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# Agronomic characteristics of forage sorghum cultivars for silage production in the lower middle San Francisco Valley

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**ABSTRACT.** Productive performance for silage production of five forage sorghum genotypes (BRS Ponta Negra, BRS 655, BR 601, BRS 506 and BRS 610) was evaluated through the yield of dry matter, digestible dry matter, and fresh matter, plant height, percentage of lodged and broken plants, and anatomical fractions in Brazilian semi-arid region. BRS 506 and BRS Ponta Negra varieties achieved the highest fresh forage yields (89.4 and 76.2 ton. $ha^{-1}$), and BRS 506, stood out for dry and digestible dry matter yield (25.2 and 12.1 ton. $ha^{-1}$, respectively). Regarding the participation of the plant fractions, BRS 655 and BRS 610 genotypes showed a higher percentage of panicles (50.2 and 41.0% respectively), while BRS 506 stressed out the stem participation (84.6%), and BRS Ponta Negra, the leaf participation (17.9%). Among the materials evaluated for silage production, stood out the BRS 506 and BRS Ponta Negra genotypes. The results obtained for production of dry and digestible dry matter, and the ratio of plant fractions indicates the possible use of these genotypes on silage production in the Brazilian semiarid.

**Keywords:** forage, dry matter, nutrition, ruminants, *Sorghum bicolor* (L.) Moench.

## Características agronômicas de cultivares de sorgo forrageiro para produção de silagem no Submédio do Vale do São Francisco

**RESUMO.** O objetivo deste trabalho foi avaliar a produtividade de matéria seca, matéria verde e matéria seca digestível, altura das plantas, percentual de plantas acamadas e quebradas e a participação das frações anatômicas da planta de cinco genótipos de sorgo forrageiro para a região semiárida brasileira (BRS Ponta Negra, BRS 655, BR 601, BRS 506 e BRS 610), visando à produção de silagem. As variedades BRS 506 e BRS Ponta Negra apresentaram maiores produtividades de matéria verde (89,4 e 76,2 t $ha^{-1}$). A variedade BRS 506 destacou-se pela produtividade de matéria seca e matéria seca digestível (25,2 e 15,7 t $ha^{-1}$, respectivamente). Quanto à participação das frações da planta, os genótipos BRS 655 e BRS 610 apresentaram maior percentual de panícula (50,2 e 41,0%, respectivamente), enquanto a variedade BRS 506 apresentou 84,6% de participação do colmo e a variedade BRS Ponta Negra, 17,9% de participação das folhas. Entre os materiais avaliados para produção de silagem destacaram-se as variedades BRS 506 e BRS Ponta Negra. Os resultados obtidos para produção de matéria seca e matéria seca digestível, assim como a relação das frações da planta atestam a possibilidade de utilização dos genótipos avaliados para a produção de silagem na região semiárida brasileira.

**Palavras-chave:** forragem, matéria seca, nutrição, ruminantes, *Sorghum bicolor* (L.) Moench.

## Introduction

Sorghum crop is spread all over the northeast region of Brazil, considered as one of the most important agricultural commodities for the region, occupying an area about 109.5 thousand hectares (IBGE, 2007). This forage features a potential to be used for animal feeding, given some traits indispensable in semiarid zones, such as high yield and resistance to drought (OLIVEIRA et al., 2002; PITOMBEIRA et al., 2002).

In the last eight years, planted areas in Brazilian northeast produced an average of 141.875 ton. of grains $year^{-1}$ which represents around 1.600 ton. $ha^{-1}$, whereas the national mean is 2.150 ton. $ha^{-1}$ (AGRIANUAL, 2010). This can be accounted for the following factors, local climatic particularity, technological level adopted, selection of inappropriate genotypes and regional information lacking about agronomic behavior of the genetic materials available and recommended to semiarid zones.

Sorghum plant is suited to ensiling due to its phenotypic features that can ease the plantation, management, harvest, and storage. It can also be cited its high nutritional value and soluble carbohydrate concentration, essential for good lactic fermentation, and its high yield of dry matter per unit of area (NEUMANN et al., 2002).

