Original Article

PRODUCTION AND CHEMICAL COMPOSITION OF HYBRID *Brachiaria cv. Mulato II* UNDER A SYSTEM OF CUTS AND NITROGEN FERTILIZATION

PRODUÇÃO E COMPOSIÇÃO BROMATOLÓGICA DA Brachiaria híbrida cv. Mulato II *SOB REGIME DE CORTES E ADUBAÇÃO NITROGENADA*

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ABSTRACT: The production capacity of green and dry mass of the entire plant, efficiency of N conversion, apparent N recovery and the chemical composition of cultivar Mulato II was evaluated under a system of cuts and nitrogen doses. The assay, conducted in the municipality of Goiânia, GO, Brazil, had a totally randomized 2 x 4 factorial design (2 height cuts, 0.40 and 0.50 m and 4 nitrogen doses), with three replications and subdivided subplots. Treatments comprised four N doses (0, 50, 100 and 150 kgha^{-1} N, with urea as nitrogen source). There was no significant interaction ($p>0.05$) between N doses and cut heights for the variables productivity of green (PGM) and dry (PDM) mass, nitrogen use efficiency (NUE) and apparent N recovery (ANR), which were neither affected ($p<0.05$) by N doses nor by evaluated cut heights. Average productivity reached 59,450 kgha^{-1} (PGV) and 10,367 kgha^{-1} (PDM) and it was produced an average of 19.62 kg of DM per kg of N, with a mean 56.00% recovery. N doses and cut heights did not affect ($p>0.05$) DM rates of the plant, whilst mean dry matter rate was 17.49%. CP rates were affected ($p<0.05$) by N doses (0, 50, 100 and 150 kgha^{-1}) and cut heights (0.40 and 0.50 m) and by the interaction of these factors. CP rates of the entire plant hybrid *Brachiaria* cv. Mulato II increased ($p<0.05$) due to N doses through an increasing linear relationship. Since there was a significant effect ($p<0.05$) with regard to cut height and CP rates decreased with height increase. NDF rates were significantly influenced by N doses ($p<0.05$) and by cut heights ($p<0.05$), with significance for the interaction ($p<0.05$) of over 100 kgha^{-1} N doses only. No significant interaction ($p>0.05$) occurred in ADF rates among the variables analyzed. ADF contents were influenced by N supply ($p<0.05$) with decreasing quadratic regression as N doses increased.

KEYWORDS: Apparent nitrogen recovery. Bromatological composition. Chemical fertilizers. Nitrogen use efficiency.

INTRODUCTION

Livestock farming is one of the main causes for Brazil´s economic growth. Cattle's breeding in Brazil is run on pasture since it is a low-cost activity and less harmful to the environment. However, Brazilian production systems are developed in vast extensive areas currently undergoing a degradation process and thus low productivity/animal indexes, which are insufficient to warrant the sustainability of livestock (DIAS-FILHO, 2014).

So that such a negative performance may be minimized, the use of roughage feed with good nutritional quality, high productivity and low production costs are required. In fact, tropical grass represents the main nutrient source for meat cattle in pasture systems (DIAS-FILHO, 2014).

The performance of the hybrid *Brachiaria* cv. Mulato II (CIAT 36087), originated from the crossing *Brachiaria ruziziensis* x *B. decumbens* x *B. brizantha*, is scantily known in Brazilian conditions although already extensively employed. Early results have shown that the forage has a high potential productivity (10 – 27 t.ha^{-1}.year^{-1} of dry matter) and a good development at different altitudes and rainfall levels. The grass adapts well to acid low-fertility soils with high rates of aluminum (ARGEL et al. 2007). The cultivar Mulato II revealed higher rates of crude protein than cultivars Xaraés and Mulato during the rainy and dry seasons when evaluated in naturally low-fertility soils on the experimental farm of CIAT in Santander de Quilichao, Colombia (ARGEL et al. 2007).

However, forage plants with high productivity and good nutritional quality require greater nutritional demands, or rather, high fertility soils (ABREU et al. 2006). Consequently, the supply of nutrients, especially nitrogen in proper quantities and amounts, is very important within the

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pasture productive process (FAGUNDES et al. 2005).

Nitrogen is the main nutrient for the maintenance of productivity of forage grasses and it is an essential component of proteins, nucleic acids, hormones and chlorophyll (DIAS-FILHO, 2011) affecting leaf length, shoot rates, and the formation of axillary buds (Da SILVA et al. 2008).

The defoliation process by adjustments and combination between frequency and intensity of cuts or pasture is another aspect that should be considered. Owing to the complex interaction between processes involving forage accumulation, the several factors linked to the management of forage plants, such as the height of cuts, or pasture, in the plants may produce different responses in the accumulation and nutrition rate of the forage produced.

