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RESEARCH ARTICLE

PRODUCTION AND CHEMICAL COMPOSITION OF FORAGE PEARL MILLET SUBMITTED TO NITROGEN DOSES AND CUT HEIGHTS

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ABSTRACT

We evaluated the response of millet cultivars (ADR 500 and BRS 1501) to nitrogen fertilization (0; 45; 90 or 180 kg ha^{-1}) and pre-cut heights (0.70; 0.80 and 0.90 m). Data underwent analysis of variance and means were compared by Tukey´s test. Crude protein (CP) was determined by the Kjeldhal method; insoluble neutral and acid detergent fiber (NDF and ADF) and lignin by sequential method. Ether extract (EE) was determined by Soxhlet method and total carbohydrates (tCHO) by Sniffen´s equation. Both cultivars showed linear response to nitrogen. The 0.90 m cut provided higher dry matter (DM) rates and the 0.80 and 0.70 m cuts had DM rates limiting to consumption. NDF rates varied between 69.08% (BRS 1501, 180 N, 0.80 m) and 83.19% (ADR 500, 180 N, 0.70 m); ADF varied between 27.38% (BRS 1501, 45 N, 0.80 m) and 39.06% (ADR 500, 90 N, 0.80 m); lignin had a mean 5.15% and EE had a mean 3.47%, with no variations due to treatments. Despite high NDF, cultivars presented high tCHO and EE rates, indicating high energy density. Nitrogen fertilization improved the chemical composition and productivity, especially for the 0.90 m cut.

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INTRODUCTION

Lack of fertilization and incorrect management are the main causes for pasture degradation in Brazil. Nitrogen fertilizers are the most employed not only in Brazil but also worldwide, because nitrogen, a component of proteins, nucleic acids, hormones and chlorophyll, enhances and accelerates the productivity of vegetal cultures (Silva *et al.*, 2008). Nitrogen fertilization, therefore, influences support capacity and pasture quality Pearl millet (*Pennisetum glaucum* (L.) R. Brown) is a plant originated in the south of the Sahara and used for the production of grains and forage in regions with highly severe climatic conditions in Asia and sub-Saharan Africa (Sharma *et al.*, 2014); it is one of the alternatives for the recovery of pastureland and its integration with agriculture. The Brazilian Enterprise for Agriculture and Livestock Research-Embrapa, (2014) attributes increase in millet crop in the Brazilian savannah regions to its great capacity of soil coverage in non-tillage system and its use as forage. Producers have currently a wide variety of cultivars available on the market since government-run and private enterprises have developed cultivars aimed especially to meet the demands of determined regions or specific uses. Cultivar ADR 500, launched in 2003 by two firms Sementes Adriana and Bonamigo Melhoramento, was developed for the production of forage characterized by a late cycle and excellent shoots and do not develop at temperatures below 10ºC. Further, cultivar BRS 1501, launched by EMBRAPA/CNPMS in 1999 as a two-aim cultivar, is an open pollinated variety, derived by improved genetic selection of an American population, and characterized by a medium cycle and good shoot capacity, recommended for the Mid-Western, South-Eastern and Southern regions of Brazil (Embrapa, 2014). The plant´s height is one of the aspects that should be taken into account when assessing a forage plant. The above observation is highly important due to the dry matter production curve of tropical grass. As the plant grows, the production and the production rate of its dry matter

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increase while the nutritional rate decreases, coupled to increase in fiber rates and decrease in total digestible nutrients.

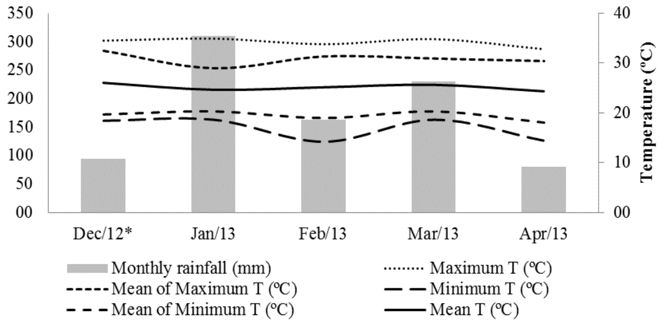
Current assay evaluates the production capacity and chemical composition of two millet cultivars under three pre-cut heights and with four N (urea) doses.