Agronomic characterization of genetic materials available is important to guide the selection of sorghum plants that provide high productivity and nutritional value. Neumann et al. (2002) believed that it is possible to characterize the different hybrids of sorghum for silage through the percentage participation of plant fractions and chemical composition, identifying thus a plant profile for this type of conservation process.

Several studies concluded that even the sorghum hybrids for silage production with higher proportion of panicles usually present stems reaching 50% or more of the total forage (NEUMANN et al., 2002). Thus, the efforts to balance the proportions of leaf, stem and panicle in order to provide a production of good dry matter have been the main aim of the genetic breeding programs worldwide.

Importantly, northeastern semiarid regions are characterized by some setbacks such as water shortage and unevenly distributed rainfall that imposes severe restrictions to livestock production. Taking into account these adversities and the forage lacking to meet herd demands, it emerges an urgent need for assessing new cultivars of sorghum, for silage production, adapted to semiarid conditions in the Northeastern region. This study had the goal to evaluate the agronomic characteristics of five cultivars of sorghum for silage production.

## Material and methods

The experiment was conducted at the Experimental Area of Bebedouro, belonging to Embrapa Semiarid, in Petrolina, Pernambuco State, Brazil (09º09"S and 40º22"W), located in the lower middle San Francisco Valley. The average regional rainfall is 570 mm per year, altitude of 365.5 m and annual average temperature of 33.46ºC (maximum) and 20.7ºC (minimum), respectively. Crops were established on a red-yellow sandy oxisol, with an average depth of 1.5 m, from September 2009 to December 2009.

Data of rainfall, temperature, evaporation, and relative air humidity during experimental period are listed in Table 1.

**Table 1.** Meteorological data during the experimental period

| Month/ Year | Days[1] | Rain (mm)[2] | Temperature (ºC) Max. | Min. | Means | Evaporation (mm) | RH (%)[3] | Wind (km day$^{-1}$)[4] |
|---|---|---|---|---|---|---|---|---|
| September 2009 | 00 | 0.0 | 34.4 | 20.9 | 27.1 | 9.3 | 49 | 206.1 |
| October 2009 | 12 | 105.7 | 33.7 | 22.3 | 27.0 | 8.2 | 64 | 162.4 |
| November 2009 | 00 | 0.0 | 34.8 | 22.0 | 27.4 | 9.0 | 55 | 163.5 |
| December 2009 | 07 | 49.0 | 33.7 | 23.0 | 27.4 | 7.3 | 60 | 149.8 |

[1]Rainfall occurrence in days; [2]Rainfall in millimeters; [3]Relative Humidity (%); [4]Wind average speed at 2 m height; Source: Agro meteorological station in the Experimental Area of Bebedouro, Embrapa Semiarid, Petrolina, Pernambuco State.

The experimental design consisted of randomized blocks with five treatments and five repetitions. The treatments were made up by five sorghum genotypes indicated for the northeastern semiarid region (Table 2).

**Table 2.** Agronomic characteristics of the sorghum cultivars.

| Cultivar | Type | Panicle Type | Grain Color |
|---|---|---|---|
| BRS Ponta Negra | Variety | Semi-open | Light brown |
| BRS 655 | Hybrid | Semi-open | Brown |
| BR 601 | Hybrid | Semi-open | Red |
| BRS 506 | Variety | Semi-open | White |
| BRS 610 | Hybrid | Semi-open | Red |

Experimental plots were composed of four 0.7m-spaced-rows, 5.0 m length. It was considered only the two central rows as useful area, discarding 0.5 m from each end. Twenty days after emergence it was allowed about 12 plants per linear meter for all the treatments.

The fertilization was performed according to soil analysis, which revealed the following chemical traits: pH (water): 5.60; P 4.80 mg dm$^{-3}$; K 0.58 cmol$_c$ dm$^{-3}$; Al 0.05 cmol$_c$ dm$^{-3}$; H + Al 1.98 cmol$_c$ dm$^{-3}$; Ca 1.60 cmol$_c$ dm$^{-3}$; Mg 0.75 cmolb$_c$ dm$^{-3}$; O.M. 12.03 g kg$^{-1}$; V% 59.0. By the sowing fertilization it was used 750 kg per hectare of the formula 4-20-20, with two top-dressings with 60 kg of nitrogen per hectare at 30 and 45$^{th}$ days after emergence. Irrigation was employed twice to prevent a possible influence of water stress on the treatments. Sorghum received through irrigation 267 mm of water till harvest, with 48% being supplied between the late vegetative and late reproductive phases.