Plant maturity progress, which is related to cutting height, changes the participation of its structural components, especially the leaf: stem ratio and senescent matter, with the subsequent increase in the percentage of low digestibility fiber (BORTOLO et al. 2001). In their research on xaraés grass, Carloto et al. (2011) concluded that the intensity of pasture represented by cut height changes significantly the canopy structure, the forage´s nutrition rate and the consumption of dry matter. Research on tropical forage grass (*B. brizantha* cv. Marandu, *B. brizantha* cv. Xaraés, *B. decumbens, B. ruziziensis* and *B.* hibrida cv. Mulato) by Bauer et al. (2011) demonstrated that different intensities of cuts modified the structural characteristics of the forage grass and influenced the forage production, leaf percentage and loss due to senescence, and thus the quality of the plant.

Taking into consideration the dearth of studies on the response of hybrid *Brachiaria* cv. Mulato II to nitrogen fertilization and cut height, current study was done to evaluate the productivity of green (PGM) and dry (PDM) matter of the aerial section of the forage plant, the efficiency of apparent conversion of nitrogen (NUE), the apparent recovery of nitrogen (ANR) and the chemical composition (Dry Matter (DM), Crude Protein (CP), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) of the vegetal biomass of the plant´s aerial section, under a cutting system and submitted to nitrogen doses.

MATERIAL AND METHODS

The experiment was performed in the period of november 2012 to april 2013, on the farm of the Department of Animal Production of the Veterinary and Animal Science School (EVZ) of the Universidade Federal de Goiás (UFG), Campus II, in Goiânia, GO Brazil, at S 16º 35’ 00’’ and W 49º 16’ 00’’, altitude 727 m.

Meteorological data were monitored monthly during the experiment and measured by the Weather Station of the Agronomy and Food Engineering School of the Universidade Federal de Goiás (EAEA/UFG). According to Koeppen (1948), regional climate is Aw (hot and semi-humid with well-defined seasons: the dry season between May and October, and the rainy season between November and April), with an annual mean temperature of 23.2ºC. Mean rainfall is 1,759.9 mm (Brasil, 1992) and the rainy season is characterized by low insolation.

The soil of the experimental area is classified as Dystrophic Red Latosol (Embrapa, 1999) and samples were collected at a depth of 0-0.20 m for chemical characterization. Table 1 shows data of soil chemical attributes of the experimental area before the experiment. Soil analysis results required phosphate (P_2O_5) and potassium (K_2O) fertilizations, following recommendations by Martha Júnior et al. (2007).

Treatments comprised four doses of N (urea): (0, 50, 100 and 150 kgha^{-1} N) and two heights (0.40 and 0.50 m).The totally randomized experimental design comprised a factorial design 2 X 4 (2 cut heights X 4 nitrogen doses), with three replications and subdivided parcels. The statistical model was:

$$y_{jik} = \mu + \alpha_i + b_j + e_{ij} + \gamma_k + (\alpha\gamma)_{ik} + e_{ijk}$$

y_{jik} = observation at the jth block of the ith level of fertilization and kth cut height

μ = general means

α_i = Effect attributed to ith level of fertilization

b_j = Effect attributed to jth block

e_{ij} = Error associated to the lot (ij)

γ_k = Effect attributed to kth height

$(\alpha\gamma)_{ik}$ = Interaction effect between the fertilization level and cut height

e_{ijk} = Error associated to the sub-lot (ijk)

Twelve 5 x 2 m (10 m²) parcels were selected in the experimental area and randomly divided into three replications for each N dose (0, 50, 100 and 150 kg). Later, the parcels were randomly subdivided into two treatments (0.40 and 0.50 m) with one meter space between lots. Further, 0.50 m borders were left between each lot and between the two treatments within the same lot.

Table 1. Physical and chemical characteristics of the soil of experimental area¹.

Characteristic	Result
pH ($CaCl_2$)	5.9
M.O. (%)	5.8
P (Mehl.) (mg dm^3)	3.8
K^+ (mg dm^3)	69.0
Ca^{2+} ($cmol_c$ dm^3)	3.4
Mg^{2+} ($cmol_c$ dm^3)	1.1
AL^{3+} ($cmol_c$ dm^3)	0.0
$H^+ + Al^{3+}$($cmol_c$ dm^3)	2.8
V (%)	62.5
CTC ($cmol_c$ dm^3)	7.5
M (%)	0.0
Clay (%)	35.0
Silt (%)	19.0
Sand (%)	46.0