MATERIALS AND METHODS

Field assay was conducted in the Veterinary and Animal Science School of the Federal University of Goiás, Campus II, Goiânia GO Brazil, 16º35' S and 49º16' W, at an altitude of 727 m. Regional climate is Aw, or rather, hot and semi-humid, with a dry season between May and October and a humid season between November and April, with mean annual temperature 23.2ºC (Brasil, 1992). Temperature and rainfall data during the experimental period between 21/12/2012 and 29/04/2013 are given in Figure 1. The soil of the experimental area is a dystrophic oxisol composed of 35% clay, 46% sand and 19% silt, with the following chemical properties: pH ($CaCl_2$) 5.9; cation exchange capacity (CEC) 7.5 cmolc dm^{-3}; saturation per bases 62.5%; phosphorus (Mehlich) 3.8 mg dm^{-3}; potassium 69.0 mg dm^{-3}; calcium 3.4 cmolc dm^{-3}; magnesium 1.1 cmolc dm^{-3}; aluminum 0.0 cmolc dm^{-3} and 1.8% organic matter. Treatments for each millet cultivar (*Pennisetum glaucum*) (ADR 500 and BRS 1501) comprised four doses of nitrogen (urea) (0; 45; 90 and 180 kg ha^{-1}) and three pre-cut heights (0.70; 0.80; 0.90 m). Seeding occurred on the 21st December 2012 when 60 kg ha^{-1} P_2O_5 (simple phosphate), 50 kg ha^{-1} micronutrients (FTE Br 12) and 50 kg ha^{-1} K_2O (KCl) were applied, following the recommendations from Sousa *et al*. (2007) and Vilela *et al.* (2007). Nitrogen doses were applied once, at 15 days after the emergence of seedlings. Evaluation split-plots comprised 5 rows of five meters each, spacing 0.30 m and totaling 6.0 m^2 (5.00 x 1.20). Seeding was made by hand at a density of 20 pure viable seeds per linear meter for a population of 666,600 plants ha^{-1}. Evaluation cuts were performed when split-plots reached mean evaluation heights (0.70; 0.80; 0.90 m). When the split-plot reached the desired height, pasture was cut, leaving a 0.20 m high residue. The borders of the split-plots (0.50 m at each end and at the two external rows) were not counted. The evaluated area was made up of four linear meters of the three central rows, with an evaluation area of 2.40 m^2. After the cuts, all material was harvested and weighed to evaluate the production of green matter per area. One part was selected and taken to the laboratory for analysis. Dry matter (DM) was chemically analyzed at the laboratory of forage of Campus II of PUC Goiás. Samples were weighed and pre-dried in forced-air buffer (65ºC) for 72 hours. After pre-drying, the samples were ground in a Thomas-Willey mill, sieve 1.0 mm, and stored in plastic pots for future chemical analysis. Chemical analyses were performed by drying the material in a forced air buffer at 65º C, followed by muffle at 105º C, and dry matter rates were determined by weight difference. Crude protein (CP) was calculated by micro Kjeldhal method (AOAC, 1990) and neutral detergent fiber (NDF) and acid detergent fiber (ADF), hemicellulose, cellulose and lignin were calculated by the sequential method (Robertson and Van Soest, 1981). Ether extract (EE) was determined in a Goldfisch apparatus with support for glass cartridges and collecting tubes (Soxhlet) (Silva and Queiroz, 2002). Total carbohydrates (tCHO) were determined according to Sniffen *et al*. (1992):

$$tCHO = 100 - (\%CP + \%EE + \%Ashes)$$

Production potential was calculated by the extrapolation of DM productivity in the useful area of the split-plot (2.40 m^2) for one hectare. Experimental design comprised randomized blocks in a 3 x 4 factorial arrangement (3 cut heights x 4 N doses) with three replications (blocks) with two cultivars. Data underwent analysis of variance and means were compared by Tukey´s test at 5% (0.050) probability. Effect of N doses and heights on the production of dry matter was evaluated by regression. Statistical analyses were done by statistical software R (R Development Core Team, 2012).