The agronomic assessments were performed when the plants presented the grains in the panicles with milky/farinaceous stage, by means of the measures: plant height; fresh matter yield (ton. ha$^{-1}$); dry matter yield (ton. ha$^{-1}$); digestible dry matter yield (ton. ha$^{-1}$); number of plants ha$^{-1}$; percentages of panicle, stem, and leaf in the dry matter (DM), and percentages of lodged and broken plants. The cut was done at 5cm height above the ground. Plants of the central rows were weighed, and based on the weight of plants of each row and the respective DM content, were estimated fresh and dry matter yield. To determine the digestible dry matter yield (DDM) it was taken one sample from the useful area of each plot to determine the in vitro digestibility of dry matter (IVDDM) of the entire plant.

DDM yield was estimated by multiplying the IVDDM from each repetition by its respective DM production.

The number of broken plants was recorded and the values were converted into percentages (broken plants / total plants, in the useful area of the plot). The same procedure was applied to the lodged plants.

From each parcel it was withdrawn a representative sample with 15 whole plants, which was weighed, placed in paper bags and taken to a forced air oven at 65°C for 72h. Afterwards, the samples were left at room temperature for 1 hour and weighed to determine the pre-dried matter. In order to calculate the dry matter, the samples were ground in a mill with 1 mm-diameter-sieves according to Silva and Queiroz (2002). The IVDDM was determined using the methodology of Tilley and Terry (1963).

The percentages of panicle, stem, and leaf in the dry matter were measured by selecting, at random, five plants from each plot. Later, the panicles, stems and leaves from each plot were sorted, weighed, and ground. The representativeness of each fraction was achieved based on their dry matter.

In terms of statistical analyses, first of all, the normal distribution was checked for all variables and, secondly, the data were submitted to analysis of variance and the mean values were compared using a Tukey's test at 5% level, using PROC GLM procedure. Also, the Pearson correlation coefficient was calculated (PROC CORR). All tests were run with the aid of the software SAS (SAS, 2002).

## Results and discussion

Significant differences ($p < 0.05$) were detected for plant height (PH) and percentage of broken plants (PBP), but not to the percentage of lodged plants (PLP) and plants $ha^{-1}$ ($p > 0.05$), because it was established a population around 170 thousand plants $ha^{-1}$ for all evaluated cultivars (Table 3).

**Table 3.** Plant height (PH), percentage of lodged plants (PLP), percentage of broken plants (PBP) of sorghum cultivars studied in lower middle San Francisco Valley.

| Cultivars | PH (m) | Plants $ha^{-1}$ | PLP (%) | PBP (%) |
|---|---|---|---|---|
| BRS Ponta Negra | 2.3bc | 171.600a | 0.0a | 0.0b |
| BRS 655 | 1.9d | 178.035a | 0.6a | 1.1ab |
| BR 601 | 2.5ab | 171.957a | 4.9a | 3.4a |
| BRS 506 | 2.6a | 178.035a | 0.6a | 0.1b |
| BRS 610 | 2.1cd | 171.957a | 0.0a | 0.0b |
| Mean | 2.3 | 174.317 | 1.2 | 0.9 |
| CV (%) | 6.3 | 3.2 | 22.8 | 13.7 |

Means followed by different letters in the column are significantly different by Tukey's test ($p < 0.05$).

As for the plant height, the BRS 506 variety presented the highest value ($p < 0.05$) in relation to all cultivars, except for BR 601 hybrid, which in turn not differed from BRS Ponta Negra ($p < 0.05$).