Canopy height (0.40 m or 0.50 m, according to treatment) was the parameter for cuttings, being carried out, on average, 6 cuts per parcels. Height average of the canopy was obtained by measuring three points of the sub-parcel by a centimeter-graded ruler and taking the length of the main tiller plant from the base to the last leaf (without considering inflorescences)

Cuts were done by a steel scissors, employing an iron square (1 m^2), at a height of 0.15 m from the ground and excluding the borders. The lowering of the parcel was done by a shoulder-strapped cutter after each assessment cut at the pre-established height (0.15 m). Residues were removed and the cut material was collected and weighed, afterwards, it was conditioned in tagged plastic bags and immediately transported to the laboratory. The evaluation of green matter production is justified to assist in the choice of management techniques and the definition of stocking rate.

The collected material was then subdivided into samples of approximately 500 g each and dried in a forced air ventilation at 65°C for 72 hours. The material was then weighed once more and ground in a Willey mill with a 1 mm-diameter sieve and conditioned in plastic pots.

It was evaluated productivity of the green (PGM) and dry (PDM) matter due to the cuts and rates transformed into kgha^{-1}.Nitrogen in plant tissue (NT) and crude protein (CP) rate were calculated following methodology by Silva and Queiroz (2002). Rates of acid detergent fiber (ADF) and neutral detergent fiber (NDF) were calculated according to methodology by Van Soest (1991).

The Nitrogen Use Efficiency (NUE) and apparent N recovery (ANR) were calculated according to Carvalho and Saraiva (1987) by the formulas:

$$\text{NUE} - \frac{\text{PDM(fertilized)} - \text{PDM (notfertilized)}}{\text{N (applied)}}$$

NUE = Nitrogen use efficiency, expressed in kg of PDM produced per kg ha^{-1} of N applied
PDM (fertilized) = dry matter forage production in fertilized parcels with treatments (kg ha^{-1})
PDM (not fertilized) = dry matter forage production in not fertilized parcels (kg ha^{-1})
N (applied) = nitrogen doses applied as treat (kg ha^{-1} of N).

$$\text{ANR} = \frac{\text{NC(fertilized)} - \text{NC (not fertilized)}}{\text{N (applied)}} \text{ X 100}$$

NC (fertilized) = nitrogen concentration in shoots of plants in fertilized parcels with treatments (kg ha^{-1})
NC (not fertilized) = nitrogen concentration in shoots of plants in not fertilized parcels (kg ha^{-1})
N (applied) = nitrogen doses applied as treat (kg ha^{-1} de N).

The difference between total production of forage from each treatment and control treatment (supposing that the soil´s nitrogen contribution was the same for all treatments), divided by the amount of nitrogen applied, expressed in kg of dry matter rates (DM) produced per kg of applied N, was calculated to obtain the efficiency of NUE, adapted from Carvalho and Saraiva (1987).

DM production (kgha^{-1}) was multiplied by the nitrogen rate in gkg^{-1} to determine the absorbed nitrogen by the forage. The amount of N in the forage from the non-fertilized parcels was employed to estimate N supply from the soil and the air. N in roots and residues was not calculated since N recovery or the percentage of N absorbed from the total applied takes into account only N in the plant´s aerial section (CARVALHO; SARAIVA, 1987).

Results underwent analysis of variance by R (R Core Team, 2010). Tukey´s test at 5% significance verified averages of treatments. Regression analyses were adjusted by testing linear and quadratic models of the N doses applied.

RESULTS AND DISCUSSION

No significant interaction (p>0.05) occurred between N doses and heights of cuts for the variables PGM, PDM, NUE and ANR. Table 2 shows productivity results of green (PGM) and dry (PDM) mass. In spite of the numerical trends, PGM and PDM were not affected (p>0.05) by the N doses under analysis (0, 50, 100 and 150 kgha^{-1}).

Productivity means amounted to 59,450 kgha^{-1} (PGM) and 10,367 kgha^{-1} (PDM) which were higher than those by Castagnara et al. (2011a) for Mulato grass with productivity 29,033 and 4,593 kgha^{-1}, respectively for PGM and PDM. However, averages in current research were close to rates reported by Costa et al. (2010) for Marandu grass with productivity up to 10,075 kgha^{-1} of dry matter.

Table 2. Productivity of green (PGM) and dry (PDM) matter of hybrid *Brachiaria* cv. Mulato II submitted to N doses at different cut heights.

