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Scientific Article

Forage performance in silage production under water deficit conditions

Desempenho de forrageiras na produção de silagem sob déficit hídrico

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ABSTRACT - The positive performance of different cultivars in relation to a water deficit is directly correlated with an increase in biomass production, with repercussions for ensuring system sustainability. The objective of this study was to evaluate the production and nutritional value of four millet genotypes in comparison with that of corn and sorghum under two water supply conditions (simulated water deficit and normal conditions). This experiment was conducted using a completely randomized design (CRD), with six cultivars, two irrigation levels, and four replicates, totaling 48 experimental units. At the end of 12 weeks after sowing, biometric and bromatological evaluations were conducted. Based on these results, pearl millet ADR300, ADR500, BRS1501, and ADRf6010 showed promise and are interesting alternatives to be explored by silage producers in more critical water deficit periods. Among millets, ADRf6010 performed similarly to corn and sorghum, which are commonly used in Brazil as forage, indicating that it is the best alternative for silage formation.

Keywords: Climate risk. Income components. Forage. *Zea mays*.

RESUMO - O desempenho positivo de diferentes cultivares ao déficit hídrico está diretamente correlacionado com o aumento da produção de biomassa, com reflexos na garantia da sustentabilidade do sistema. Objetivou-se com esse estudo avaliar a produção e valor nutritivo de quatro cultivares de milheto em comparação com o milho e sorgo, sob duas condições de fornecimento de água (simulando uma condição de déficit hídrico e uma condição normal). O delineamento experimental foi inteiramente ao acaso (DIC), com 6 cultivares, 2 níveis de irrigação e 4 repetições, totalizando 48 unidades experimentais. Ao final de 12 semanas após a semeadura, foram realizadas as avaliações biométricas e bromatológicas. Com base nos resultados, os milhetos ADR300, ADR500, BRS1501 e ADRf6010 se apresentaram promissores e são alternativas interessantes a serem exploradas por produtores para silagem em períodos mais críticos ao déficit hídrico. Dentre os milhetos, o ADRf6010 apresentou desempenho semelhante quando comparado com o milho e sorgo, comumente utilizados no Brasil como forragem, indicando ser a melhor alternativa para a formação de silagem.

Palavras-chave: Risco climático. Componentes do rendimento. Forragem. *Zea mays*.

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INTRODUCTION

Agribusiness accounted for approximately 26.6% of Brazil's gross domestic product in 2021, of which 10% was accounted for by livestock, which is also a source of wealth for the country, generating thousands of jobs where millions of hectares are under pasture, a large part of which is cultivated extensively (ABIEC, 2021). These factors, combined with proper pasture and animal production management, have resulted in Brazil having a cattle herd of approximately 224.6 million animals in 2021, which is considered the largest commercial herd in the world, becoming a benchmark for global beef exports (IBGE, 2022).

Pasture is the most economical food source for livestock. However, owing to climatic seasonality, pasture availability during the year is unequal in many Brazilian regions, resulting in pasture production abundance during the wet season and scarcity during the dry season. These factors negatively affect forage nutritional value, consumption, and digestibility, limiting animal production and increasing food supplementation costs, thus compromising livestock sector competitiveness (CAVALCANTI et al., 2016).

Therefore, it is necessary to adopt alternatives, such as silage production, to satisfy roughage demand during the dry season. Storing excess forage from the rainy season for use in the dry season is a viable strategy for livestock farming (FERNANDES; EVANGELISTA; BORGES, 2016). Corn is a primary energy source used to feed high-production cattle in Brazil. However, feed supplementation with diets containing corn silage and noble cereal grains increases cattle production costs during forage scarcity periods, creating the requirement for alternative feed sources for ruminants during this period. Among the primary alternative food sources with potential for use are sorghum (*Sorghum bicolor* L.) and pearl millet (*Pennisetum glaucum* (L.) R. Brown) (SIMÃO et al., 2015a).

Pearl millet is widely used as a mulch in the no-till system (SIMIDU et al., 2010), and when used in succession to soybeans and corn, it is an interesting alternative for increasing the availability and quality of the diet offered to animals, also improving land-use efficiency (SIMÃO et al., 2015b).