Dalla Chieza et al. (2008) found an average of 2.1 m to the plant height when investigated sorghum hybrids for silage production for feeding feedlot steer. Similar results were observed by Neumann et al. (2003), although they had reported smaller size for dual-purpose hybrids with an average of 1.6 m height. These data are confirmed by Flaresso et al. (2000) who verified that later sorghum hybrids, like the forage, presented higher height and yield of DM than earlier hybrids, like the dual-purpose, which have lower height and DM yield.

The high incidence of lodging and breaking in forages plants, like sorghum or maize, has been one of the major obstacles for the productivity and may be related to the lignin content (MARCHÃO et al., 2006). No lodging was observed for BRS Ponta Negra and BRS 610 cultivars. The cultivars were not mutually different ($p > 0.05$) considering the percentage of lodged plants. Moreover, the best results for the percentage of broken plants were registered for BRS Ponta Negra, BRS 506 and BRS 610, which differed from the BR 601 hybrid ($p < 0.05$) that, in turn, did not diverge ($p < 0.05$) from the BRS 655 hybrid. The BR 601 genotype showed higher averages of lodging and breaking (4.9 and 3.4%, respectively). The average wind speed during the experimental period was 170.5 km $day^{-1}$, not enough to cause significant damage to the stand of analyzed genotypes. Brito et al. (2000) investigated seven sorghum genotypes (four large and three small sized) and found average values of 0.8% for the number of lodged plants. Although lodging is an undesirable feature responsible for increasing silage costs due to increased labor and losses, Von Pinho et al. (2007) concluded that the sorghum lodging is not a serious problem in normal conditions of silage production. The harvest of plants at milky/pasty stage may contribute to a low lodging degree, since according these authors, the lodging may occur with advancing maturity stage.

There was a significant effect ($p < 0.05$) of the cultivar on the yield of fresh matter, dry matter and digestible dry matter (Table 4).

**Table 4.** Yield of fresh matter (FM), dry matter (DM) and digestible dry matter (DDM) from sorghum cultivars.

| Cultivar | FM (ton. $ha^{-1}$) | DM (ton. $ha^{-1}$) | DDM (ton. $ha^{-1}$) |
|---|---|---|---|
| BRS Ponta Negra | 76.2ab | 19.7ab | 11.2b |
| BRS 655 | 48.9c | 17.1b | 9.5b |
| BR 601 | 68.0bc | 18.8b | 11.2b |
| BRS 506 | 89.4a | 25.2a | 15.7a |
| BRS 610 | 55.3c | 17.7b | 9.7b |
| Mean | 67.6 | 19.7 | 9.0 |
| CV (%) | 15.7 | 14.8 | 14.9 |

Means followed by different letters in the column are significantly different by Tukey's test ($p < 0.05$).

For the fresh matter yield (ton. $ha^{-1}$), it was observed the superiority of BRS 506 and BRS Ponta Negra in relation to BRS 655 and BRS 610 ($p < 0.05$). On the other hand, the BR 601 hybrid did not differ from the other treatments, except for the BRS 506 variety. Ferrari Jr. et al. (2005) argued that the fresh matter productivity is one of the first evaluated parameters when information on a specific cultivar is sought, being observed before the silage quality parameters, because it is important for dimensioning the silos and contribute to dilute the costs of establishing the crop, by increasing the yield.

The results obtained by this experiment for the FM yield were higher than observed by Cunha and Lima (2010), studying 29 sorghum genotypes in Rio Grande do Norte State, which detected an average of 46.7 ton. $ha^{-1}$. This study also presented higher mean values than registered by Oliveira et al. (2005), who evaluated four sorghum cultivars in central-western Brazil, and observed a mean value of 59.3 ton. $ha^{-1}$. The FM yield of the evaluated varieties was higher than the mean data of Neumann et al. (2003) that remarked an average of 41.1 ton. $ha^{-1}$, considering the assessment of four sorghum hybrids in the Central Depression of Rio Grande do Sul State, being these values close to found by Gomes et al. (2006) that achieved an average of 32.1 ton. $ha^{-1}$ with 11 sorghum cultivars in the Ceará State.