Cut height	PGM (kgha^{-1})					CV (%)
	N doses (kgha^{-1})				Means	
	0	50	100	150		
0.40 m	54,533	58,500	62,583	66,100	60,429	8.29
0.50 m	51,967	56,767	60,967	64,184	58,471	9.05
Means	53,250	57,633	61,775	65,142	59,450	
Cut height	PDM (kgha^{-1})					CV (%)
	N doses (kgha^{-1})				Means	
	0	50	100	150		
0.40 m	9,162	10,828	11,397	11,157	10,636	9.50
0.50 m	8,968	9,852	11,007	10,564	10,098	8.83
Means	9,065	10,340	11,202	10,860	10,367	

Nitrogen fertilization in most researches has provided immediate and visible increase in forage production. In fact, rising productivity increases have been reported with increases in nitrogen doses (CORRÊA et al. 2007; COSTA et al. 2010; VIANA et al. 2011). However, responses in current research may have been the result of high fertility of the soil on which the experiment was conducted, which may have contributed to the fact that Mulato II presented no response to N fertilization. Applied nitrogen may have been used by the plant in a different way, such as, for instance, responses in composition as has been actually reported in current assay. In addition, the lack of response in dry matter production can be because nitrogen fertilization causes an increase in water absorption on fodder plants. This was observed by Castangara et al. (2011a). However, the number of cuts may have not been enough to show the forages production capability.

There were no variations (p>0.05) in PGM and PDM due to cut heights under analysis (0.40 and 0.50 m). Different responses were reported by Carloto et al. (2011) on Xaraés grass. They detected the influence of the intensity of pasture represented by cut height in the productivity of DM. Research by Bauer et al. (2011) on tropical forage grass (*B. brizantha* cv. Marandu, *B. brizantha* cv. Xaraés, *B. decumbens*, *B. ruziziensis* and hybrid *B.* cv. Mulato) revealed that the different intensities of cuts changed the structural characteristics of the forager grasses and, consequently, forage production.

There was no significant effect (p>0.05) of N doses applied to the nitrogen use efficiency (NUE) for the heights under analysis (Table 3). Although there was no effect of doses on NUE, the forage grass tended towards a reduction of efficiency by increasing N doses, with mean production of 19.62 kg of DMkg^{-1}of applied N.

When response of hybrid *Brachiaria* cv. Mulato II under N doses was evaluated, Cabral et al. (2013) reported responses as high as 14.85 kg of DM for each kg of N applied. Similarly, Castagnara et al. (2011a) reported maximum nitrogen efficiency with dose 106 kgha^{-1}, and producing 29 kg of DMkg^{-1} of N.

According to Dougherty and Rhykerd (1985), studies on the efficiency of nitrogen usage in production system is highly relevant. As the applied quantity exceeds the plants' capacity for the absorption of the nutrient for production, the nitrogen may be leached or accumulate in the tissues, with a decrease in its efficiency.

Nitrogen is essential among nutrients to provide significant increase in forage production. However, the efficiency of nitrogen fertilization is related to such factors as type of soil, management, climate conditions, forage species, quantity applied and sources, all of which are the bases of different productions and responses in the literature (MARTHA JÚNIOR et al. 2004).

According to Martha Júnior et al. (2007), the efficiency of N conversion into forage in tropical grass pastures may reach rates up to 83 kg of DM per kg of applied N. However, in their review of the literature, Martha Júnior et al. (2004) verified that in an average of 382 observations with tropical forage grass, N conversion efficiency was 26 kg of DM per kg of N applied, with mean highest efficiencies in doses up to 150 kgha^{-1} of N. As a rule, results in current assay may be considered satisfactory when compared to those in the literature.

Table 3. Mean rates of Nitrogen Use Efficiency (NUE) (kgha^{-1} of DM of forage grass produced per kg of applied N) and Apparent Nitrogen Recovery (ANR) (%) of hybrid *Brachiaria* cv. Mulato II submitted to nitrogen doses, managed at different cut heights.

Height of cut	N doses (kgha^{-1})				Mean	CV (%)
	0	50	100	150		
			(NUE) (kgha^{-1})			
0.40 m	-	33.32	22.35	13.30	22.99	43.60
0.50 m	-	17.68	20.40	10.64	16.24	31.00
Mean	-	25.50	21.38	11.97	19.62	
			ANR (%)			
0.40 m	-	68.57	71.85	57.59	66.00	11.32
0.50 m	-	36.04	58.15	43.78	45.99	24.40
Mean	-	52.31	65.00	50.69	56.00	

Statistical analysis showed no significant effect (p>0.05) of N doses on ANR for none of the cut heights evaluated (Table 3).Taking into consideration all N doses and the two cut heights, the average recovery reached 56.00%. Overall N recovery rate ranged between 36.04 and 71.85%. The above rates are close to the range reported by Martha Júnior et al. (2004) who insisted that N recovery in the plant´s aerial section of tropical pastures might vary between 15 and 60%, depending on different factors such as source and management of the application.