Pearl millet agronomic characteristics include high drought tolerance, suitability for low-fertility soils, and good developmentand biomass production. Even with a lower energy content than corn and sorghum silage, pearl millet silage, with its qualitative characteristics, has been a positive factor and exploitable alternative (JACOVETTI et al., 2018). For cattle, this plant is used for grazing, haymaking, silage, and grain production, making it a good option for off-season crops in the *Cerrado* region.

There has been little research on silage production and use as animal feed in the state of Espírito Santo. The use of roughage has ensured sustainable dairy production in the state, including the storage of corn *(Zea mays* L.), sorghum *(Sorghum bicolor* L.), pearl millet *(Pennisetum glaucum* (L.) R. Brown), cassava foliage (*Manihot esculenta* Crantz), elephant grass (*Pennisetum purpureum*), and sugarcane *(Sacharum officinarum*).

A few years ago, the state experienced a severe water deficit that directly affected animal production systems and created obstacles to animal feed supplies.

Considering that forage conservation is a very important practice for livestock farming, especially during forage scarcity periods, helping to make up for food deficits in quantity and quality, the aim was to evaluate the production and nutritional value of four pearl millet cultivars compared to that of corn and sorghum, under two water supply conditions.

MATERIALS AND METHODS

The experiment was conducted in a greenhouse at the Federal University of Espírito Santo, São Mateus Campus, Brazil. The regional climate is hot and humid (Köppen-type Aw), with a dry season in autumn and winter and a rainy season in spring and summer (ALVARES et al., 2013).

The pearl millet genotypes used were ADR300, ADR500, BRS1501 and ADRf6010, as well as the maize Agroceres 4051 and the forage sorghum hybrid Volumax Agroceres®. The experimental design was completely randomized (CRD), with six crops, two irrigation levels, and four replicates, totaling 48 experimental units.

The soil used was collected from the 0-0.20 m depth layer of an *Argissolo Amarelo sandy clay loam texture* (Ultisol) and 0.4 dag kg^{-1} of organic matter which had the following chemical attributes (Table 1).

Table 1. Chemical analysis of the soil used as substrate for the experiment.

Depth	pH	P	K	Na	Ca	Mg	Al	H+Al	SB	t	T	V	m
m	(H_2O)	--------- mg dm^{-3} ---------			------------------------------- cmol$_c$ dm^{-3} -------------------------------							------- % -------	
0-0.20	5.15	3.35	85.0	3.0	1.75	1.4	0.15	4.82	3.5	3.5	8.35	42.2	4.7

The soil was collected, sieved and placed in 60 L rectangular polypropylene pots (experimental unit) measuring 0.57 x 0.35 x 0.30 m, corresponding to height, width and depth, respectively. The entire pot was filled with soil, which in turn was corrected with dolomitic limestone with relative neutralizing value = 80%, applying the equivalent of 1.0 t ha^{-1} (basically to provide Ca and Mg), 30 days before and foundation fertilization at sowing time, respectively, based on soil analysis and recommendations for the state of Espírito Santo (PREZOTTI; MARTINS, 2013), applying to maize: for productivity > 50 t ha^{-1}, the equivalent of 120 kg ha^{-1} P_2O_5, 120 kg ha^{-1} K_2O (80 at sowing and 40 as part of top dressing) and 200 kg ha^{-1} N (20 at sowing and 180 as part of top dressing); sorghum: for productivity > 60 t ha^{-1}, equivalent to 90 kg ha^{-1} P_2O_5, 90 kg ha^{-1} K_2O (80 at sowing and 10 inserted into top dressing) and 160 kg ha^{-1} N (20 at sowing and 140 as top dressing); pearl millet: for productivity > 20 t ha^{-1}, equivalent to 100 kg ha^{-1} P_2O_5, 60 kg ha^{-1} K_2O (50 at sowing and 10 as part of top dressing) and 100 kg ha^{-1} N (20 at sowing and 80 as part of top dressing).

