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Production and composition of anatomical fractions of four sorghum hybrids under nitrogen dosages

Potencial produtivo e composição das frações anatômicas de quatro híbridos de sorgo sob doses de nitrogênio

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SUMMARY

The objective of this study was to evaluate the production and composition of anatomical fractions of four forage sorghum hybrids under three N (nitrogen) dosages. The experimental design was in randomized blocks in a factorial scheme 4x3 (four sorghum hybrids and three N dosages). The sorghum hybrids were the following: 1F 305, 0369 267, 0369 255 and BR 700, and N dosages were 0, 60 and 120 kg/ha. It was determined the NMP (natural matter production), DM (dry matter contents), DMP (dry matter production), TDMP (total dry matter production), regrowth percentage and composition of the anatomical fractions of the plants. In the first and second cuts the N dosage of 120 kg/ha had greatest NMP and DMP. DM contents were influenced by both hybrids and N dosages in the first cut, but not in the second one. The hybrid 0369 255 and N dosage of 120kg/ha had the highest TDMP. The hybrid 1F 305 differed from the others in relation to the proportion of leaves in the first cut. In the second cut the hybrids 1F 305 and BR 700 had the highest proportion of leaves. In both cuts, the N dosage of 120kg/ha had the highest proportion of leaves. Overall, the hybrid 0369 255 fertilized with 120kg/ha of N is the best combination for obtaining high yields of forage-type sorghum.

Keywords: cut, dry matter, leaves, panicles, regrowth, stems

RESUMO

Objetivou-se nesse trabalho avaliar a produção e composição das frações anatômicas de quatro híbridos de sorgo sob doses de nitrogênio (N). O delineamento experimental foi em blocos ao acaso em esquema fatorial 4x3 (quatro híbridos de sorgo e três doses de N). Os híbridos de sorgo testados oram os seguintes: 1F 305, 0369 267, 0369 255 e BR 700, enquanto que as doses de N foram 0, 60 e 120kg/ha. Foram determinadas a produção de matéria natural (PMN), teor de matéria seca (MS), produção de matéria seca (PMS), produção total de matéria seca (PTMS), porcentagem de rebrota e composição das frações da planta (folhas, colmo e panículas). No primeiro e segundo cortes a PMN e PMS foram maiores na dose de 120kg/ha de N. O teor de MS foi influenciado tanto pelos híbridos quanto pelas doses de N apenas no primeiro corte, mas não no segundo. O híbrido 0369 255 e a dose de 120 kg/ha de N apresentaram maiores rendimentos de PTMS. O híbrido 1F 305 diferiu dos demais em relação à proporção de folhas no primeiro corte, enquanto que no segundo, os híbridos 1F 305 e BR 700 apresentaram maior porcentagem de folhas em relação aos demais. Obteve-se maior proporção de folhas na dose de 120kg/ha de N nos dois cortes. A utilização do híbrido 0369 255 adubado com 120kg/ha de N é a melhor recomendação para obtenção de altos rendimentos de sorgo forrageiro.

Palavras-chave: colmo, corte, folhas, matéria seca, panículas, rebrota.

INTRODUCTION

The availability of forage is not continuous along the year in Brazil because of the climatic conditions, which alternate periods of excess and shortage of rainfall. Therefore, to maintain high animal performance, it is necessary to preserve the surplus of forage produced in the rain season to be utilized during the dry season.

According to Neumann et al. (2002), *Sorghum bicolor* (L.) (Moench) shows good adaptation for silage making due to its high yield (DM/ha), easy drilling and crop management, harvest and preservation in the silo, and also because of its high nutritive value, especially the high concentration of soluble carbohydrates that are essential for appropriate anaerobic fermentation.

Demarchi et al. (1995) reported that high nutritive value sorghum silage depends on the balance between the anatomical composition of the fractions of the plant (stems, leaves and panicles) and the yield. According to these authors, increases in the proportion of panicles occur towards the maturation stage of the plant, being this fraction the major responsible for increases in DM content of sorghum plants. Later on, Silva et al. (1999) reported that it is necessary at least 40% of panicles in the sorghum plant in order to obtain high quality silage. However, the large genetic variability of varieties and hybrids of forage-type sorghum that have been currently cultivated is the main factor for the broad range of the anatomical composition of the sorghum plant, which then interferes in the final quality of the silage (GOURLEY & LUSK, 1997).

