohydrates (CHOT, %) and non-fibrous carbohydrates (NFC, %), were analyzed.

To calculate total carbohydrates (CHOT), equation 2 was applied, according to Sniffen et al. (1992), while for the determination of non-fibrous carbohydrates, equation 3 was used.

Equation 2. CHOT = 100 – (CP% + EE% + MM%)

Equation 3. NFC = 100 – (CP% + NDF% + EE% + MM%)

In the statistical analysis, the data were subjected to normality assessment using the Kolmorogov-Smirnov test (P<0.05) and for homoscedasticity, verified through graphical visualization of the residuals. When the assumptions were met, analysis of variance was performed using the “F” test and when significant, the means were compared using the Tukey test (P<0.05), using the PROC GLM command of the SAS University Edition statistical program, with the graphics generated by the SigmaPlot program (KORNBROT, 2000).

RESULTS AND DISCUSSION

It was observed that the fractionation of fertilization was not able to influence the development and production of elephant grass cv. BRS Capiaçu, with no significant difference (P>0.05) for most of the variables investigated (with the exception of BMM and V/M ratio), therefore, the following averages were found: 135,333.60 kg DM/ha (equivalent to 1,127.78 kg DM ha^{-1} day^{-1}), 47,047.41 kg DM/ha (equivalent to 392.06

kg DM ha^{-1} day^{-1}), 71,842.15 kg DM/ha (equivalent to 598.68 kg DM ha^{-1} day^{-1}) and 0.65, for TFB, GLB, GSB and L/S ratio, respectively.

However, it was detected that the frequency of nitrogen-rich organic fertilization significantly influenced the variables DFB ($P < 0.01$) and the G/D ratio ($P<0.01$), with the PLSD treatment presenting the highest (20,439.84 kg DM/ha) and lower (5.93) average, respectively, which represented an increase of 64.22% in DFB (kg DM/ha/year) and a reduction of 37.57% in the G/D ratio, when compared to PLFD treatment (Table 1). According to Sollenberger et al. (2019) the accumulation of the dead fraction is mainly the result of the action of several factors, including solar radiation, which when reaching C_4 grasses (such as elephant grass) causes greater efficiency in the use of light photons by the leaves. until the moment the canopy reaches the critical leaf area index (LAI), when from this moment on, the stem and dead material fractions increase their volume considerably when compared to the leaf blade fraction, retaining a greater carbon input in the forestry system. production, which increases the production of dead material and reduces the relationship with the green component.

This factor can be further boosted when fertilizers with rapid release of nitrogen are used, such as urea. In the case of poultry litter, this behavior is mitigated, since, due to its greater amount of carbon, it becomes slower. These behaviors, found in the production of DFB and in the G/D ratio, may be a reflection of the higher dose of PL applied in the PLSD treatment in the first 30 days of regrowth, which accelerated plant growth and caused the plants to reach the critical IAF (greater physiological age) faster when compared to those fertilized in the PLFD treatment.

Nitrogen, according to Vasconcelos et al. (2020), acts positively on the canopy growth process throughout the plant's growth cycle. Its use is generally done strategically, given its high cost, and this application is made soon after the plant has suffered some type of defoliation (whether via human or animal action), which makes it possible to use the canopy again, since the It is considered a controlling factor for different growth processes due to the increase in carbon fixation in plants.

Furthermore, it was possible to carry out some simulations, taking into account the market prices of the input used, which reinforces that PL is an important alternative to the use of urea. It can be seen in table 1 that the N cost to produce 1 kg of MS was R$ 0.02.

Table 1. Total forage biomass, its fractions and relationships of biomass components of elephant grass cv. BRS Capiaçu subjected to different frequencies of nitrogen fertilization through organic fertilization

Treat.	Biomass production and its fractions (kg DM ha^{-1})				List of components	
	TFB	GLB	GSB	DFB	L/S	G/D
PLSD	141,721.70A	46,648.24A	74,632.12A	20,439.84A	0.62A	5.93B
PLFD	128,945.56A	47,446.58A	69,052.18A	12,446.80B	0.68A	9.50A
Average	135,333.60	47,047.41	71.842,15	16,443.32	0.65	7.71
CV (%)	8.11	13.09	4.56	12.70	9.74	10.35
P-Value	0.22	0.88	0.10	<0.01	0.29	<0.01

Economic analysis (author's simulation with information quoted on 04/24/2024, local market)

Type of fertilizer	Composition	R$/kg	R$/kg of N	Kg DM/ha
Organic (PL)	3% of N	0.30	10.00	135,333.60