The sowing season was October 2016, when there were more days with > 13 h of light. The following weather data were recorded (average, maximum and minimum, respectively): 24.50; 29.16 and 21.31ºC temperature; 83.96, 96.80 and 63.33% relative humidity; the average radiation was 690.73 kJ m^{-2} and the total rainfall during the period was 186 mm. Four maize seeds were sown per pot, spaced 0.10 m apart linearly within the pot, leaving two plants spaced 0.2 m apart after pruning. For pearl millet and sorghum, eight seeds were sown per pot, spaced 0.04 m apart, and pruned to four seeds per pot, which were then spaced 0.08 m apart. The sowing depth was 0.03 m and pruning was performed 15 days after sowing.

The plants were maintained with periodic drip irrigation in each pot, aiming to satisfy 50 and 100% of the water requirement, simulating water deficit and normal conditions, respectively. The watering shift was daily, with 50 and 100% of the required water replaced, depending on the treatment. The water used was obtained from a well drilled at the Experimental Farm, with an electrical conductivity of

0.0015 dS m^{-1}. The water levels were determined based on the daily crop requirements, using data generated by the meteorological station on the CEUNES campus, São Mateus-ES (the closest to the study area), with data available on the Instituto Nacional de Meteorologia website. Irrigation was maintained until the maize reached the milky-pasty grain stage and the pearl millet and sorghum reached the pre-farinaceous stage.

The following biometric evaluations were conducted at the end of planting, approximately 12 weeks after sowing: plant height (PH, m), measured using a tape measure from the insertion of the stem into the soil to the end of the panicle or the shoot. The stem diameter (SD, mm) was measured using a digital caliper 1 cm from the insertion into the soil. The number of green and dry leaves (Nº. leaves) was determined by counting all leaves in each pot. All plants were then cut and transported to the Sample Processing Laboratory at the CEUNES Experimental Farm. On these plants, we measured leaf area (LA, cm² $vase^{-1}$), destructive method, using an automatic bench leaf area meter (Li-Cor® L1-3100), leaf dry matter (LDM, kg), stem dry matter (SDM, kg) and plant dry matter (PDM, kg), obtained by collecting the material from each experimental unit, followed by drying in a forced air circulation oven at 65ºC for 72 h and weighing on a precision scale (to two decimal places).

After the biometric assessments, and cutting and sampling of the plants, the fresh aerial part of each plant was chopped in a stationary machine for chopping and crushing forage crops, to a particle size of approximately 2 mm, homogenized and packed in PVC silos 0.10 m in diameter with a 0.40 m height (one silo for each experimental unit/pot). After packaging, the material was compacted and sealed for 60 d to allow fermentation to occur, stored at room temperature, and protected from sunlight and rain.

After 60 d, the material in the silos was dried in a forced ventilation oven at 65ºC for 72 h. It was then ground in a Willey mill to obtain 1 mm particles for use in bromatological determinations. At this stage, a single sample was collected from each replicate to construct a single composite sample per treatment. This procedure was adopted because of operational and financial constraints in conducting the analyses.

The bromatological evaluations were conducted at the UFMG Veterinary School, Animal Nutrition Laboratory, and the dry matter content (DM, %), mineral matter (MM, %), organic matter (OM, %), and crude protein (CB, %), the neutral detergent fiber (NDF, %), acid detergent fiber (ADF, %), and lignin content (LC, %) and the in vitro dry matter digestibility (VDMD, %).

The data obtained were subjected to analysis of variance, and the means were compared using Tukey's test at a 5% significance level. Subsequently, the data were subjected to cluster analysis, and a dendrogram was constructed. To strengthen and understand the degree of proximity between the genotypes under study, a hierarchical cluster analysis was used based on a methodology used to identify associations within the dataset, dividing them into sets with similar characteristics (LIU et al., 2020). To avoid the effects of different scales, the data were standardized. Cluster analysis was conducted using the Ward method and Mahalanobis distance as the dissimilarity method because biometric characteristics are usually correlated. The "y" axis of the graph identifies the distance between the groups, while the "x" axis shows the unity of the groups (QUEIROZ et al., 2019).

Bromatological data were then subjected to principal component analysis (PCA), a multivariate statistical technique used to identify significant traits in large datasets (AHMED et al., 2019; LIU et al., 2020). PCA allows variables to be selected and categorized based on their homogeneity and dissimilarity (AHMED et al., 2019). Bromatological variation patterns were analyzed for both factors studied and were divided according to the level of irrigation.