Some authors have studied the adequate amount of fertilizer for each sorghum genotype according to the environmental conditions where they have been cultivated. Neumann et al. (2003) determined the production of four sorghum hybrids with the application of 300 kg/ha of the formula 10-18-20 (N-P-K) at drilling, plus 80 kg/ha of N after 40 days of emergence of the seedlings. These authors reported 31.4 to 59.7 t/ha of NMP and 10.4 to 19.4 t/ha of DMP. On the other hand, when evaluating eight sorghum hybrids and lower quantity of N fertilization after emergence of seedlings (60 kg/ha), Pedreira et al. (2003) reported 5.1 to 7.1 t/ha of DMP and variation in DM content from 34.4 to 39.1%.

The effects of N fertilization in annual summer grasses have been much more studied than other nutrients, since N is considered the nutrient that definitely brings most responses in increasing yields. Thus, the objective of this study was to evaluate the production and composition of anatomical fractions (stems, leaves and panicles) of four forage sorghum hybrids under three levels of N fertilization.

MATERIAL AND METHODS

The experiment occurred from November/22nd/2003 until June/05th/2004 on the fields of the Department of Animal Production of the School of Veterinary of the Federal University of Goiás, Campus II, Goiânia - GO, located in the latitude S 16º36' and longitude W 49º16', and altitude of 727m.

According to Köppen's classification, the climate of this area is Aw (hot and semi-humid, with a dry season that lasts from May to October). The average temperature is 23.2ºC, with minimum average of 17.9ºC and annual rainfall of 1,759 mm (BRASIL, 1992).

The experimental plot was ploughed once and disked twice for tilling purposes. The soil is classified as Red distrophic Latossol and, in order to know its chemical characterization, soil samples were collected in the depth of 0.20 m. Data of chemical attributes of the soil before the beginning of the experiment are presented in Table 1.

Table 1. Chemical attributes of the experimental soil

Ca	Mg	K	Al	H	P(Mel)	K	pH	V	O.M.
		$cmol_c/dm^3$			mg/dm^3		$CaCl_2$	%	g/kg
2.7	0.9	0.13	0	1.9	17.5	51	5.6	66.1	39

Manual sowing occurred in November/22nd/2003, aiming 20 seeds/linear meter. The replicates were constituted by four rows of five linear meters each, 0.60m apart from each other, totaling $12m^2$/replicate, and for evaluation purposes only the two central rows were used, disregarding the two external ones and also half meter of the extremities of the central rows.

Nitrogen and potash fertilization were divided in two times; the first application with half of the dosage of both nutrients happened in December/24th/2003 and the second one with the remaining half of the dosage in January/05th/2004. Treatments were constituted by three N dosages (0, 60 and 120kg/ha in the form of ammonium sulfate) and four sorghum hybrids: BR 700, 1F 305, 0369 267 and 0369 255, (all tall, dry stems and tannin-free). All hybrids are forage-type, and the last two ones are still experimental genotypes supplied by EMBRAPA-CNPS, located in Sete Lagoas – MG.

The following parameters were evaluated: NMP (natural matter production), DM% (dry matter contents), DMP (dry matter production), TDMP (total dry matter production), regrowth% (expressed as the percentage of the yield from the first cut) and finally the anatomical composition of the fractions of the plants (stems, leaves and panicles).

The first cut was in March/13th/2004. By that time the plants had completed 112 days of vegetative growth, occasion when the grains were at pasty stage and tending for farinaceous. Stage of maturation of the grains was evaluated in the medium part of the panicle. Plants were cut ten centimeters above the soil, immediately weighed and then a sample from each replicate was shredded, manually homogenized and frozen at -10ºC for further DM analysis.

The second cut (also done by hand) happened in June/05th/2004 when the grains were also at pasty stage and tending for farinaceous, after 84 days of the first cut. The same methodology was adopted likewise the first cut.

During the first and second cuts, five plants were randomly chosen to quantify the anatomical fractions of the plants (stems, leaves and panicles) and these values are expressed in Table 4 as percentage of natural matter.