*Data for December 2012 refer only to the period 21/12/2012 - 31/12/2012.
Source: Evaporimetric Station of the Agronomy School - UFG.

Figure 1. Temperature and rainfall during the experimental period

RESULTS

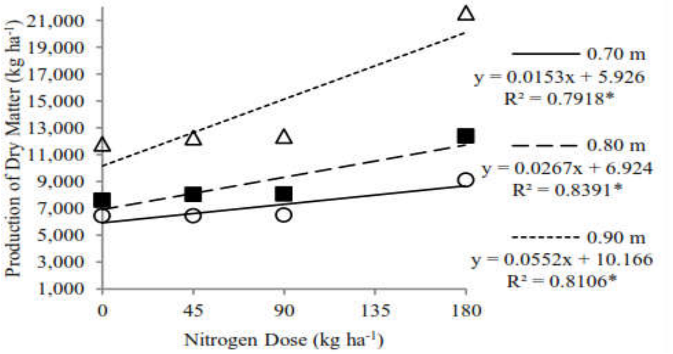
Production

Although different amounts of cuts were possible in the cultivars (Table 1), this was due to the number of sprouts, since mean time between cuts within the heights under analysis was not different between cultivars or between N doses. The first cut occurred after 35, 38 and 49 days after seeding (DAS) in plants with a pre-cut height of 0.70 m, 0.80 m and 0.90 m, respectively. For other cuts, mean time between cuts amounted to 16.2 days for 0.70 m; 19.0 days for 0.80 m and 27.3 days for 0.90 m.

Table 1. Number of cuts in each cultivar due to N doses and pre-cut heights

Height	N dose (kg ha^{-1})			
	0	45	90	180
	ADR 500			
0.70	3	3	3	4
0.80	3	3	3	4
0.90	3	3	3	4
	BRS 1501			
0.70	3	3	3	3
0.80	3	3	3	3
0.90	3	3	3	3

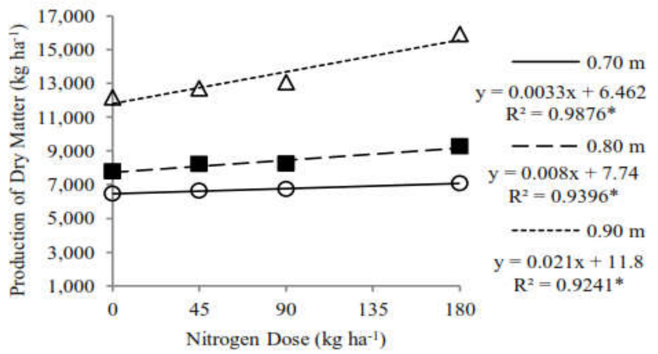
Figure 2 shows the production of dry matter of cultivar ADR 500 according to N doses and pre-cut heights. DM production increased (P<0.05) due to N dose and cut height, which was expected. Cultivar ADR 500 revealed differences (P<0.05) in DM production between evaluated heights in all N doses.



*Significant at 5% probability by Test t

Figure 2. Production of dry matter of cultivar ADR 500 as a function of N dose and pre-cut height

Differences were due not only to height of plant but to DM rates which averaged 109.9 g kg^{-1} as fed (0.70 m); 129.4 g kg^{-1} as fed (0.80 m) and 196.3 g kg^{-1} as fed (0.90 m). Four cuts were undertaken when the cultivar was fertilized with 180 kg N ha^{-1} and thus contributed towards the great production difference of this dose compared to the others. Figure 3 registers the production of dry matter of cultivar BRS 1501 as a function of N doses and pre-cut heights.