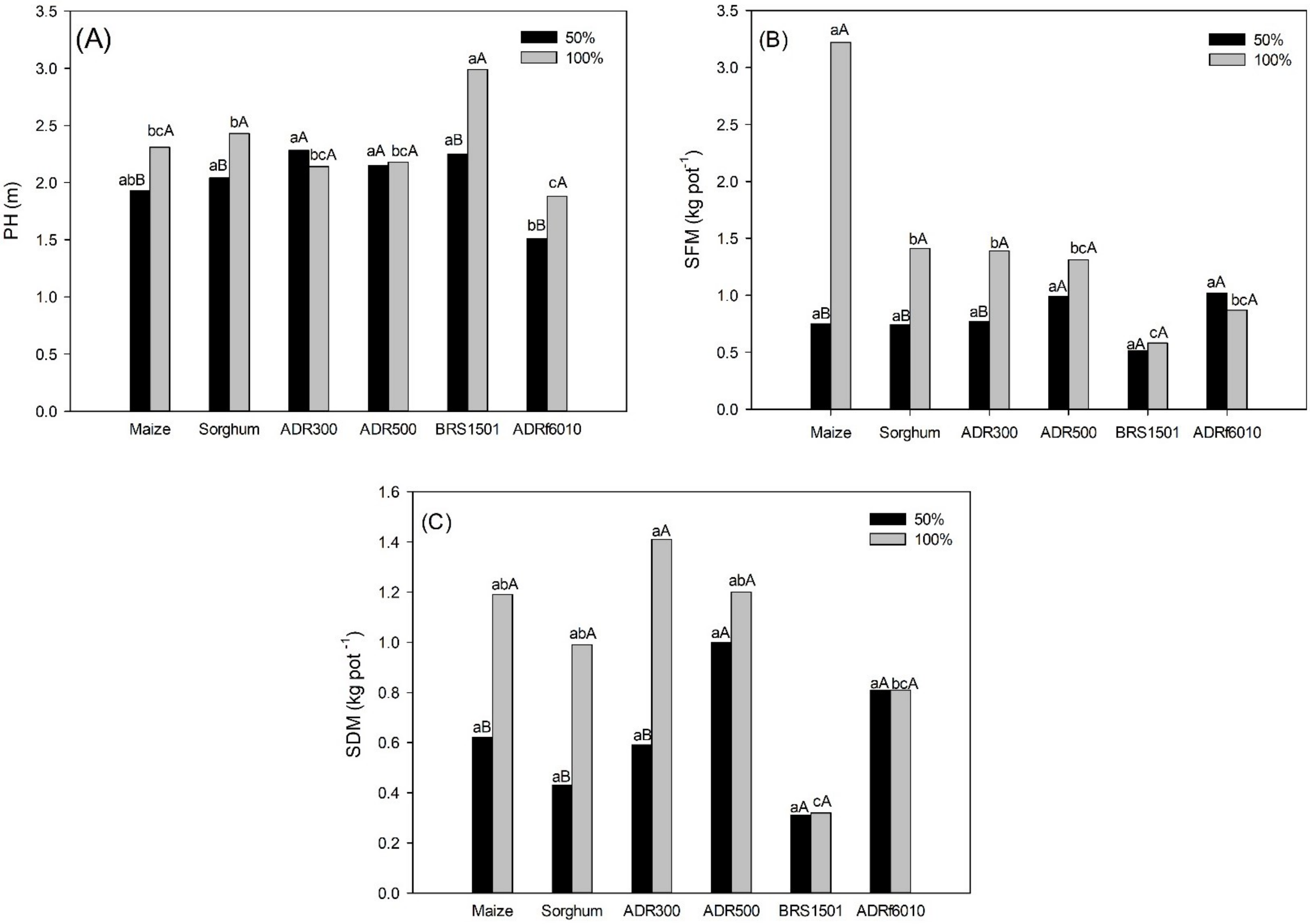
Statistical tests were performed using R software, version 4.2.1 (R CORE TEAM, 2023).