	R$ with N	R$ wiht N/kg MS
Organic (PL)	3,000.00	0.02

Means followed by different capital letters in the columns differ from each other using the Tukey test (P<0.05). Treatment (treat). Loss due to urea volatilization (300 kg of N applied, but only 240 kg used by the plant)

No effect (P>0.05) of the frequency of organic fertilization was identified on the structural variables of biomass, and the averages were quantified at the end of 120 days for PH, LF, LL, SD, NIN and NLL of 2.72 m (2.31 cm day^{-1}); 3.81cm; 111.32 cm; 1.56 cm; 10.16 number of internodes (0.08 internodes day^{-1}) and 14.28 number of living leaves, respectively (Table 2).

Soil fertility, like fertilization, has an effect on both production and plant structure. However, in the present study, these effects were not observed, possibly due to the presence of other elements (mainly phosphorus and potassium) present in the soil (material and method section), which, like N, boost biomass production. These elements are important because, in semi-arid regions, characterized by a high degree of weathering, they have low levels of phosphorus, which is extremely important as it is the main limiting factor for agricultural production (BOTTREL et al., 2023). According to Showler (2015), organic fertilization can be an important strategy in managing the conservation of the environment and especially the soil, being an increase factor in addition to N and P, organic carbon. Castro et al. (2016), analyzing the effect of organic fertilization replacing inorganic, obtained similar results, reaching maximum productivity for Marandu grass with an average dose of cattle manure of 24.3 t/ha and for Mombaça grass with the dose maximum applied of 36 t/ha

Poultry litter, when compared to cattle manure, has a higher density of nitrogen, phosphorus and potassium, in addition to having a slower release of these nutrients, when compared to urea, which favors better use by plants. According to Arruda et al. (2014) the chemical composition of poultry litter can change depending on the type of material to be used on the floor covering the aviary, and the number of batches of birds used, with average levels being identified in the order of 2 to 5 % for nitrogen, 1.5 to 3% for potassium and 2 to 4% for phosphorus. Some work carried out by Malavolta (1981) and Kiehl (1985) also presented other benefits, such as the slower release of these nutrients. According to the authors, for example, nitrogen is released by 50% in the first year of application, 20% in the second and 30% in subsequent years, reducing loss through volatilization and improving utilization by the plant. According to Chagas et al. (2017) the rapid and intense volatilization that occurs in conventional urea (the main inorganic fertilizer used in crops) is due to the dissolution and hydrolysis of urea, which in the absence of precipitation, is boosted in the initial five days after its application to the soil.

The incorporation of this material favors the reduction of losses due to volatilization, as this enables greater contact between the fertilizer and soil particles, increasing the adsorption of $NH^{+}{}_{4}$ (ammonium ion), with the negative charges of the phase solid soil, making it difficult to transform it into $N\text{-}NH_3$ (ammonia). Also according to the authors, the volatilization rate ($N\text{-}NH_3$) is 28.10%.

Table 2. Structural components of the biomass of elephant grass cv. BRS Capiaçu subjected to different frequencies of nitrogen fertilization through organic fertilization

Treat.	PH (m)	LW (cm)	LL (cm)	SD (cm)	NIN (N°)	NLL (N°)
PLSD	2.86A	4.19A	113.87A	1.56A	9.90A	14.77A
PLFD	2.69A	3.44A	108.77A	1.57A	10.44A	13.72A
Average	2.78	3.81	111.32	1.56	10.16	14.28
CV (%)	7.32	13.27	9.11	20.40	20.05	6.89
P-Value	0.35	0.14	0.57	0.97	0.75	0.25

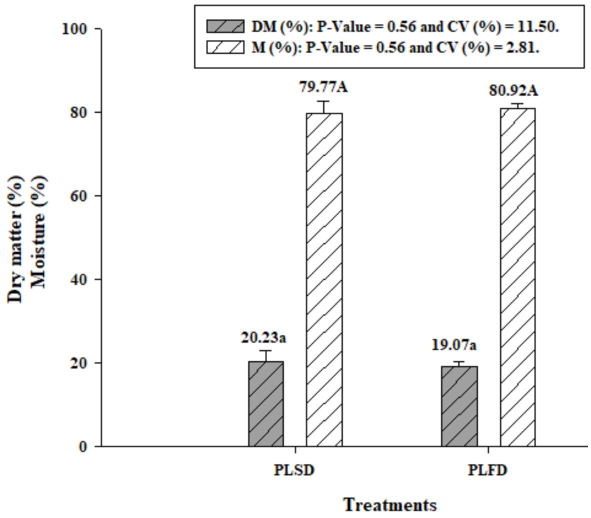
Height (PH, m); Leaf width (LW, cm); Leaf length (LL, cm); Number of internodes (NIN, no.); Number of green leaves (NLL, no.); Stem diameter (SD, cm). Means followed by different capital letters in the columns differ from each other using the Tukey test (P<0.05). Treatment (treatment)

