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Chemical composition of *Urochloa brizantha* depending on the seasons and cutting frequencies

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The aim of this research was to assess the chemical composition of *Brachiaria brizantha* cv. Piatã variety and to determine which cutting frequency is the most suitable for autumn, winter and spring. The experimental design adopted was the completely randomized in factorial scheme with plots subdivided in time. Each plot consisted of four cutting frequencies (21, 28, 35 and 42 days between cuts) and sub plots were the three seasons (autumn, winter and spring) with 12 replicates per treatment (experimental units). The assessed parameters were; crude protein content, neutral detergent fiber, lignin and *in vitro* organic matter digestibility. No significant differences were observed in crude protein content between the cutting frequencies of 21, 28 and 35 days for autumn and winter; only the cutting frequency of 42 days showed the lowest values. The cutting frequency of 35 days showed higher crude protein and digestible organic matter for autumn and winter. As for the spring season, the cutting frequency that showed higher production of crude protein and digestible organic matter was 28 days.

Key words: Animal nutrition, pastures, *Brachiaria brizantha*.

INTRODUCTION

Brazil has the largest commercial herd in the world, around 213 million head distributed virtually throughout the country. Pasture is the main source of food, and 90% of beef cattle are raised in extensive production systems (Jank et al., 2014). Production of ruminants under grazing conditions is the way to produce meat at a low cost and high quality (Guarda and Guarda, 2014).

The growing challenge of providing food for an increasing population especially animal protein, makes agricultural scientists search for better pasture species. *Brachiaria brizantha* cv. Piatã emerges as a valid option in tropical and subtropical climate of the Central-West region of Brazil. According to Jank et al. (2014), the Piata grass was developed by the breeding program of Embrapa.

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One of the advantages of Piata is its early flowering (January and February), which results in the production of good quality forage in late autumn and early winter (critical period), unlike the late flowering species.

The effect of vegetation height of tropical forage on elongation rate and leaf senescence is linear; however, for stem elongation, there is a quadratic effect where vegetation height management can control this process. Leaf area index is favored with the increase in vegetation height, in addition to the production or accumulation of raw forage according to Santos et al. (2017).

According to Orrico Junior et al. (2013), plants Piatã that feature long periods between cuts provide lower forage quality; however, according to Difante et al. (2011), (Marandu) pastures managed with cutting interval corresponding to three leaves emerged per tiller regardless of cutting height, accumulate large amount of leaves, a highly desirable component for animal feed. Even so, Dim et al. (2015) highlighted that the increase in height of the Piata pasture does not provide change in CP content and digestibility and increase in content of NDF (neutral detergent fiber), it only changed the NDF at 60 cm of cutting height due to the greater lignin concentration. Euclides et al. (2009) highlight the importance of Piatã variety in the Cerrado biome as a new alternative because of its nutritional values consistency in both the pre and post grazing, which due to its great flexibility of management under continuous grazing, and can be managed between 15 and 45 cm height (Nantes et al. 2013).

Due to the lack of information regarding the behavior of the chemical composition of Piatã in different times of the year or cutting heights, this study was performed with the aim to assess the effect of the seasons and cutting heights on the chemical composition Piatã.

MATERIALS AND METHODS

The experiment was performed in the municipality of Dourados-MS, Brazil (22° 13’ 18.54’’ S, longitude 54° 48’ 23.09’’, 452 m). The study began on March 4, 2010 and lasted until December 17, 2010 so that autumn, winter and spring seasons were assessed. The climate of the region is Humid Mesothermal of the Cwa type, with average annual temperatures and precipitations varying from 20 to 24°C and 1250 to 1500 mm, respectively (Köppen classification).

The experimental design was completely randomized in factorial scheme 4 x 3, four cutting frequencies (21, 28, 35 and 42 days between cuts) and three seasons (autumn, winter and spring), with 12 replicates per treatment (experimental units). *B. brizantha* cv. Piatã variety were collected with the aid of a square of 0.25 m², cut randomly four times within each bed (production per area).