*Significant at 5% probability by Test t

Figure 3. Production of dry matter of cultivar BRS 1501 as a function of N dose and pre-cut height

Effects of pre-cuts in the cultivar were greater at dose 180 kg N ha^{-1}. The difference in DM production with the above N dose and between heights 0.80 m and 0.70 m reached 7.4%, whereas difference between 0.90 m and 0.80 m was 12.9%. Difference was 19.3% when heights 0.90 m and 0.70 m were compared. Response to nitrogen fertilization was slight for plants with pre-cuts at 0.70 and 0.80 m. Productivity difference between dose 180 kg N ha^{-1} and control for plants at a cut height of 0.70 m was 8.6%; difference was 16.1% for plants with pre-cut height at 0.80 m. Plants with pre-cut height 0.90 m had a greater response to N and the difference in productivity between the plot fertilized with 180 kg N ha^{-1} and that without any fertilization was 23.6%.

Chemical composition

DM rates were affected (P<0.05) by pre-cut heights but not by N doses (P>0.05). Ash (mean 73.3 g kg^{-1} of dry matter) and organic matter (926.7 g kg^{-1} of dry matter) rates were not influenced by treatments. Significant interaction (P<0.05) occurred between N doses and pre-cut heights for crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) rates (Tables 2 and 3). Both cultivars at all treatments had CP rates above the minimum limit of 70.0 g kg^{-1} of DM predicted by Van Soest (1994), which would be restricting for the development of rumen microorganisms. Cultivars fertilized with 180 kg N ha^{-1} demonstrated Higher CP rates when N doses were compared. Total carbohydrate rates did not change because of cut height but were affected by N doses, with lower rates in split-plots fertilized with 180 kg N ha^{-1}. Total carbohydrate average in these plots was 691.6 g kg^{-1} of DM. In the other N doses, the tCHO rate in DM percentage was 792.0 g kg^{-1} of DM, without any difference between doses and pre-cut heights.

Table 2. Mean chemical compositions in pearl millet cultivar ADR 500 for N doses in three pre-cut heights

Nutrient	Height (m)	N dose (kg ha^{-1})			
		0	45	90	180
CP	0.70	120.4 Ba	122.0 Ba	140.3 Aa	166.7 Aa
(g kg^{-1} DM)	0.80	136.3 Aa	131.6 Aa	129.3 Aa	147.4 Aa
SEM* = 3.39	0.90	128.6 Aa	136.8 Aa	139.8 Aa	159.3 Aa
NDF	0.70	792.5 Aa	746.8 Bb	788.9 Aa	831.9 Aa
(g kg^{-1} DM)	0.80	752.2 ABb	736.5 Bb	785.5 Aa	714.4 Bb
SEM = 23.89	0.90	690.5 Bc	779.5 Aa	820.3 Aa	786.0 Aa
ADF	0.70	348.4 Aa	379.3 Aa	386.6 Aa	380.6 Aa
(g kg^{-1} DM)	0.80	353.4 Aa	329.6 Aa	390.6 Aa	321.3 Ba
SEM = 10.82	0.90	328.6 Aa	359.2 Aa	382.6 Aa	373.9 Aa
Lignin	0.70	47.1	50.6	49.7	42.8
(g kg^{-1} DM)	0.80	35.5	41.5	71.5	73.7
SEM = 19.67	0.90	40.4	37.1	77.9	50.1

Means for the same nutrient and cultivar, followed by the same capital letters on the same line and small letter in the same column do not differ according to Tukey´s test at 5% probability.
*SEM = Standard error of the mean.