On the other hand, Primavesi et al. (2006) enhance that knowledge on N recovery of the fertilizer by the plant in intensively managed pastures with high N rates is highly important to form strategies aiming at maximizing its efficiency and minimizing impact on the environment. Further, Heringer and Moojen (2002) reported that N recovery rate in tropical pasture is greater, due to the high capacity of DM production and fast absorption of nitrogen by the root system.

According to Primavesi et al. (2004), increase in N dose decreases the percentage of recovered nitrogen. In her work on Mombaça grass, Silva (2009) registered that as N doses became higher, a decrease in ANR occurred, with highest rates in dose 100 kgha^{-1}of N. ANR percentages obtained by the author were 50.01, 45.21 and 32.62% respectively for doses 100, 300 and 500 kgha^{-1}of N.

Applied N doses and cut heights failed to influence (p>0.05) the plants DM rates. Table 4 shows mean DM rates of the entire plant due to N doses. Mean DM rate (17.49%), lower than that by Faria Filho (2012) for the cultivar Mulato II (27.30%), may be due to rainfall conditions during the period under analysis, even though it is close to rates by Castagnara et al. (2011a) for Tanzania (16.44%), Mombaça (17.28%) and Mulato (16.77%) grasses.

Table 4. Mean rates of dry matter (DM) in % of the entire hybrid *Brachiaria* cv. Mulato II plant submitted to nitrogen doses and managed at different cut heights

Height of cuts	(DM rates) (%)					CV (%)
	N doses (kgha^{-1})				Mean	
	0	50	100	150		
0.40 m	17.46	17.39	18.21	16.39	17.36	4.32
0.50 m	17.01	18.31	18.58	16.58	17.62	5.53
Mean	17.23	17.85	18.40	16.49	17.49	

In spite of very close numbers, response by Castagnara et al. (2011a) differs from that in current research. Although they did not report any difference in DM rates between the forage grasses under analysis, they detected an effect with regard to N doses evaluated (0, 40, 80, 120 and 160 kgha^{-1}). The above mentioned authors underscored a 0.56% decrease in dry matter percentage of grass for every 40 kgha^{-1} of nitrogen applied, due to a higher nitrogen availability. When growth of plant was stimulated, a higher water accumulation occurred.

In their assessment of the effect of nitrogen doses in Tifton grass 85 (*Cynodon* spp.), Quaresma et al. (2011) did not detect any effect of N doses in dry matter rates of green grass, at a mean rate of 21.18%. In the case of cut height with *Brachiaria decumbens* cv. Basilisk, Maranhão et al. (2010) report that dry matter rates were similar throughout the year. According to the authors, the young plant had high water rates which decreased when close to maturity.

CP rates were influenced (p<0.05) by N doses, cut heights and the interaction of these factors. CP rates of the entire hybrid *Brachiaria* cv. Mulato II increased (p<0.05) due to N doses and provided an increasing linear relationship, with only the 50 kgha^{-1}dose equivalent to control (Table 5). There was a significant effect (p<0.05) in cut height and showed that CP rates decreased with an increase in height.

Table 5. Mean rates of Crude Protein (CP) in % of the entire plant hybrid *Brachiaria* cv. Mulato II submitted to nitrogen doses and managed at different cut heights

Height of cut	(CP rate) (%)					CV (%)
	N doses (kgha^{-1})				Mean	
	0	50	100	150		
0.40 m	11.52Ac	11.72Ac	13.20Ab	14.34Aa	12.69A	10.46
0.50 m	10.37Bc	10.58Bc	11.75Bb	12.67Ba	11.34B	9.46
Mean	10.95c	11.15c	12.48b	13.51a	12.02	-

Different small letters in the lines are different by Tukey´s test (p<0.05).

Nitrogen fertilization had a linear increase (p<0.05) in CP rates of the Mulato II grass (Figure 1), with 0.0151 dagkg^{-1} for each kgha^{-1} of N applied. Results were higher than those by Quaresma et al. (2011) with an increase of 0.0095 dagkg^{-1} in CP rate of Tifton 85 grass for every kg of N applied. Linear increases of CP rates as a response to N doses were also detected by Medeiros et al. (2011) in two*B. brizantha* cultivars (cv. Marandu and cv. Vitória).

In their research on Mulato II grass, Cabral et al. (2013) detected responses described by a quadratic regression model in N concentration in the plant´s aerial part where there was an increase in CP rate up to dose 604 kgha^{-1}of N. According to the authors, a higher N concentration means a higher CP rates in the forage grass. Results may be elucidated by report by Malavolta and Moraes (2007) that increase in CP rates caused by N doses may be explained by the decrease of N to ammonium and assimilates to the carbon skeletons via GSGOGAT cycle (glutamic and glutamate acid).