The soil of the experimental area was prepared with disc harrow and leveled. The sizes of the experimental plots were 3 m x 7 m, totaling 21 m². Prior to sowing, soil samples were collected from the experimental area at the 0-20 cm layer to analyze the chemical characteristics. The results were: pH (CaCl2) = 5.0; P (mg / dm 3) = 18; K (cmolc / dm 3) = 2. Ca (cmolc / dm 3) = 51; Mg (cmolc / dm 3) = 26; Al (cmolc / dm 3) = 1.8; H + Al (cmolc / dm 3) = 55; base weight (cmolc / dm3) = 79. Based on the results of the soil analysis, 500 kg/ha of gypsum were applied, and 2 kg/ha of commercial fertilizer diluted in water and sprayed on all plots with 5% of zinc, 5% boron, 4% manganese, 2% copper, 0.5% iron, 0.5% molybdenum, 1% magnesium, 10% sulfur, and 10% potassium. Phosphorus fertilization was not carried out because the result of the soil analysis performed showed 18 mg/dm³ of phosphorus in the soil, considered a high index for forage production.

The sowing of the pasture was carried out in March 2009, with 10 kg/ha of commercial seeds with a cultural value of 50%. After 45 days, the invasive plants were controlled and nitrogen fertilization (urea) was carried out in two applications of 100 kg/ha of N, totaling 200 kg/ha of N on 12/15/2009 and 03/15/2010. After each application of nitrogen the whole surface was irrigated for better use of the nutrient. On March 4, the grass was cut for standardization to start the experiment.

The forage samples were randomly collected with a frame of 0.25 m² four times in each plot. The cutting was performed at 20 cm from the soil, simulating a 20 cm residue management (Lima, 2009). After sampling, the pasture of the plots were cut and homogenized with a costal brush cutter at 20 cm and the cut material was removed with a scraper.

The material collected was weighed and placed in plastic bags, identified and immediately transported to the laboratory where the dry matter was determined. The sample was weighed and placed in forced ventilation oven at 65°C for 72 h, for determination of dry matter content. After drying, the material was ground using a Willey type mill, with a 1 mm mesh sieve. The contents of crude protein (CP), neutral detergent fiber (NDF), lignin (Lig) and *in vitro* organic matter digestibility (IVOMD) were determined by near infrared reflectance spectroscopy (NIRS), according to Marten et al. (1985). The data that have attended the normality and homogeneity assumptions were subjected to analysis of variance and means were compared by Tukey test at 5% probability. Statistical analysis was performed using the SAS 9.1 software (SAS, 2002).

RESULTS AND DISCUSSION

Piatã showed higher crude protein content during the autumn in comparison to the other seasons of the year as indicated in Table 1.

In the autumn season, the mean content of crude protein was 11.62% in the DM, about 55% more protein than plants harvested in the winter (7.47%). Euclides et al. (2014) found values of 12.3, 11.0 and 11.1 of CP at heights of 15, 30 and 45 cm, in the region of Campo Grande, MS in autumn season, similar to the present study. However, Orrico Junior et al. (2013) found mean of 11.51% crude protein in the DM of Piatã during the autumn, with cutting intervals that ranged from 26 to 35 days, very similar to those achieved in this study. There were no significant differences in crude protein content among the cutting frequencies of 21, 28 and 35 days, for the seasons of autumn and winter, only the cutting frequency of 42 days showed lower values ($p = < 0.05$) in these seasons. The mean coefficients of organic matter digestibility were 63.40, 55.77 and 58.42% for autumn, winter and spring, respectively, in the winter period. Agulhon et al. (2004) did not find variation of Marandu organic matter digestibility, 48.69% on average, considered a low value, which was found due to the high amount of fiber. With the maturity of the plant, the concentration of digestible components such as soluble

Table 1. Mean content (% of DM) of crude protein, neutral detergent fiber, lignin, *in vitro* organic matter digestibility and productions (kg/m^2) of dry matter, crude protein and digestible organic matter of *Urochloa brizantha* grass Piatã variety at different cutting frequencies (days) and seasons.