The productivity of DM varied between 25.2 and 17.1 ton. $ha^{-1}$, especially the BRS 506 variety ($p < 0.05$) in relation to the other cultivars, except for Ponta Negra BRS ($p > 0.05$). The mean value of 19.7 ton. DM $ha^{-1}$ was below the mean productivity of 25.4 ton. $ha^{-1}$ recorded by Dalla Chieza et al. (2008). Nevertheless, similar to the averages of 17.9 ton. $ha^{-1}$ and 20.3 ton. $ha^{-1}$ observed by Pedreira et al. (2005) and Silva et al. (2005), respectively. Our results were superior to the productivity values from 6.8 to 16.0 ton. $ha^{-1}$, and from 3.2 to 10.1 ton. $ha^{-1}$ found by Magalhães et al. (2010) and Skonieski et al. (2010), respectively, working with sorghum hybrids in the Central Depression of Rio Grande do Sul State.

The DDM yield is directly associated with the DM production and its digestibility. This variable is important to establish the productive potential of the genotypes, once it integrates the nutritional value with yield. Among the studied genotypes, the BRS 506 variety stood out ($p < 0.05$), regarding the digestible dry matter yield, whose value was around 15.7 ton. $ha^{-1}$. It should be noted that, even though the BRS 506 genotype had a higher percentage of stem, this variety still had a higher digestible dry matter yield, indicating its higher digestibility. Researches on the fiber quality of these genotypes are important to understand the reason why this material, even with higher percentage of stem, shows the highest production of DDM.

The highest yields of dry matter and digestible dry matter presented by the BRS 506 and BRS Ponta Negra varieties are interesting results for family farming, by enabling the production their own seeds. The use of varieties has some advantages on commercial hybrids, due to its genetic composition. According to Emygdio and Pereira (2006), three factors make the varietal cultivars excellent alternatives for family farmers, usually undercapitalized and/or low-tech, which are: a) seeds price up to five times lower than hybrid cultivars seeds; b) possibility of seed production, once unlike the hybrids, the varieties do not lose productive potential when sowed on the next harvest; and, c) the greatest plasticity of the varieties under stress conditions.

Significant differences were found between the cultivars regarding the percentage participation of stem, leaf, and panicle in the fresh and dry matter ($p < 0.05$) (Table 5).

**Table 5.** Yield of phenological components of sorghum cultivars in the fresh matter (%FM) and in the dry matter (%DM).

| Cultivars | Panicles | | Stem | | Leaf | |
|---|---|---|---|---|---|---|
| | %FM | %DM | %FM | %DM | %FM | %DM |
| BRS Ponta Negra | 15.7c | 25.5c | 71.9b | 56.6b | 12.4a | 17.9a |
| BRS 655 | 34.1a | 50.2a | 54.1d | 38.8c | 11.8a | 11.0b |
| BR 601 | 19.3c | 37.4bc | 73.5b | 55.1b | 7.2b | 7.5b |
| BRS 506 | 6.0d | 7.0d | 86.4a | 84.6a | 7.6b | 8.4b |
| BRS 610 | 26.3b | 41.0ab | 61.6c | 51.1bc | 12.1a | 7.9b |
| Mean | 20.2 | 32.2 | 69.5 | 57.2 | 10.2 | 10.6 |
| CV (%) | 14.4 | 20.7 | 4.4 | 11.5 | 16.3 | 23.6 |

Means followed by different letters in the column are significantly different by Tukey's test ($p < 0.05$).

The percentage participation of panicle in the DM of the BRS 655 hybrid was higher than the other cultivars ($p < 0.05$), otherwise the BRS 506 variety had the lowest value ($p < 0.05$). However, the inverse was observed for the percentage participation of stem, once the BRS 506 variety showed the highest value ($p < 0.05$), while the lowest value was observed for the BRS 655 hybrid ($p < 0.05$). Regarding the leaf participation in the FM, the BRS Ponta Negra, BRS 655 and BRS 610 presented 12.4, 11.8 and 12.1%, respectively, not different from each other, but significantly superior to the other treatments ($p < 0.05$). Once the BRS 506 variety had the highest height, it might be deduced a correlation between plant height and stem participation in the FM yield. According to Gomes et al. (2006), the highest hybrids showed the highest participation of stems, probably compromising their nutritional value.