The experimental design was in randomized blocks in a factorial scheme 4x3 (four sorghum hybrids x three N dosages) with four replicates. The mathematical model was the following: $Y_{ijk} = m + B_i + H_j + D_k + HD_{jk} + e_{ijk}$; Y_{ijk} = observation correspondent to the replicate from block "i", with sorghum hybrid "j" and N dosage "k"; m = general mean ; B_i = effect of block "i"

(i = 1, 2, 3, 4); H_j = effect of sorghum hybrid "j" (j = 1, 2, 3, 4); D_k = effect of N dosage "k" (k = 1, 2, 3); HD_{jk} = effect of the interaction between sorghum hybrids x N dosage; and e_{ijk} = random variation.
The data were analyzed by SISVAR 4.6 software (FERREIRA, 2000) and means were compared by Tukey test at 5% of probability. The adjustment of means by regression was not done because only three N dosages were tested, thus an appropriate description of the response of N fertilization would not be provided.

RESULTS AND DISCUSSION

The means of NMP, DMP and DM% of four sorghum hybrids in the first and second cuts under three N dosages are presented in Table 2. In both cuts the N dosage of 120kg/ha had greater NMP and DMP ($P<0.05$) than 0 and 60 kg/ha of N, reassuring that this nutrient has a major response in increasing yields of cultivated crops. In the second cut, the NMP of the hybrids 1F305, 0369 267 and 0369 255 differed from BR700 ($P<0.05$), whose respective means were 28.7; 28.0; 31.3 and 19.9 t/ha. It was also observed in the first cut interaction between hybrids and N dosages of 60 and 120 kg/ha for NMP (range from 47.0 to 70.8 t/ha) and DMP (range from 11.3 to 17.6t/ha).
Still looking at Table 2, the DM contents in the first cut were influenced by both hybrids and N dosages ($P<0.05$), resulting in interaction among treatments, with variation from 21.6 to 28.2%. In the second cut, the DM contents of the hybrids 0369 267 and BR 700 differed from the others only in the dosage of 120kg/ha ($P<0.05$). Unlike what occurred in the first cut, there was no effect of N dosages over DM contents in the second cut ($P>0.05$).

Overall, NMP ranged from 36.2 to 70.8 t/ha in the first cut and 11.2 to 43.8 t/ha in the second one (Table 2), while DMP varied from 8 to 17.6 t/ha (first cut) and from 2.8 to 11 t/ha (second cut).
Some authors have previously investigated yields of different sorghum genotypes under different levels of N fertilization. Molina et al. (2000) evaluated six sorghum genotypes harvested in three different stages of maturation and reported NMP from 13.4 to 31.1 t/ha and DMP from 4.5 to 7.9 t/ha, while DM percentages varied since 26.2 to 45%. Gontijo Neto et al. (2002) obtained DMP of 18.7; 12.5; 16.2; 16.7 and 14.6 t/ha for the hybrids AG-2002, AG-2005E, AG-X202, AG-X213 and AG-X215; respectively, with N application of 70 kg/ha in the form of ammonium sulfate in two equal applications. Observing the DMP in the present study in the N dosage of 60 kg/ha (first cut), yields were in general lower than the ones reported by Gontijo Neto et al. (2002), but similar in the N dosage of 120 kg/ha. Apart from environmental conditions that surely varied from one experiment to the other, it is likely that the hybrids studied by Gontijo Neto et al. (2002) had higher DMP potential than the genotypes evaluated in the present study.
Yields of four sorghum hybrids were evaluated by Neumann et al. (2003) with the application of 180 kg/ha of urea (81 kg/ha of N). These authors observed values since 31.3 to 59.7 t/ha and 10.4 to 19.4 t/ha for NMP and DMP respectively, hence, within the range determined in this research in the first cut. On the other hand, Pedreira et al. (2003) reported DMP from 5.1 to 7.1 t/ha in eight hybrids with application of 60 kg/ha of N, much lower than the yields found in this research in the same N dosage (considering just the first cut).

Table 2. Means of NMP and DMP (t/ha) and DM contents determined in the first and second cuts of four sorghum hybrids under three N dosages