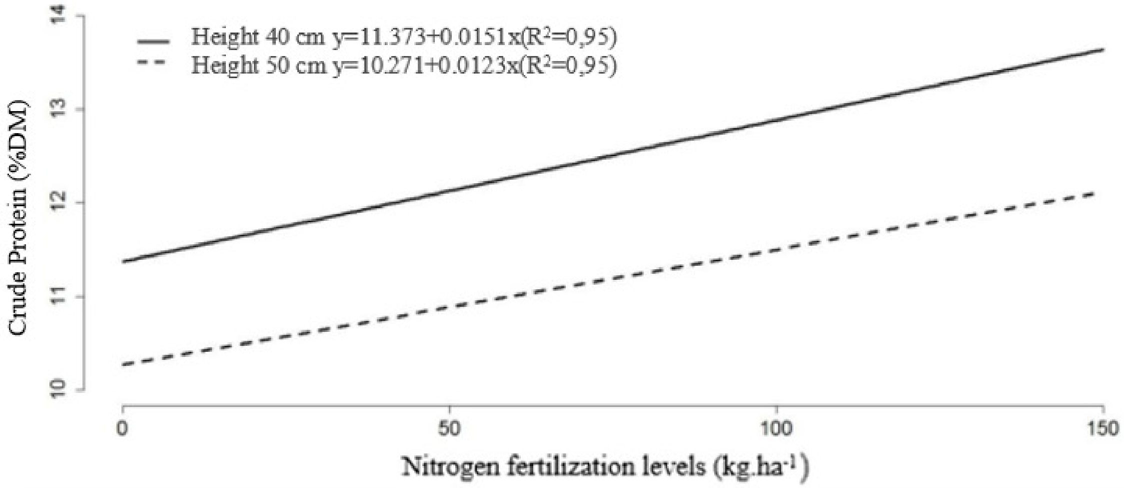

Figure 1. Estimates of crude protein (CP) rates of the entire plant hybrid *Brachiaria* cv. Mulato II submitted to nitrogen doses and managed at different height cuts.

Increase in height cut caused a decrease in the rates of crude protein (CP) in the forage grass. The decrease in CP level attributed to cut heights, and this fact can be explained by the plant aging, which leads to a decrease in cellular content and increase in cellular wall (Taiz and Zeiger, 2013). The above response corroborated research by Carloto et al. (2011) who evaluated the nutrition rates in pastures of Xaraés grass (*Brachiariabrizantha* cv. Xaraés), 15, 30 and 45 cm high, under continuous parceling, and reported higher CP rates for pastured managed at a height of 15 cm (12.70%) when compared to that managed at 45 cm (10.30%). According to the authors, lower nutrition rate of the high pasture was caused by a greater amount of old leaves on the canopy, since the leaves rejected by the animals continued to get older.

Maximum (14.34% and 12.67%) and minimum (11.52% and 10.37%) rates of CP for heights 0.40 m and 0.50 m were obtained respectively by N doses 150 and 0 kgha^{-1}. When all treatments were taken into consideration, CP rates ranged between 10.37% and 14.34% due to heights of the cuts and N doses. The above results are close to those reported for the same cultivar by Faria Filho (2012) who registered CP rate of 11.7% and by Teodoro et al. (2012) who registered rates between 11.50% and 14.60%.

As a rule, the mean CP rates found in current research, even in control, are sufficient to warrant minimum protein rates required by the ruminants (7.0%), proposed by Mertens (1987). According to the author, 7.0% of CP is the minimum required rate to stimulate voluntary consumption of forage and provide adequate fermentation, with the best conditions for the best use of forage by digestion.

Levels of NDF and ADF were significantly affected by N doses ($p<0.05$); while cut heights influenced ($p<0.05$) only NDF levels. There were no interactions between cut heights and nitrogen doses (Table 6).

These results are similar to those by Castagnara et al. (2011b) who also detected the influence of N doses studied for NDF rates. The authors researched three tropical grasses and four N doses (0; 40; 80 and 160 kgha^{-1}) with urea as source, and registered that the grasses had a quadratic behavior for the variable NDF. The lowest rate was obtained with N dose of 115 kgha^{-1} and means 71.92%, 73.54% and 69.86% of NDF were reported respectively for Tanzania, Mombaça and Mulato grasses.