Dalla Chieza et al. (2008) observed average values of 22.4, 65.8 and 11.6% for the percentage participation of panicle, stem, and leaf in the fresh matter, respectively. However, Oliveira et al. (2005) found values ranging from 2.6 to 28.4%, 63.5 to 85.7% and 11.5 to 13.5% for the participation of panicles, stem and leaf, respectively. The values found by these authors were similar to observed in the present experiment.

No significant differences were detected between BRS 655 and BRS 610 ($p > 0.05$), but they presented higher amount of panicles ($p > 0.05$) based on the DM, compared with BRS Ponta Negra and BRS 506. The BR 601 hybrid did not differ from BR 610 and BRS Ponta Negra varieties ($p > 0.05$). There were significant differences ($p > 0.05$) for the percentage of stem in the DM, among sorghum cultivars, and the BRS 506 variety had the highest value. The BRS Ponta Negra variety showed higher amount of leaves ($p < 0.05$) than the other cultivars, which were not mutually different ($p > 0.05$).

Besides the quantitative aspects, the quality of the vegetative fraction, of both sorghum and maize, can directly influence the nutritional value of produced silages. Actually, stem and leaf fractions make up 50%, on average, of the whole plant and thus the profile of the constituents of the fibrous fraction should be considered to determine the nutritional value of the plants and consequently of the produced silages. As a result, the genetic improvement programs of these fractions should be targeted to obtain high-quality final products, providing a better bioeconomic performance of the ruminant production systems.

Our findings for the percentage of panicle, stem and leaf in the DM were close to those of Gomes et al. (2006) achieving averages of 37.0, 48.2 and 14.7%, respectively. Moreover, Pedreira et al. (2005) observed a variation of 44.6 to 55.1% for panicle component (DM basis), of 20.1 to 29.7% for leaf (DM basis) and of 22.8 to 33.1% for stem fraction when evaluated eight sorghum hybrids (dual-purpose) recommended for producing silage in Southeastern Brazil. The values of stem percentage were lower, and the percentage of panicle and leaf, higher than found in this experiment.

The proportion ratio of panicle in relation other components, based on the dry matter, indicates the great potential of these genotypes, indicated for the Brazilian Northeastern region, since they can provide soluble carbohydrates for production of silage with good quality in lower middle San Francisco Valley.

Regarding the correlations, the plant height was not correlated ($p > 0.05$) with the percentage of lodged and broken plants (Table 6).

A positive correlation between plant height and lodging is extremely undesirable for the efficient production of sorghum silage. Even though it had not been detected significant difference ($p > 0.05$) between hybrids, probably due to the high variation of this characteristic, it was found a trend for higher lodging in the hybrid BR 601, a high size genotype.