There was no significant difference in the variables DM (P = 0.56; CV = 11.50%), M (P = 0.56; CV = 2.81%), MM (P = 0.23; CV = 3 .06%) and OM (P = 0.30; CV = 0.46%), with the following means identified: 19.65%, 80.35%, 12.14% and 87.84%, respectively (Figure 2A and 2B), which demonstrates that the application of a single dose of PL in up to 300 kg of N ha^{-1} is a way of intensifying biomass production with a lower operational cost when compared to two applications through fractionation of the dose

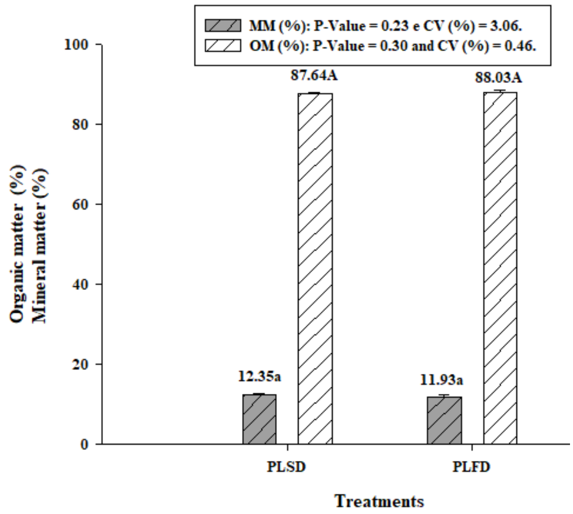
When analyzing the variables individually, it is noted that the dry matter content was close to that established by Pereira et al. (2016) for this species (20%), however, the high fertilizer dosage may have influenced the greater accumulation of mineral material present in the biomass, according to comparative data from the work developed by Ribeiro et al. (2014), where the authors found 6.3% of MM.

Furthermore, according to Pereira et al. (2016), the high moisture content present in forage grasses can be a limiting factor for adequate fermentation to occur, which can harm the nutritional value of the silage. According to McDonald et al. (1983), the nutritional value will depend on how the fermentation process occurs inside the silo, since this behavior is the result of the interaction between the processing of the harvested forage biomass and its chemical composition. Also according to the authors, the minimum value of 25% DM is considered ideal so that the silage is not compromised, since in this situation lactic acid (LA) will be produced (from lactic acid bacteria - LAB) and will preserve the ensiled mass in an anaerobic environment. The presence of this acid inhibits the multiplication of other microorganisms capable of deteriorating silage.

However, tropical grasses quickly reach (especially if fertilized with nitrogen) their harvest condition with high nutritional value, however, with high moisture content and low soluble carbohydrate content, which reflects in marked buffering power. These factors, when acting together, negatively influence the fermentation process. In the case of the work carried out, the DM and moisture content were similar for both conditions, not having compromised the nutritional value of the ensiled material.



(A)



(B)

Figure 2. Dry matter and moisture (A) and mineral and organic matter (B) of elephant grass silage cv. BRC Capiaçu managed under different frequencies of organic fertilizer. Means followed by different letters, lowercase in the gray columns and uppercase in the white columns, differ from each other using the Tukey probability test (P<0.05).

For the variables NDF (P = 0.65; CV = 6.11%), ADF (P = 0.79; CV = 5.43%), CP (P = 0.08, CV = 14.78%) and EE (P = 0.91, CV = 4.80%), no significant differences were observed (P>0.05), with the following means being found: 62.65%, 40.65%, 4.14 % and 3.04%, respectively.

When analyzing the values found in NDF and ADF and comparing them with those of other studies, such as that of Bonfá et al. (2015), it is noted that, in the present work, the values were lower (NDF = 71.83% and ADF = 40.19%), which proves to be an indication of a biomass with better digestible value. In biomass whose NDF content is high, food intake by ruminants is reduced. This is due to its greater rumen filling capacity, however, lower values of this fraction are considered positive, since its presence is an important regulator of consumption, due to its slow degradation and reduced passage rate. One of the major constituents of ADF is lignin, which is made up of a phenolic polymer that associates with structural carbohydrates (Cellulose and hemicellulose) of the plant cell wall. Therefore, its presence in excess influences the effective degradation rate of bulky foods consumed, as it limits the digestion and absorption of these carbohydrates in the rumen, which are considered the largest sources of energy used by ruminants (VAN SOEST, 1994).