RESULTS AND DISCUSSION

During the cultivation period, there were significant differences between the depths applied and the cultivars evaluated for PH, SFM, and SDM (Figure 1). However, when observing the PH, it was concluded that the 100% depth provided the greatest height for most of the forage plants, with pearl millet BRS1501 standing out as having the greatest PH compared with those of the other cultivars tested. In the three attributes evaluated, for most combinations between cultivars and depths, as was physiologically expected, the results were superior under the 100% depth.

The corn PH evaluated under the two irrigation depths was > 1.80 m, which was higher than that found by Uate et al. (2015) in a field trial with soil classified *as Latossolo Vermelho-Escuro clayed* (Oxisol) in the state of Minas Gerais, whose results were approximately 1.54 m in height. The non-differentiation in evaluated PH of the ADR300 and ADR500 pearl millets at the different irrigation depths corroborates the findings of Bonfim-Silva et al. (2011), who subjected pearl millet to 30 and 60% field capacities and found that plant height was not affected by water stress.

The biometric attributes, SFM and SDM, when analyzed at 50% irrigation depth and compared between cultivars, did not differ significantly. For the 100% irrigation depth, maize had the highest value for the SFM attribute, whereas sorghum and pearl millets ADR300 and ADR500 did not differ; they were also superior to pearl millets BRS1501 and ADRf6010, whereas maize, sorghum, ADR300, and ADR500 did not differ, with ADRf6010 differing only from ADR300, which belongs to the first group, however, with values that did not differ from pearl millet BRS1501, which had the lowest average among the cultivars evaluated.



A = Plant height (PH, m); B = Stem fresh matter (SFM, kg pot^{-1}); C = Stem dry matter (SDM, kg pot^{-1})

Bars followed by equal capital letters for the same cultivar indicate that there was no significant difference between 50 and 100% irrigation depths, and equal lowercase letters between the cultivars indicate that there was no significant difference by Tukey's test at 5%.

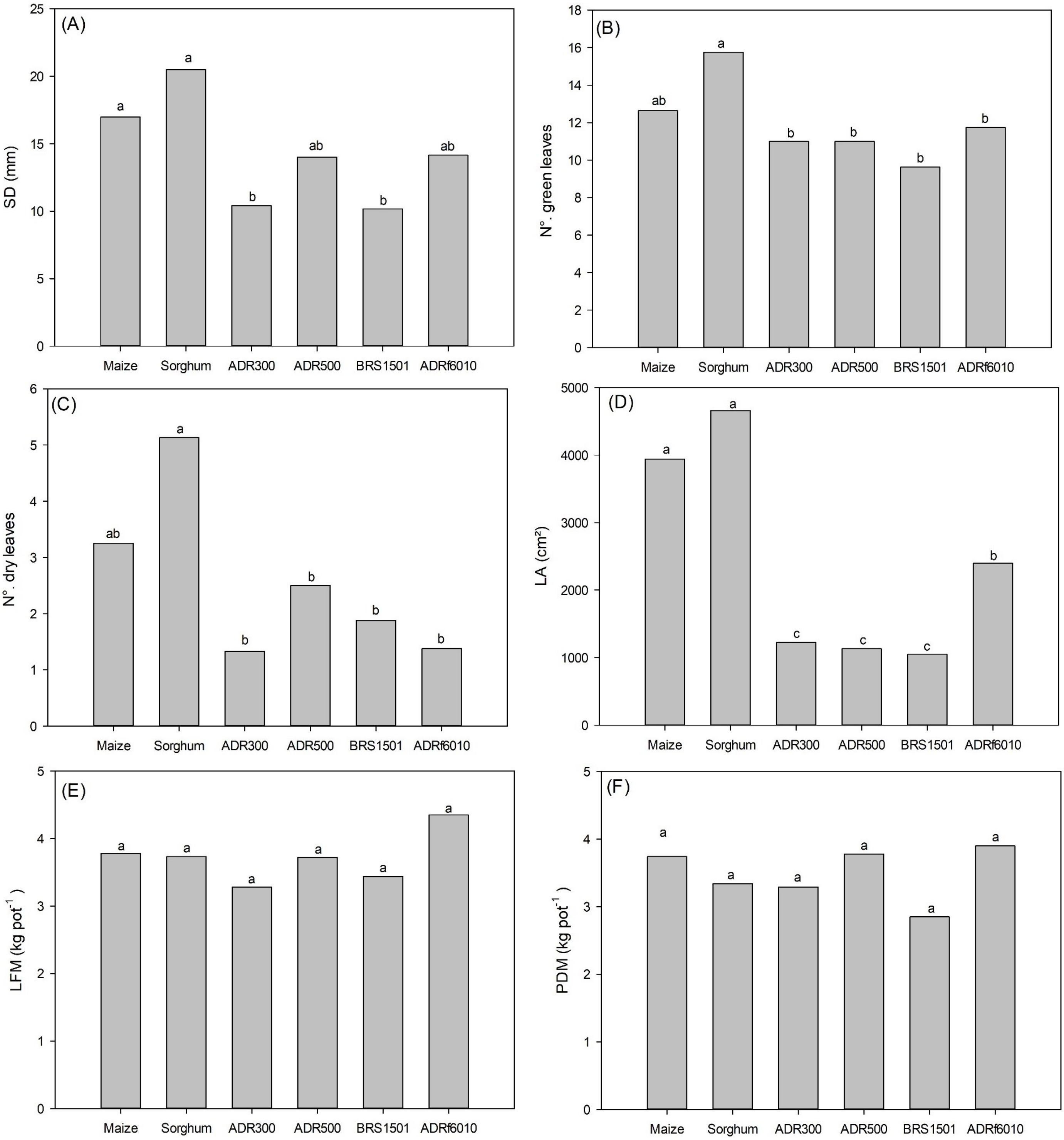
Figure 1. Biometric attributes of forage cultivars under two irrigation depths.