Cut	Parameters	Hybrid	N dosages (kg/ha)			Mean
			0	60	120	
First	NMP	1F 305	36.2^{C}	54.7^{abB}	62.0^{bA}	51.0
		0369 267	38.1^{C}	52.8^{abB}	62.5^{bA}	51.1
		0369 255	43.9^{C}	60.5^{aB}	70.8^{aA}	58.4
		BR 700	36.7^{B}	47.0^{bA}	47.4^{cA}	43.7
		Mean	38.7^{C}	53.7^{B}	60.7^{A}	---
	DMP	1F 305	8.0^{C}	11.8^{bB}	16.0^{bA}	12.0
		0369 267	9.4^{B}	14.1^{aA}	15.0^{bA}	12.8
		0369 255	9.6^{C}	14.2^{aB}	17.6^{aA}	13.8
		BR 700	9.4^{C}	11.3^{bB}	13.3^{cA}	11.3
		Mean	9.1^{C}	12.8^{B}	15.5^{A}	---
	DM%	1F 305	22.1^{bB}	21.6^{cB}	25.7^{bA}	23.1
		0369 267	24.7^{aAB}	26.6^{aA}	24.1^{bB}	25.1
		0369 255	21.8^{bB}	23.4^{bcAB}	25.0^{bA}	23.4
		BR 700	25.8^{aB}	24.0^{bB}	28.2^{aA}	26.0
		Mean	23.6^{B}	23.9^{B}	25.8^{A}	---
Second	NMP	1F 305	28.0	21.7	36.3^{ab}	28.7^{a}
		0369 267	17.7^{B}	28.9^{AB}	37.4^{abA}	28.0^{a}
		0369 255	26.9^{B}	23.1^{B}	43.8^{aA}	31.3^{a}
		BR 700	11.2	25.4	23.0^{b}	19.9^{b}
		Mean	20.9^{B}	24.8^{B}	35.1^{A}	---
	DMP	1F 305	6.6	5.7	8.4^{ab}	6.9
		0369 267	4.3^{B}	6.9^{AB}	10.2^{abA}	7.1
		0369 255	6.7^{B}	5.8^{B}	11.0^{aA}	7.8
		BR 700	2.8^{B}	6.9^{A}	6.3^{bAB}	5.3
		Mean	5.1^{B}	6.3^{B}	9.0^{A}	---
	DM%	1F 305	23.7	25.6	23.6^{b}	24.3
		0369 267	24.2^{B}	24.1^{B}	27.4^{aA}	25.2
		0369 255	25.2	25.4	25.2^{ab}	25.3
		BR 700	24.8	26.8	27.3^{a}	26.3
		Mean	24.5	25.5	25.9	---

Means within columns followed by different small letters and within rows followed by different capital letters differ by Tukey test (P<0.05). CV 1st cut (NMP = 8.16%; DMP = 6.59%; DM% = 4.82%); CV 2nd cut (NMP = 32.89%; DMP = 33.07%

NMP = natural matter production; DMP = dry matter production; DM% = dry matter contents

However, DM contents registered by Pedreira et al. (2003) varied from 34.4 to 39.1%, whereas in the present study the DM content in the N dosage of 60 kg/ha was 23.9%. Taking into account TDMP (sum of DMP of first and second cuts) as the basis for comparisons with the authors cited above, yields in this work were higher than the ones reported by Molina et al. (2000), Gontijo Neto et al. (2002) and Neumann et al. (2003), therefore emphasizing the importance of

sorghum regrowth capacity to increase the bulk of forage, which can be a relevant advantage in large scale feedlots, where shortage of forage is known as a limiting factor.

The DM contents found in this study ranged from 21.6 to 28.2% in the first cut and from 23.6 to 27.4% in the second one (Table 2), much lower than the findings from Molina et al. (2000), which ranged from 26.2 to 45%; Neumann et al. (2003), from 32.6 to 38.7%; Pedreira et al. (2003), from 34.4 to 39.0% and Vieira et al. (2004), from 24.8 to 38.2%. The low DM contents determined in the present study can be attributed to the low participation of panicles and high proportion of stems (Table 4). According to Zago (1992) and Silva et al. (1999), the panicle is the anatomical fraction that mostly contributes for raising DM contents when sorghum plants are in the maturation stage, whereas Carvalho et al. (1992) reported that the stem is the anatomical fraction that least contributes to raise DM content, followed by leaves, and finally panicles. Moreover, Zago (1992) determined correlations of 0.76 between percentage of panicles and DM contents, respectively. Furthermore, Zago (1992) stated that high proportions of panicles improve silage quality not only because of its better nutritive value compared to stems and leaves, but also due to increases in the DM content of the silage. Besides, Silva et al. (1999a) observed increase in crude protein content with increasing proportions of panicles, indicating that this fraction contains more crude protein than leaves + stems. Flaresso et al. (2000) highlighted that high proportions of panicles are of great importance to produce silages rich in energy.

Another relevant fact was that the DM contents determined in this research did not reach 30 to 35%, considered as ideal for adequate lactic fermentation in the silo, although Mcdonald et al. (1991) affirmed that high quality silages can be achieved even when DM content of forages are around 25%, as long as there is adequate contents of soluble carbohydrates.