Corrêa et al. (2007) also reported a decrease of NDF rates with the increase of nitrogen fertilization in Coastcross grass. Similarly, Medeiros et al. (2011) reported a decreasing linear effect of NDF rates in their experiments with *Brachiaria brizantha* cv Vitória, due to an increase in N doses (0, 100, 200, 300 and 400 kgha^{-1}). Similar results were reported by Quaresma et al. (2011) who concluded that an increase in N doses enhanced a linear reduction ($p<0.05$) of 0.0143 dagkg^{-1} for each kgha^{-1} of applied N in NDF rates.

Table 6. Mean rates of Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) in % of the entire plant hybrid *Brachiaria* cv. Mulato II submitted to N doses and managed at different height cuts.

Height	N doses (kgha^{-1})				Mean	CV (%)
	0	50	100	150		
			NDF (% of DM)			
0.40 m	72.63Aa	70.70Aa	65.61Bb	59.03Bc	66.99B	9.08
0.50 m	74.40Aa	71.74Ab	68.11Ac	62.57Ad	69.21A	7.40
Mean	73.52a	71.23b	66.86c	60.80d	68.10	-
			ADF (% of DM)			
0.40 m	35.08a	32.68b	30.61bc	28.72c	31.77B	8.61
0.50 m	37.31a	34.49b	32.47bc	30.39c	33.67A	8.76
Mean	36.20a	33.59b	31.54c	29.56d	32.72	-

Different small letters in the lines are different by Tukey´s test ($p<0.05$).

Further, increase in NDF rates due to the increase of cut heights is consistent with reports by Muller et al. (2006) who report that increase in fiber rates occurs because of the plant´s maturity. In fact, progress in the vegetative cycle triggers increase in lignin rate and in cell wall thickness in the plant´s tissues, mainly due to a decrease in the leaf: stem ratio.

In their assessment of elephant grass at various cutting ages, Martins-Costa et al. (2008) registered that NDF rates increased as cut age increased. Mean rates were 69.49; 68.70; 73.94; 79.87; 76.67 and 78.85%, respectively for ages 30, 45, 60, 75, 90 and 105 days of vegetative growth.

NDF concentration is the component most consistently associated with forage intake (VAN SOEST, 1994). In current research, except for dose 150 kgha^{-1}at a height of 0.40 m, the NDF rates were above 60% for the entire plant. According to Van Soest (1994), this fact is negatively co-related to intake. However, fiber is also used by ruminants as an important energy source by the short fatty acids chain produced during fermentation in the rumen (VAN SOEST, 1994).

The difference in ADF rates between doses 0 and 150 kg N ha^{-1} were 18.1% when Mulato II was managed at 0.50 m and 18.5% when cut height was 0.40 m. ADF, formed by cellulose and lignin, co-relates inversely to the digestibility of the forage grass as its rate increases in the plant. However, negative linear association naturally depends on several factors among which forage species, climate, soil and management could be mentioned (VAN SOEST, 1994).

The lowest ADF rates of the entire plant were obtained when the highest N rates were applied. The above corroborated results by Medeiros et al. (2011) who in their research on *Brachiaria brizantha* cv. Vitória reported a linear effect in ADF rates due to N doses applied (0, 100, 200, 300 and 400 kg ha^{-1}) where increase in N doses triggered a reduction of ADF rates.

Similarly, Costa et al. (2010) evaluated four N doses (0, 100, 200 and 300 kgha^{-1}.year^{-1}) in Marandu grass and concluded that N doses affected ADF rates, or rather, there was a linear decrease when N doses increased. Adjusted means ranged between 41.14% and 30.33%, with a 26% decrease in ADF rate at maximum dose when compared to the non-application of nitrogen. ADF rates had a decreasing quadratic regression when N doses increased (Figure2).

Besides nitrogen fertilization, management may also influence ADF rates in the forager plant. Although results failed to show the influence of cut height between the doses under analysis, treatment averages were significant ($p<0.05$) with a lower ADF rate for height 0.40 m (31.77%) when compared to height 0.50 m (33.67%).

Results for ADF rates in current research were lower than those by Faria Filho (2012), with mean 42.13%, whereas Teodoro et al. (2012) registered rates between 38.78% and 43.27% on the cultivar Mulato II. However, rates were close to those by Mertens (1994), at a maximum of 30%, considered the best for maximum intake and higher digestibility of forage.

Influence of nitrogen on NDF and ADF levels can be explained by the nutrient influence on plant morphology. Nitrogen stimulates leaf appearance and promotes increase in leaf: stem ratio and accelerates tissue renewal. Martuscello et al. (2005) reported decrease in phyllochron and increase in leaf appearance rate of Xaraés when fertilized with nitrogen. Fagundes et al. (2006) reporter higher leaf elongation rate, higher final leaf length and higher leaf area index in Signal grass fertilized with nitrogen.