For the other attributes, the analysis showed no significant differences in factorial distribution, with no differences for the 50 and 100% irrigation depths. The values of attributes SD, Nº. of dry and green leaves, LA, FLM, and PDM differed between cultivars (Figure 2). Among these attributes, SD was the highest for maize, sorghum, ADR500, and ADRf6010. ADR300 and BRS1501 had the same averages as those of the other pearl millets but lower values than those of maize and sorghum. For the attribute Nº. of green and dry leaves, sorghum had the highest average and did not differ from maize, which in turn had equal values to those of pearl millets.

According to Perazzo et al. (2014), stems have higher fiber content than leaves, which compromises material digestibility. Consequently, the nutritional value of plants may be impaired when stem production is high. However, stem diameter is positively related to plant resistance to lodging, a factor that can imply lower losses during harvest (DEMÉTRIO et al., 2008), which, according to the results, could favor maize, sorghum, ADR500 and ADRf6010.

The Nº. of green and dry leaves is an important attribute to consider because it is directly correlated with the final quality of silage, and its proportion affects the chemical composition and digestibility of the final product (ACIOLY; PERAZZO, 2022).

Greater leaf component participation is preferable, as it is typically the most nutritious part of the plant. According to the results, the LA of maize and sorghum showed the highest averages, superior to that of pearl millets; however, when analyzing FLM and PDM, the averages remained the same for the six cultivars under study. This information is of great importance because biomass production is the most important quantitative attribute when considering forage crops. Therefore, the lack of differences between cultivars implies that any of them can be used with only mass production as a requirement.



A = Stem diameter (SD, mm); B = number of green leaves (Nº. green leaves); C = Number of dry leaves (Nº. dry leaves); D = Leaf area (LA, cm² pot^{-1}); E = Leaf fresh matter (LFM, kg pot^{-1}); F = Plant dry matter (PDM, kg pot^{-1})

Equal lowercase letters between the cultivars indicate that there was no difference and illustrate statistically equal means by Tukey's test at 5%.

Figure 2. Biometric attributes of the six forage cultivars.

In the state of Rio Grande do Sul, Bergamaschi et al. (2004) observed that maize crops required approximately 7 mm of water daily during flowering; therefore, productivity was not affected. Under these conditions, the use of irrigation becomes fundamental because the greatest effects of water deficit occur on both dry matter production and grain yield during the critical period. As observed in this study, simulating a water deficit led to a reduction in the PH, SFM, and SDM averages for most cultivars.