The sum of NMP in the first and second cuts was 59.6; 78.5 and 95.8 t/ha corresponding to N dosages of 0; 60 and 120 kg/ha, respectively. According to Embrapa (1995), sorghum crops have the potential to reach up to 90 t/ha[1] of NMP, which only occurred in the N dosage of 120 kg/ha (95.8 t/ha, Table 2).

Regarding the sorghum's regrowth capacity, Zago (1992) described that this is a peculiar characteristic of this plant, what makes possible to reach up to 60% of the DMP from the first cut. Silva et al. (1990) reported DMP from 7.0 to 7.6 t/ha in the second cut testing the "Santa Elisa" variety, which corresponded to 51.7 and 51.8% from the production of the first cut. The DMP of the second cut in the present study ranged from 5.1 (0 kg/ha of N) to 9 t/ha (120 kg/ha of N), corresponding 57.3 to 57.9% from the first cut (Table 2), hence, similar to the findings from Silva et al. (1990).

The TDMP (sum of first and second cuts) and regrowth percentage are shown in Table 3. TDMP varied from 16.7 to 21.6 t/ha and the hybrid 0369 255 had the highest TDMP ($P<0.05$), while N dosage of 120 kg/ha had greatest TDMP than the other two dosages ($P<0.05$). It can also be noticed that regrowth percentage was not influenced by either hybrids or N dosages ($P>0.05$).

Table 3. Means of TDMP (t/ha) and regrowth capacity expressed by the percentage of the yield from the first cut of four sorghum hybrids under three N dosages

Parameters	Hybrids	N dosages (kg/ha)			Mean
		0	60	120	
TDMP	1F 305	14.6^{B}	17.6^{B}	24.5^{aA}	18.9^{bc}
	0369 267	13.7^{C}	21.0^{B}	25.3^{aA}	20.0^{ab}
	0369 255	16.3^{B}	20.0^{B}	28.6^{aA}	21.6^{a}
	BR 700	12.2^{B}	18.2^{A}	19.6^{bA}	16.7^{c}
	Mean	14.2^{C}	19.2^{B}	24.5^{A}	---
Regrowth%	1F 305	83.7^{aA}	51.2^{B}	53.1^{B}	57.5
	0369 267	45.2^{bc}	49.1	69.2	55.4
	0369 255	70.7^{abA}	41.8^{B}	61.9^{AB}	56.5
	BR 700	29.6^{cB}	60.6^{A}	47.4^{AB}	46.9
	Mean	57.3	50.7	57.9	---

Means within columns followed by different small letters and within rows followed by different capital letters differ by Tukey test (P<0.05). CV TDMP = 12.24%; CV regrowth% = 27.84%.
TDMP = total dry matter production; sum of first and second cuts.

Zago (1992) reported that the biggest advantage of sorghum over corn is that the first one maintains its root systems alive after cutting, what makes possible to reach up to 60% of DMP from the first cut as long as there are adequate conditions of humidity, temperature and fertilization. In the present experiment, the regrowth capacity varied from 29.6 to 83.7% (Table 3), indicating the feasibility to obtain high yields of these four hybrids in the second cut, especially in the N dosage of 120 kg/ha, when all hybrids were close or even slightly overcame 60% of regrowth, established as optimum by Zago (1992). However, data from the present work are in disagreement with Gontijo et al. (2008), who studied six sorghum hybrids that were cut twice and reported higher regrowths compared to this study (from 72 to 79%).

The percentage of anatomical fractions (leaves, stems and panicles) determined in the first and second cuts based on natural matter are presented in Table 4. It can be seen that both the four hybrids and N dosages did not influence the proportion of stems in the first cut (P>0.05).

The hybrid 1F 305 differed from the others in relation to the proportion of leaves in the first cut (P<0.05), while in the second cut the hybrids 1F305 and BR 700 differed from the others in the proportion of leaves (P<0.05). The N dosage of 120 kg/ha had the highest proportion of leaves in both cuts (P<0.05).

There was no difference for percentage of panicles in the first cut (P>0.05). However, there was interaction between the genotypes 1F 305 and 0369 267 and all three N dosages in the second cut.