Table 3. Mean chemical compositions in pearl millet cultivar BRS 1501 for N doses in three pre-cut heights

Nutrient	Height (m)	N dose (kg ha^{-1})			
		0	45	90	180
CP	0.70	106.3 Ca	112.3 Ca	136.9 Ba	172.4 Aa
(g kg^{-1} DM)	0.80	107.3 Ba	104.2 Ba	97.0 Bb	156.2 Ab
SEM = 14.74	0.90	98.0 Ba	98.8 Ba	129.9 Aa	154.3 Ab
NDF	0.70	751.1 ABa	807.4 Aa	744.2 ABa	710.3 Ba
(g kg^{-1} DM)	0.80	766.1 Aa	715.4 Bb	784.8 Aa	690.8 Ba
SEM = 24.33	0.90	726.9 Bb	766.6 Aa	748.1 Aa	718.7 Ba
ADF	0.70	309.2 Aa	359.1 Aa	328.6 Ba	326.3 Aba
(g kg^{-1} DM)	0.80	327.4 Aa	273.8 Aa	346.6 ABa	325.4 Aba
SEM = 19.22	0.90	278.6 Aa	337.2 Aa	320.6 Ba	334.7 Aba
Lignin	0.70	52.4	55.4	73.1	42.8
(g kg^{-1} DM)	0.80	53.0	45.6	59.4	35.5
SEM = 25.46	0.90	42.6	54.3	52.9	42.3

Means for the same nutrient and cultivar, followed by the same capital letters on the same line and small letter in the same column do not differ according to Tukey´s test at 5% probability. *SEM = Standard error of the mean.

DISCUSSION

Production

According to Silva *et al.* (2008), when the basic needs of all nutrients are supplied, nitrogen determines the velocity of growth and forage production. Nitrogen fertilization, the main component of proteins, nucleic acids, hormones and chlorophyll and influences leaf length and shoot rates and enhances the formation of axillar buds (Silva *et al.*, 2008). Rates in current study are higher than those reported by Silva *et al.* (2012) who evaluated ADR 500 under N doses and reached maximum production with 1,143 Mg MS ha^{-1}, (160 kg N ha^{-1}) after the three cuts. The great difference in production between the two studies may have occurred due to the fact that in Silva *et al.* (2012) the first cut occurred after 31 days of emergence and the second and third after 14 days of re-sprout, with height of residue at 0.30 m in all cuts. Contrastingly, the residue height in current analysis was 0.20 m. Linear regression equations showed a great response capacity of the cultivar to nitrogen fertilization. Linear responses of cultivar BRS-1501 were also reported by Silva *et al.* (2012) who assessed doses 0; 40; 80 and 160 kg N ha^{-1}. Cultivars ADR 500 and BRS 1501 had a similar production at all heights till dose 90 kg N ha^{-1}, but total highest production occurred with dose 180 kg N ha^{-1}. The above was due to the fact that ADR 500 provided four cuts, at all heights, when fertilized with 180 kg N ha^{-1}, whereas cultivar BRS 1501 had only three cuts in all treatments. Average production of the two cultivars, per cut, at 180 kg N ha^{-1} at heights 0.70; 0.80 and 0.90 m were respectively 2,280; 3,090 and 5,390 kg ha^{-1} for ADR-500 and 2,360; 3,090 and 5,310 kg ha^{-1} for BRS-1501, respectively. The evaluation of production response of millet to nitrogen fertilization (0; 71.43; 107.14; 142.83 or 178.57 kg N ha^{-1}) (ammonium nitrate) and post-cut heights (0.10 or 0.20 m residue) by Shain *et al.* (2013) showed that dose 107.14 kg N ha^{-1} and height 0.10 m of residue enhanced a greater shoot rate after the first two cuts. Authors also reports that the combination of 178.57 kg N ha^{-1} with 0.10 m of the residue enhanced the greatest shoot rates after the third cut. The greatest production of green matter was reached at a combination of 178.57 kg N ha^{-1} with 0.10 m residue (71,600 kg ha^{-1}, at a 35.3% rate of DM), whereas the greatest production of DM occurred in a combination of 178.57 kg N ha^{-1} and 0.20 m residue (25,700 kg ha^{-1}, with a 43.8% DM rate). The authors reported that lowest productions of green and dry matter occurred respectively in the split-plot without any fertilization, with a 0.10 m cut (23,100 kg ha^{-1}, with a 40.6% DM rate) and in the split-plot without any fertilization at 0.20 m (8,600 kg ha^{-1}, with a 36.9% DM rate). Although the above DM rates were higher than those usually verified in other experiments, the authors did not specify the criterion used for plant harvesting but only harvests of plants at different heights, ranging between 0.64 m and 1.43 m.