The results highlight maize sensitivity to a water deficit from flowering to the start of grain formation (TRIVEDI et al., 2018), that is, in a relatively short period, which makes this crop highly susceptible to water (SOUZA et al., 2015). These inferences agree with those of Pegorare et al. (2009), who concluded that there is an increase in maize productivity with high irrigation depth and that water deficit during dry periods decreases productivity. Conversely, the same authors observed that irrigation as a palliative method to avoid plant death was viable for off-season maize when rainwater availability was low and showed good economic results.

During years of drought, maize can perform satisfactorily in some seasons, as long as there is a palliative supply of water during the critical period. Thus, irrigation can guarantee a satisfactory yield only during this period. Pearl millet, however, has its own peculiarities and is an interesting alternative to be explored by producers during more critical periods of water deficit. A primary characteristic of pearl millet is its high water-use efficiency, which uses up to 70% less water than maize to produce the same amount of dry matter (TABOSA et al., 1999).

Cluster analysis of the biometric characteristics of the individuals and the formulation of the dendrogram (Figure 3) made it possible to analyze the similarities between the maize and sorghum species and millet cultivars. The variation in the Mahalanobis distance in relation to the similarity of characteristics and the separation of groups using the method developed by Mojena (1977) enabled individuals to be classified into two groups (GI and GII).

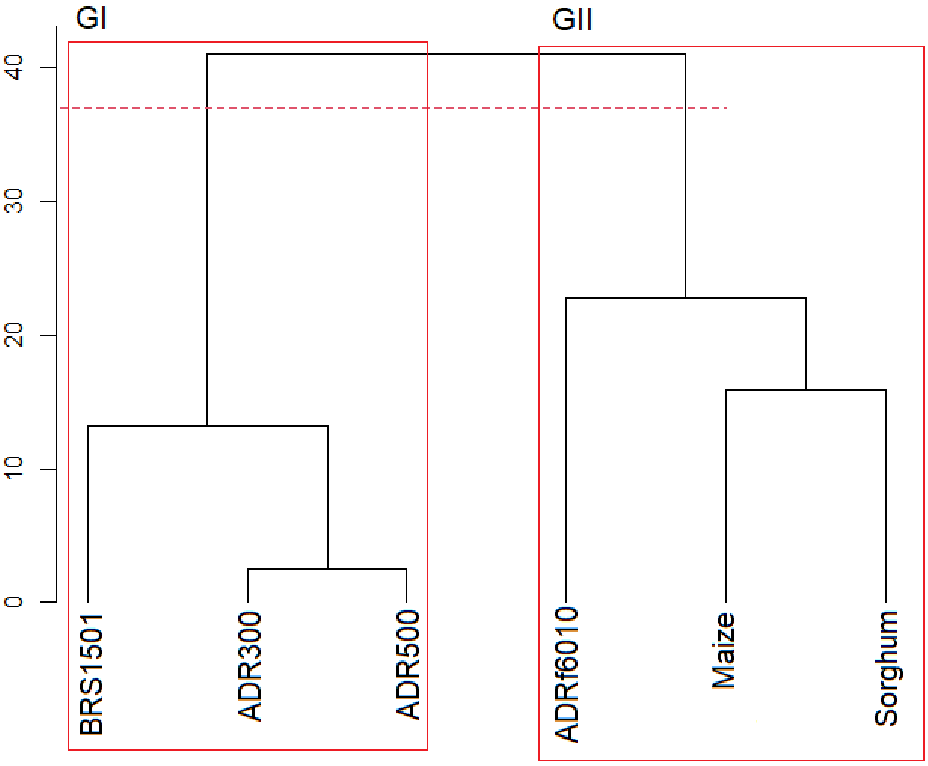


Figure 3. Cluster analysis dendrogram for the maize, sorghum and pearl millet cultivars ADR300, ADR500, BRS1501 and ADRf6010, based on the individual biometric characteristics.

The bifurcation and formation of groups GI and GII showed that the individuals of the maize, sorghum, and pearl millet variety ADRf6010 were similar, but differed from GII, which comprised cultivars ADR300, ADR500, and BRS1501.

Intra-group conformity is related to the biometric similarity and planting purpose of the individuals, because all GI cultivars are used as straw, whereas the ADRf6010 hybrid, maize and sorghum are commonly used in Brazil as fodder (NICOLE et al., 2021).