The percentage of stems, leaves and panicles in this study do not match the results reported by Molina et al. (2000), Flaresso et al. (2000) and Gontijo Neto et al. (2002). The first authors reported 40.5 to 67% of stems, 12.1 to 21.6% of leaves and 20.9 to 40.6% of panicles in six sorghum hybrids, while the second authors studied eight sorghum hybrids with N fertilization of 120 kg/ha and obtained 31.3 to 62.2% of stems; 11.6 to 17.9% of leaves and 22.7 to 48.9% of panicles, and the last authors investigated the anatomical composition of five hybrids and obtained 29.1 to 53.4% of

stems; 16.7 to 20.9% of leaves and 29.9 to 52.4% of panicles.

The agronomic characterization of sorghum genotypes is of great importance for obtaining silages with high nutritive value. The genetic variability of sorghum hybrids currently available is determinant in the variation of different proportions of the anatomical fractions of the plant, which then influence the quality of the forage and hence the silage (SILVA et al., 1999).

Table 4. Means of percentages of anatomical fractions of the plants determined in natural matter basis in the first and second cuts of four sorghum hybrids under three N dosages

Cut	Parameters	Hybrid	N dosages (kg/ha)			Mean
			0	60	120	
First	Stems	1F 305	72.25	68.75	66.25	69.25
		0369 267	75.00	74.50	69.75	73.00
		0369 255	70.25	71.25	72.25	71.25
		BR 700	72.25	69.50	66.25	69.25
		Mean	72.44	71.00	68.63	---
	Leaves	1F 305	15.75^{B}	16.75^{AB}	21.00^{aA}	17.75^{a}
		0369 267	15.00	12.75	14.50^{b}	14.00^{b}
		0369 255	13.25	14.00	14.50^{b}	13.75^{b}
		BR 700	12.75	15.25	16.50^{ab}	14.75^{b}
		Mean	14.19^{B}	14.69^{AB}	16.63^{A}	---
	Panicles	1F 305	11.75	14.50	12.50	13.00
		0369 267	10.00	13.00	15.75	13.00
		0369 255	16.25	15.50	13.25	15.00
		BR 700	15.25	15.50	17.50	16.00
		Mean	13.31	14.63	14.75	---
Second	Stems	1F 305	73.00^{aA}	63.25^{B}	66.00^{abB}	67.50
		0369 267	70.25^{aA}	69.25^{A}	60.75^{bB}	66.75
		0369 255	67.75^{ab}	67.75	67.50^{a}	67.75
		BR 700	62.25^{b}	66.00	62.00^{ab}	63.50
		Mean	68.31^{A}	66.56^{AB}	64.06^{B}	--
	Leaves	1F 305	12.75^{B}	12.00^{B}	16.00^{aA}	13.50^{a}
		0369 267	12.50	12.00	13.50^{ab}	12.75^{b}
		0369 255	11.25	12.25	12.00^{b}	11.75^{b}
		BR 700	13.00^{B}	12.75^{B}	15.75^{aA}	13.75^{a}
		Mean	12.38^{B}	12.25^{B}	14.31^{A}	---
	Panicles	1F 305	14.50^{cB}	24.75^{aA}	18.00^{bB}	19.00
		0369 267	17.25b^{cB}	18.50^{bB}	25.75^{aA}	20.50
		0369 255	20.75^{ab}	20.75^{ab}	20.75^{ab}	20.50
		BR 700	24.75^{a}	21.25^{ab}	22.25^{ab}	22.75
		Mean	19.31	21.31	21.69	---

Means within columns followed by different small letters and within rows followed by different capital letters differ by Tukey test (P<0.05). CV 1st cut (stems = 7.22%; leaves = 16.63%; panicles = 35.81%); CV 2nd cut (stems = 5.01%; leaves = 11.02%; panicles = 15.1%)

According to Mcbee & Miller (1993), tall varieties of sorghum (which were the case of this experiment) tend to present high concentrations of cell wall carbohydrates due to more proportion of stems, that is why all four hybrids evaluated in this study had more proportion of stems, compared to the reports from Molina et al. (2000), Flaresso et al. (2000) and Gontijo Neto et al. (2002).

The percentage of panicles found in this work were below the bottom limit established by Silva et al. (1999), which is around 40%, in order to obtain good quality silages and favor the process of compaction in the silo. Besides the high proportion of stems registered in all hybrids of this work, another reason for the low proportion of panicles was that all four hybrids were tannin-free, thus favoring the consumption of grains by birds, a typical situation of experiments conducted in small plots.

High yields of DMP determined in this work occurred because of high regrowth capacity of the sorghum hybrids. The hybrid 0369 255 fertilized with 120 kg/ha of N is the best combination to obtain the highest yield of forage production.

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