Results in current analysis were higher than those by Guideli *et al.* (2000), who reported DM productions of 6,995 kg ha^{-1} with 225 kg N ha^{-1} for cultivar Comum and 6,177 kg ha^{-1} for CMS 02. Productions assessed in current analysis were corroborated by Leão *et al.*(2012) who evaluated pre-cut heights (0.60; 0.80 and 1.00 m) with DM production respectively at 31,050; 36,864 and 46,482 kg ha^{-1}, in four cuts with 45 kg N ha^{-1} (15 kg after each of the first three cuts). In their evaluation of 16 millet cultivars in northwestern India, Blümmel *et al.* (2007) reported an average productivity of DM of 3,040 kg ha^{-1} in a single cut, with maximum productivity reached by hybrid ICMH 451 (3,760 kg ha^{-1}). However, cuts occurred after the grain harvest when the plants had more than 50% dry matter rates. Blümmel *et al.* (2007) took as average the productivity between systems with high technical level (65 kg N ha^{-1} and density 11 plants m^{-2}) and systems with low technical levels (21 kg N ha^{-1} and density 5 plants m^{-2}). In current study, the lowest mean productivity of cultivar BRS 1501 per cut reached 2,160 kg ha^{-1} (0 N; 0.70 m) with 10.99% of DM, with a density of 66.6 plants m^{-2}. The above demonstrated the easy adaptation of millet in the Brazilian Savannah plus improvement and selection of cultivars of the Brazilian research institutes. Studies by Queiroz *et al.* (2012) evaluated the productivity of cultivar BRS 1501 seeded on different months (February, March, April, August and September) and revealed mean productivity of DM at 3, 545 kg ha^{-1}.