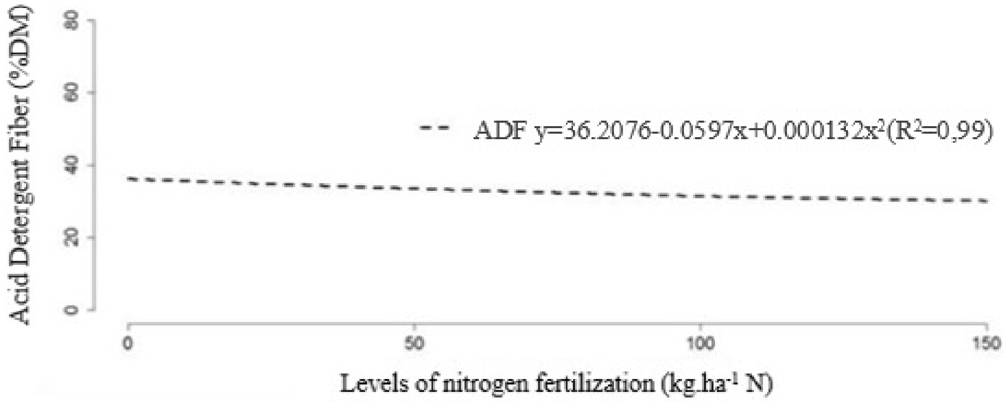

Figure 2. Estimates of acid detergent fiber (ADF) of the entire plant hybrid *Brachiaria* cv. Mulato II submitted to nitrogen doses and managed at different cut heights.

CONCLUSIONS

Hybrid *Brachiaria* Mulato II can be managed at 0.40 or 0.50 m, since there was no effect from cut height on dry matter production, which means that both heights support the same stocking rate.

Regards to nitrogen fertilization, the 150 kg ha^{-1} dose led to higher protein contents and lower ADF and NDF levels, which increases grass nutritional value and might increases its intake.

RESUMO: O presente trabalho de pesquisa teve como objetivo avaliar o potencial produtivo de massa verde e seca da planta inteira, a eficiência de conversão do N, a recuperação aparente do N, bem como a composição bromatológica do cultivar Mulato II, sob regime de cortes e submetido a doses de nitrogênio, no município de Goiânia, GO, Brasil. Utilizou-se um delineamento experimental inteiramente casualizado com arranjo fatorial 2 X 4 (2 alturas de corte (0,40 e 0,50 m) X 4 doses de nitrogênio) com três repetições e parcelas subdivididas. Os tratamentos foram constituídos por quatro doses de N (0, 50, 100 e 150 kgha^{-1} de N) (sendo a fonte ureia). Não ocorreu interação significativa (p>0,05) entre doses de N e alturas de corte para as variáveis produtividades de massa verde (PMV) e massa seca (PMS), eficiência de conversão aparente de nitrogênio (ECAN) e recuperação aparente de nitrogênio (RAN), que não foram influenciadas (p<0,05) pelas doses de N, nem em função das alturas de corte avaliadas. A média de produtividade encontrada foi de 59.450 kgha^{-1} (PMV) e 10.367 kgha^{-1} (PMS), produzindo em média 19,62 kg de MS para cada kg de N aplicado, com uma recuperação média de 56,00%. As doses de N aplicadas e as alturas de corte não influenciaram (p>0,05) os teores de MS da planta. A média do teor de matéria seca encontrada foi de 17,49%. Os teores de PB foram influenciados (p<0,05) pelas doses de N (0, 50, 100 e 150 kgha^{-1}) e alturas de corte (0,40 e 0,50 m) bem como a interação desses fatores. Os teores de proteína bruta (PB) da planta inteira *Brachiaria* híbrida cv. Mulato II aumentaram (p<0,05) em função das doses de N, apresentando uma relação linear crescente. Quanto à altura de corte, ocorreu também efeito significativo (p<0,05), evidenciando que os teores de PB diminuíram com o aumento da altura. Os teores de FDN foram influenciados significativamente pelas doses de N (p<0,05) e pelas alturas de corte (p<0,05), apresentando significância para a interação (p<0,05) apenas nas doses acima de 100 kgha^{-1} de N. Para os teores de FDA não houve interação significativa (p>0,05) entre as variáveis analisadas. O conteúdo de FDA foi influenciado pelo fornecimento de N (p<0,05), apresentando regressão quadrática decrescente com o aumento das doses de N.

PALAVRAS-CHAVE: Adubação química. Composição bromatológica. Eficiência da Conversão Aparente de Nitrogênio. Recuperação Aparente de Nitrogênio.

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