One way that has been extensively studied and proven to be efficient is the use of agro-industry co-products, as these products act as an additional source of soluble carbohydrates in the fermentation of the ensiled mass, increasing the nutritional value of the silage. Bonfá et al. (2015) observed that up to 50% of the passion fruit by-product reduced the NDF concentration and 36.39% of ADF to 63.53% (Figure 3A and 3B), the same behavior was seen in the work of Bonfá et al. (2017) when the byproduct was pineapple peel. This information shows that the PL used in organic fertilizer was not able to reduce cell content and increase plant cell walls, which maintains biomass with greater acceptability by ruminants.

Regarding the CP content, it was found that the value found is 40% lower (4.15%) when compared to the recommended value (7%) for there to be minimum ruminal functioning (Silva et al., 2015). Bonfá et al. (2017), observed an increase in the CP content in elephant grass silage, reaching values close to 5% after adding 50% of pineapple peel to the ensiled mass, associated with a reduction in neutral detergent insoluble protein (NDIP) levels, acid detergent insoluble protein (ADIP). According to Anderson (2000), CP can be better utilized by rumen microorganisms, which favors increased efficiency in the use of nutrients from silage. Lira Júnior et al. (2018), evaluating the addition of passion fruit peel to elephant grass silage, found a positive effect of this by-product on the CP content (10.00%) found in the silage without the addition (6.56% CP). This was due to the higher percentage of this nutrient in passion fruit peel, when compared to that found in elephant grass, with the exception of silage, which included 25% of passion fruit peel without wilting. Possibly for this study, due to the high moisture content, there were losses of CP, because in a condition like this, there is greater protein decomposition due to butyric fermentations, reducing the drop in nutritional value.

The EE, as described, did not obtain a significant difference, remaining close to the values found and reported (EE = 3.4%) by Ribeiro et al. (2014) when evaluating elephant grass added or not with castor bean cake. In the work developed by Lira junior et al. (2018), EE levels were reduced with the inclusion of 75% passion fruit peel (1.90%) when compared to the 0% inclusion treatment (2.04%).

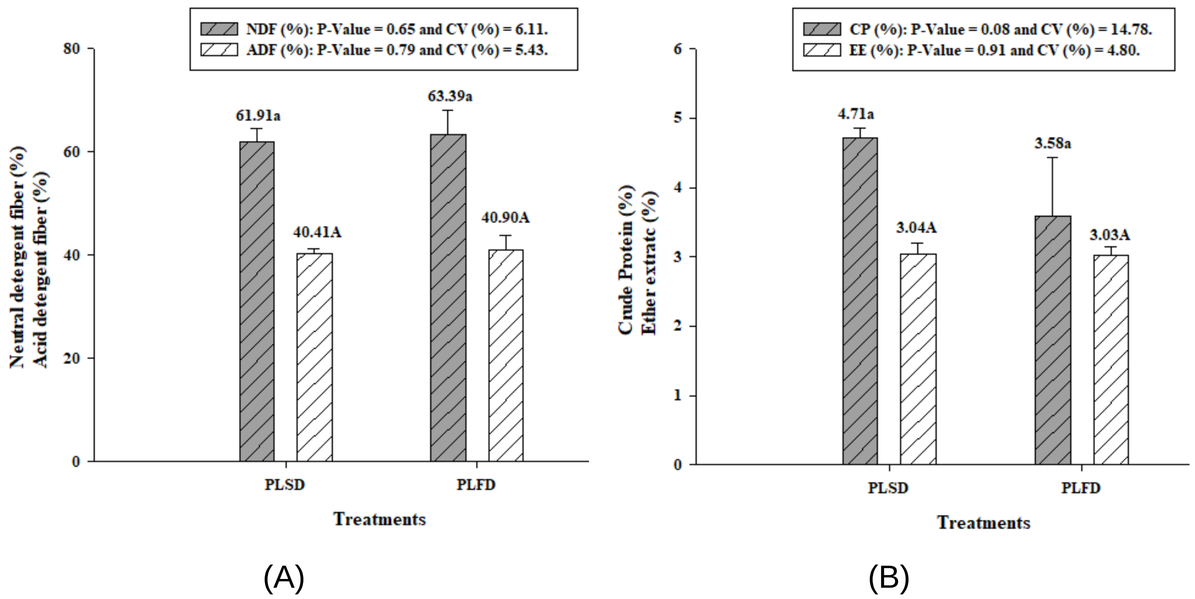


Figure 3. Neutral detergent and acid detergent fibers (A) and crude protein and ether extract (B) from elephant grass silage cv. BRC Capiaçu managed under different frequencies of organic fertilizer. Means followed by different letters, lowercase in the gray columns and uppercase in the white columns, differ from each other using the Tukey probability test (P<0.05).