Chemical composition

Millet cultivated under water stress and at N doses (0; 75; 150 and 225 kg N ha^{-1}) was assessed by Rostamza *et al.* (2011) and DM rates reached respectively 225.0; 220.0; 214.1 and 218.6 g kg^{-1} as fed. Height of residue (post-cut height) (0.20 and 0.25 m) and N doses (0; 50; 100 and 150 kg N ha^{-1}) were evaluated by Silva *et al.* (2012). DM rates for post-cut heights at 0.20 m were respectively 126.4; 105.2; 116.1 and 112.0 g kg^{-1} as fed for fertilized plots 0; 50; 100 and 150 kg N ha^{-1}. In the case of split-plots with post-cut at 0.25 m, the rates of DM were 126.8; 114.4; 106.7 and 111.9 g kg^{-1} as fed for the split-plots fertilized respectively with 0; 50; 100 and 150 kg N ha^{-1}. When cultivars ADR 7010, ADR 500 and BRS 1501 harvested at height 0.70 m were evaluated, Buso *et al.* (2014) reported dry matter rates between 89.0 and 111.4 g kg^{-1} as fed. Similar results were registered by Silva *et al.* (2012) in their analysis of millet cut after 31 days after emergence (height not given), with residue height 0.20 and 0.25 m. DM rates were 11.49% for 0.20 m residue; 12.68% for 0.25 m residue without fertilization; 11.10% for 0.25 m residue for nitrogen fertilization. In the case of millet harvested at a height of 1.65 m and 54 days, Brunette *et al.* (2014) reported a 30% DM rate. Bortolassi *et al.* (2000) harvested millet prior to panicle emission (height and age of plant not given) and registered a 21.88% DM rate. Very low DM rates jeopardize intake by ruminants since feed becomes coarse and requires diet supplementation with concentrated feed. According to the National Research Council (NRC, 2000), a male beef bull, weighing 400 kg, would ingest between 8.8 and 10.4 kg DM day^{-1}. For a pasture with 109.9 g DM kg^{-1}, the animals should consume between 80.07 (20.0% Live Weight) and 94.63 (23.6% LW) kg of natural matter per day; if DM rate of feed is 129.4 g kg^{-1}, intake should be between 68.01 (17.0% LW) and 80.37 (20.1% LW) kg of natural matter day^{-1}. Beef bulls do not reach these intake levels of natural matter. Otherwise, the intake required for the animal, in a pasture with 196.3 g DM kg^{-1} varies between 44.85 (11.2% LW) and 53.01 (13.2% LW) kg natural matter day^{-1}. In their evaluation of millet, Mombaça (*Pannicum maximum*) and Brachiaria (*Brachiaria decumbens*) grass, Braz *et al.* (2004) reported that millet was the grass with the highest accumulation of nutrients in the leaf limbus and that with maximum amounts of nutrient accumulation in the least time. Brunette *et al.* (2014) reported 121.0 g kg^{-1} ash rates, whereas Bortolassi *et al*. (2000) registered 58.2 g kg^{-1} for millet harvested at a height of 1.65 m after 54 days. On the other hand, ether extract (EE) was not affected by N doses or by cut heights, with a mean rate of 34.7 g kg^{-1} of dry matter. In the case of millet harvested at a height of 1.65 m and at 54 days of age, Brunette *et al*. (2014) registered a 20.0 g kg^{-1} EE rate. When millet (ADR 300 and ADR 7010) was harvested at 64 days old to produce silage, Pinho *et al*. (2014) reached average EE rates of 25.5 g kg^{-1} (without fertilization); 26.1 g kg^{-1} (20 kg N ha^{-1}); 26.0 g kg^{-1} (40 kg N ha^{-1}); 25.5 g kg^{-1} (60 kg N ha^{-1}) and 25.6 g kg^{-1} (80 kg N ha^{-1}). Tritan *et al*. (2013) found an average rate of 22.1 g kg^{-1} EE for millet harvested at 60 and 90 days of age, whereas EE was rated at 15.7 g kg^{-1} by Bortolassi *et al*. (2000).