**Table 6.** Coefficient of correlation of the evaluated variables in the sorghum genotypes.

| Variable[1] | PH | LP | BP | FMP | DMP | DDMP | %PFM | %PDM | %SFM | %SDM | %FMV | %FMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PH | $-0.09^{ns}$ | $0.43^{ns}$ | $0.21^{ns}$ | $0.89^{*}$ | $0.78^{ns}$ | $0.81^{ns}$ | $-0.91^{*}$ | $-0.81^{ns}$ | $0.96^{**}$ | $0.85^{ns}$ | $-0.80^{ns}$ | $-0.18^{ns}$ |
| PP | - | $-0.25^{ns}$ | $-0.17^{ns}$ | $0.07^{ns}$ | $0.40^{ns}$ | $0.43^{ns}$ | $-0.00^{ns}$ | $-0.18^{ns}$ | $0.04^{ns}$ | $0.23^{ns}$ | $-0.20^{ns}$ | $-0.21^{ns}$ |
| LP | - | - | $0.96^{**}$ | $0.03^{ns}$ | $-0.09^{ns}$ | $0.03^{ns}$ | $-0.05^{ns}$ | $0.15^{ns}$ | $0.20^{ns}$ | $-0.03^{ns}$ | $-0.71^{ns}$ | $-0.44^{ns}$ |
| BP | - | - | - | $-0.17^{ns}$ | $-0.28^{ns}$ | $-0.14^{ns}$ | $0.16^{ns}$ | $0.35^{ns}$ | $-0.02^{ns}$ | $-0.25^{ns}$ | $-0.58^{ns}$ | $-0.39^{ns}$ |
| FMP | - | - | - | - | $0.91^{*}$ | $0.90^{*}$ | $-0.99^{**}$ | $-0.97^{**}$ | $0.97^{**}$ | $0.92^{*}$ | $-0.55^{ns}$ | $0.13^{ns}$ |
| DMP | - | - | - | - | - | $0.98^{**}$ | $-0.91^{*}$ | $-0.96^{**}$ | $0.91^{*}$ | $0.97^{**}$ | $-0.58^{ns}$ | $-0.08^{ns}$ |
| DDMP | | - | - | - | - | - | $-0.89^{*}$ | $-0.93^{*}$ | $0.91^{*}$ | $0.95^{*}$ | $-0.68^{ns}$ | $-0.14^{ns}$ |
| %PFM | | - | - | - | - | - | - | $0.96^{**}$ | $-0.98^{**}$ | $-0.94^{*}$ | $0.57^{ns}$ | $-0.05^{ns}$ |
| %PDM | | - | - | - | - | - | - | - | $-0.93^{*}$ | $-0.96^{**}$ | $0.46^{ns}$ | $-0.09^{ns}$ |
| %SFM | - | - | - | - | - | - | - | - | - | $0.94^{*}$ | $-0.70^{ns}$ | $-0.07^{ns}$ |
| %SDM | - | - | - | - | - | - | - | - | - | - | $-0.61^{ns}$ | $-0.16^{ns}$ |
| %FMV | - | - | - | - | - | - | - | - | - | - | - | $0.59^{ns}$ |

*$p < 0.05$; **$p < 0.01$; [1]PH – Plant height; PP – Plant population; LP – Lodged Plants (%); PQB – Broken plants (%); FMP – Fresh matter production; DMP – Dry matter production; DDMP – Digestible dry matter production; %PFM – Panicle percentage in the fresh matter; %PDM – Panicle percentage in the dry matter; %SFM – Stem percentage in the fresh matter; %CMS – Stem percentage in the dry matter; %LFM – Leaf percentage in the fresh matter; %LDM – Leaf percentage in the dry matter.

These results diverge from Molina et al. (2000) that reported a positive correlation (0.27) between the plant height and lodging percentage, by analyzing six sorghum hybrid in Minas Gerais State.

It was observed a positive correlation between the plant height and fresh matter production (r = 0.89) and stem percentage in the dry matter (r = 0.96). This correlation was evidenced by the BRS 506 genotype, which presented a higher plant height and consequently higher production of dry matter and greater percentage of stem in the fresh matter.

The production of digestible dry matter was positively correlated with the stem percentage in the fresh and dry matter, 0.91 and 0.95, respectively, which could be related to the greater participation of this fraction in the plant. This variable was positively correlated with the dry matter productivity (0.98). This linear correlation was also registered by Gontijo Neto et al. (2002) in trials with sorghum hybrids grown under increasing levels of fertilization.

Among the fractions, the panicle negatively correlated with stem (-0.98, -0.94, -0.93 and -0.96), evidencing the dilution effect of this component with increased proportion of other components of the plant.

Flaresso et al. (2000) reported that the participation of panicle or ear is important because it is positively correlated with increased content of dry matter, grains yield, and silage quality. Nevertheless, the percentage of panicle in the dry matter should not be regarded as the single feature for selecting sorghum cultivars for silage production, since both fiber quality and plant height can influence the dry matter yield and silage quality.

The correlation coefficients obtained for the variables examined are according with those sorghum genotypes established for silage production in different Brazilian regions, pointing out the possible use of these genotypes for silage production in northeast semiarid region.

## Conclusion

The ratio between the plant fractions certifies the use of the evaluated genotypes on silage production in Brazilian semiarid region.

Among studied materials for silage production in the lower middle San Francisco Valley, the BRS 506 variety presented the highest production of digestible dry matter per ha.

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