No difference was observed between the treatments regarding CHOT (P = 0.09, CV = 1.11%) and NFC (P = 0.97, CV = 19.69%), with the averages being quantified at 80.66% and 18.01%, respectively (Figure 4). In the work developed by Cruz et al. (2010), when evaluating the inclusion of 0%; 10%; 20% and 30% of dehydrated passion fruit peel (PFP) in elephant grass silage, a reduction (CHOT) and increase (NFC) of these components in the ensiled mass were observed. Lira junior et al. (2018) also observed this same behavior when adding 0%; 25%; 50%, 75% and 100% of passion fruit peel, as well as the effect of the number of hours of wilted elephant grass, with the values 84.04% being found for the situation of 0% inclusion of CM and 0 hours of wilting. and 22.24% for CHOT and NFC, respectively. Therefore, organic fertilizer did not interfere with the composition of carbohydrates, as in this case there was no external inclusion of ingredients that could increase the pectin levels found in most agro-industrial by-products of passion fruit peel.

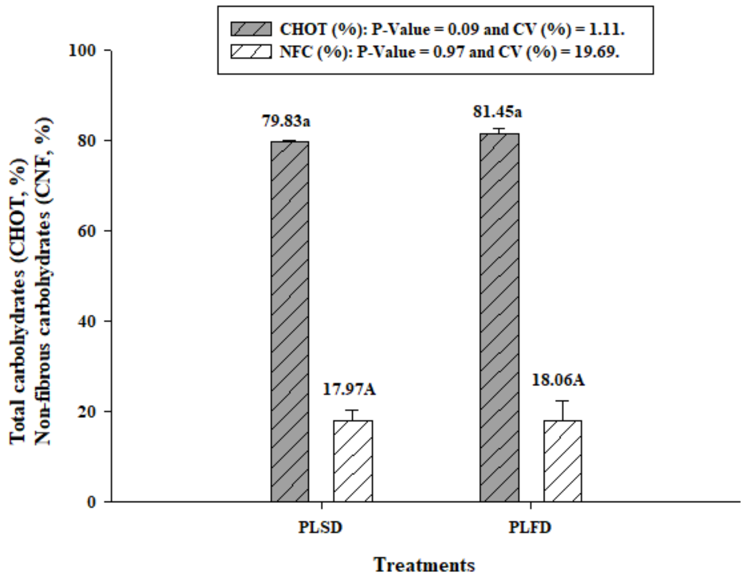


Figure 4. Total carbohydrates (CHOT, %) and non-fibrous carbohydrates (NFC, %) of elephant grass silage cv. BRC Capiaçu managed under different frequencies of organic fertilizer. Means followed by different letters, lowercase in the gray columns and uppercase in the white columns, differ from each other using the Tukey probability test (P<0.05).

Therefore, inadequate soil management, associated with the use of crops in successive cultivations and without any mineral and/or organic nutritional replacement, causes serious problems with plant development and loss of soil nutrients, which tends to be exacerbated given that, tropical soils (by nature they have low pH) are mostly worked with little or no management technology on the part of farmers. As a result, poultry litter, as a fertilizer rich in nitrogen and other compounds, becomes a viable alternative, especially for minimizing N losses to the environment and ensuring a greater supply of nutrients (LEMOS et al., 2014).

CONCLUSIONS

The fractionation of nitrogen fertilization does not interfere with the production of total forage biomass produced nor with the structural development of the canopy, which in turn, does not influence the bromatological composition of the stored material silage.

As it does not have volatilization problems, nitrogen fertilizer through the use of poultry litter can be used in a single dosage of up to 300 kg N ha^{-1}, since fractionation will incur additional costs due to the increase in agricultural operations.

If the management used is a single dose, elephant grass cv. BRS Capiaçu must be harvested between 80 and 100 days of regrowth, if the dosage is divided, it can be harvested between 100 and 120 days of regrowth, which will reduce the accumulation of dead material and improve the quality of the stored biomass.

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