According to Detmann *et al*. (2006), although with low concentrations in forage plants, EE has a central position in estimates of energy rates due to its high calorie concentration. Nitrogen fertilization not only enhanced greater productions but raised CP rates of foragers C_4 (Martha-Júnior *et al*., 2007). Data are corroborated by Buso *et al*. (2014), with millet fertilized with 50; 100; and 200 kg N ha^{-1} providing higher protein rate (mean 221.0 g kg^{-1}) than millet without any fertilization (203.0 g kg^{-1}); and by Silva *et al*. (2012) who evaluated N doses 0; 50; 100 and 150 kg N ha^{-1} in three cuts and two residue heights (0.20 and 0.25 m). Protein rates increased with N dose in all cuts and for residue heights. Brunette *et al*. (2014) evaluated millet cut after 54 days at a height of 1.65 m and reported 128.0 g CP kg^{-1} for common millet and 134.0 g CP kg^{-1} for a cultivar with high rates of soluble carbohydrates. In the case of cultivars ADR 500, LAB 1542 and LAB 1838, Leão *et al*. (2012) verified mean CP rates ranging between 175.5 g kg^{-1} (plants with 0.60 m pre-cut height on the first cut) and up to 83.8 g kg^{-1} for plants with 1.00 m height on the fourth cut. Protein rates verified in current research are between 97.0 g kg^{-1} (BRS 1501 at 0.80 m fertilized with 90 kg N ha^{-1}) and 166.7 g kg^{-1} (ADR 500 at 0.70 m fertilized with 180 kg N ha^{-1}). Four cuts were conducted on cultivar ADR-500 in treatments with 180 kg N ha^{-1} and three cuts in the other treatments, whereas BRS 1501 received three cuts in all treatments (Table 1). Studies by Silva *et al*. (2012) with three cuts and by Leão *et al*. (2012) with four cuts showed that NDF, ADF and lignin rates increased with successive cuts. Leão *et al*. (2012) demonstrated that NDF rate of cultivar ADR 500 reached 666.5 g kg^{-1} on the first cut and 721.6 g kg^{-1} on the fourth one. High NDF rates in cultivars set in the conditions of current analysis indicate that they may be a restricting factor in the animals´ voluntary intake. According to Mertens (1993), NDF concentration in the plant is associated to the thickness of the cell wall and to low fragility to mechanical rupture and to higher resistance to microbial penetration, which reduces surface area for microbial attack. Mertens (1994) states that cattle can intake approximately 1.2% NDF of their body weight (BW); limits due to physical mechanisms occur above this amount. However, Costa *et al*. (2011) evaluated Nellore calves on millet pasture and reported intakes of 1.57 and 1.80% of NDF relation to live weight for calves when plants were respectively in the vegetal and reproduction stages. Montagner *et al*. (2011) registered 1.37% NDF intake of BW in Charolês and Charolês x Nelore calves, average age 15 months and mean weight of 230 kg. ADF rates ranged between 273.8 g kg^{-1} (BRS 1501 with 45 kg N ha^{-1} and 0.80 cm) and 390.6 g kg^{-1} (ADR 500 with 90 kg N ha^{-1} and 0.80 m). Mean lignin rate was 51.5 g kg^{-1} and ranged between 35.5 g kg^{-1} (ADR 500 with no nitrogen and 0.80 cm and BRS 1501 with 180 kg N ha^{-1} and 0.80 cm) and 77.9 g kg^{-1} (ADR 500 with 90 kg N ha^{-1} and 0.90 m), without influence by N doses or pre-cut heights. Leão *et al*. (2012) reported that mean ADF rate of cultivar ADR 500 was 387.9 g kg^{-1} for pre-cut height of 0.60 m, 396.7 g kg^{-1} for 0.80 m and 427.3 g kg^{-1} for 1.00 m. ADF and lignin rates in current analysis are very close to rates assessed by other authors. Brunette *et al*. (2014) registered 377.0 g kg^{-1} of ADF and 25.0 g kg^{-1} lignin for millet harvested at a height of 1.65 m and 54 days old. In the case of cultivars ADR 500, LAB 1542 and LAB 1838 evaluated by Leão *et al*. (2012) the lowest ADF rate was 388.4 g kg^{-1} (LAB 1542, first cut) and the highest was 430.7 g kg^{-1} (LAB 1838, fourth cut). In the case of cultivar ADR 300, Silva *et al*. (2012) reported rates varying between 257.1 g kg^{-1} (first cut; fertilized with 150 kg N ha^{-1} and 0.20 m residue) and 423.1 g kg^{-1} (third cut, fertilized with 50 kg N ha^{-1} and 0.20 m residue). Millet cut at heights 0.70 and 0.80 m evidences low rates of dry matter and jeopardizes DM intake by animals. On the other hand, a 0.90 m cut is the best for the parameter. Cultivars presents high rates of total carbohydrates and ether extract which indicates the forager´s high energy density. It consequently counterbalances the negative effects of high NDF rates. Nitrogen fertilization increases the millet´s protein rate and enhances the productivity of cultivars, especially when managed at a height of 0.90 m.

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