Mean content	Cutting height (cm)	Autumn	Winter	Spring
Crude protein (%)	21	12.5^{aAa}	7.3^{bAa}	7.9^{bAa}
	28	11.9^{aAa}	7.8^{bAa}	7.3^{bAa}
	35	12.8^{aAa}	8.1^{bAa}	7.5^{bAa}
	42	9.3^{aBa}	6.7^{cBb}	7.2^{bcAa}
In vitro organic matter digestibility (%)	21	63.3^{aB}	56.6^{cAB}	60.3^{bA}
	28	61.5^{aBC}	56.8^{bA}	57.5^{bB}
	35	68.7^{aA}	55.8^{bAB}	57.5^{bB}
	42	60.1^{aC}	53.9^{bB}	58.4^{aAB}
Neutral detergent fiber (%)	21	65.6^{bB}	65.4^{bB}	68.3^{aA}
	28	68.3^{aA}	66.1^{bB}	68.9^{aA}
	35	65.5^{bB}	66.8^{bAB}	69.14^{aA}
	42	67.1^{aAB}	68.4^{aA}	68.1^{aA}
Lignin (%)	21	2.3^{abA}	2.1^{bC}	2.4^{aAB}
	28	2.4^{aA}	2.3^{aB}	2.4^{aAB}
	35	1.8^{bB}	2.4^{aAB}	2.5^{aA}
	42	2.2^{bA}	2.6^{aA}	2.2^{bB}
Production of crude protein (kg/m^2)	21	0.06^{cB}	0.05^{cB}	0.10^{bA}
	28	0.10^{bB}	0.08^{aC}	0.12^{aA}
	35	0.86^{aA}	0.50^{abB}	0.75^{bcA}
	42	0.85^{aA}	0.50^{abB}	0.70^{bcA}

Means followed by different uppercase letters compare the seasons by Tukey test (p = < 0.05). Means followed by different lowercase letters compare the cutting frequencies by Tukey test (p = < 0.05).

carbohydrates, proteins, minerals and other cell components tend to decrease, and the proportion of lignin, cellulose, hemicellulose and other indigestible fractions. Alencar et al. (2010) stated that the autumn/winter period provides higher contents of crude protein and *in vitro* dry matter digestibility and lower content of neutral detergent fiber. According to Medeiros et al. (2007), high temperatures and extended photoperiods contribute to increased rate of photosynthesis, allowing an increase in the synthesis of new tissue. However, as the cuts approached the winter there was a decrease in the rate of photosynthesis (caused by the decrease in temperature and photoperiod), reducing the contents of CP and increasing fiber content. Autumn showed grass with better nutritional value as indicated in Table 1. Thus, the nutrient content of forages by itself does not define the best cutting interval to be adopted in a pasture.

During the autumn, the highest content of neutral detergent fiber of leaf blades were observed in pastures cut at 28 and 42 days. The other frequencies did not differ. During the winter, the highest content of neutral detergent fiber of leaf blades were observed in pastures cut at 35 and 42 days and the lowest at 21 and 28 days, but without significant difference from 35 days, which shows that as the plant gets older the cellular content decreases thereby increasing the fiber, a fact also recorded by Pinho et al. (2014), according to these authors, the seasonality affects the nutritional value of Brachiaria forages in Brazilian Cerrado. In the spring there was no difference between cutting frequencies regarding the content of neutral detergent fiber of leaf blades, the season caused a rapid growth by increasing the amount of cell wall. Lignin of leaf blades was lower in the autumn at the cutting height of 35 cm; in the summer, Pinho et al. (2014) found 3.55% lignin in leaf blades at a height of 30 cm, in this season plants have higher concentration of soluble carbohydrates and less structural carbohydrates.

The cutting frequency of 35 days provided greater (p = < 0.05) production of crude protein and digestible organic matter for autumn and winter seasons, similar to the results reported by Pinho et al. (2014), who observed 13.38% CPat the cutting height of 30 cm, higher in spring and summer. For spring, the cutting period of 28 days showed higher production of crude protein and digestible organic matter. An increase in height of the pasture Piatã usually causes variations in NDF and CP, and this response is affected by the season of evaluation, the NDF does not vary in relation to growing seasons according to Dim et al. (2013). Change of growing seasons affect the nutritional components of plants as the height increases, due to the fact that as the physiological age of the plant increases, so does the percentage of cellulose, hemicellulose and lignin, reducing the proportion of digestible nutrients, yet, can significantly reduce digestibility.

Conclusions

The chemical compositions of *B. brizantha* cv. Piatã variety have higher crude protein content and neutral detergent fiber of leaf during the autumn.

The cutting frequency recommended in the autumn and spring were 35 and 28 days, respectively. In winter, the lowest concentration and yield of crude protein in the cut made at 21 cm.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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