Bromatological characteristics and VDMD were important when analyzing silage yields and those identified using different irrigation depths (Table 2). However, it should be noted that the bromatological variables and VDMD corresponded to the absolute values anticipated for the cultivars under study at 50% irrigation compared with that under 100% irrigation.

Table 2. Bromatological attributes of silage from forage crops grown under two irrigation depths.

Treatment	Irrigation depth (%)	DM	OM	MM	CP	NDF	ADF	LC	VDMD
Maize	50	36.58	96.23	3.77	7.95	54.10	31.59	5.65	67.88
Sorghum		37.03	92.68	7.32	7.04	36.76	18.76	2.46	75.67
ADR300		37.54	95.08	4.92	9.59	32.62	14.82	1.98	79.53
ADR500		30.32	94.77	5.23	8.60	57.23	31.03	6.12	65.67
BRS1501		35.30	95.74	4.26	7.88	37.30	23.70	2.54	72.60
ADRf6010		33.69	93.56	6.44	9.56	45.79	28.51	3.54	76.72
Maize	100	30.15	92.88	7.12	7.32	55.79	30.12	4.93	60.12
Sorghum		36.92	93.07	6.93	10.34	47.73	26.53	2.72	62.37
ADR300		34.62	94.23	5.47	9.43	62.65	31.92	3.73	69.67
ADR500		36.03	96.04	3.96	8.00	36.20	22.70	2.37	73.60
BRS1501		30.92	92.57	7.43	7.33	55.76	30.12	3.00	61.92
ADRf6010		33.75	93.12	6.90	8.25	43.88	25.94	3.32	70.60

Dry matter (DM, %), organic matter (OM, %), mineral matter (MM, %), crude protein (CP, %), neutral detergent fiber (NDF, %), acid detergent fiber (ADF, %), lignin content (LC, %) and in vitro dry matter digestibility (VDMD, %).

Various criteria have been used to classify the silage quality. The ensiling process can reduce the nutritional value of the original material in different ways, with dry matter and energy losses depending on the biometric characteristics of the ensiled forage because the digestibility and/or concentration of the cellular content of the plant parts (culm, leaves, and reproductive structure) directly influences the fiber quality of the entire plant (NEUMANN et al., 2018).

The plants evaluated at the different irrigation depths under study showed no significant differences in the SD, No. of green leaves, No. of dry leaves, LA, LFM, and FDM attributes (Figure 2), indicating that even under water deficit conditions (50% irrigation depth), the plants produced leaves that are directly related to photosynthetic production and survival. Another relevant factor is that plants invested less in their structure (cellulose, hemicellulose, and lignin). This can be seen in the results of the plants under water deficit conditions, which had lower PH, SFM, and SDM values (Figure 1), reinforcing the suggestion that there was less investment in structure; that is, compounds that directly affected forage digestibility. Plants under water deficit conditions showed a higher VDMD value (Table 2), as their samples sent to the laboratory tended to be more nutritious and had a lower proportion of fibers when compared to that of the plants at 100% irrigation depth conditions.

Burton et al. (1969) conducted studies on pearl millet and identified the d2 (dwarf) gene as causing a reduction in growth rate, internode length, plant height, and dry matter production but with an increase in leaf percentage, digestibility, and crude protein (CP). In synthesis, the water deficit favored formation of a smaller plant with less investment in structure and consequently resulted in higher quality results for the laboratory sample, especially VDMD. The average DM content of the silages evaluated at the two irrigation depths was within the values considered adequate according to Neumann et al. (2018), who indicated DM content between 30 to 35% for a good fermentation pattern in silages. In addition, the best parameter for evaluating silage is digestibility, as it is highly correlated with lignin content. According to Nogueira (1995), very good-quality sorghum silage should have a VDMD > 63%.

The PCA results for 50% irrigation depth conditions indicated that the two principal components (PCs) explained 83.94% of the total variance (Table 3). For each factor, characteristics with a loading > 0.80 were considered significant. According to the table, the variables with the highest association were, in descending order, for positive values, LC and MM, and negative variables, DM and OM, whereas for negative values, NDF was predominant in PC2, followed by the other variables.

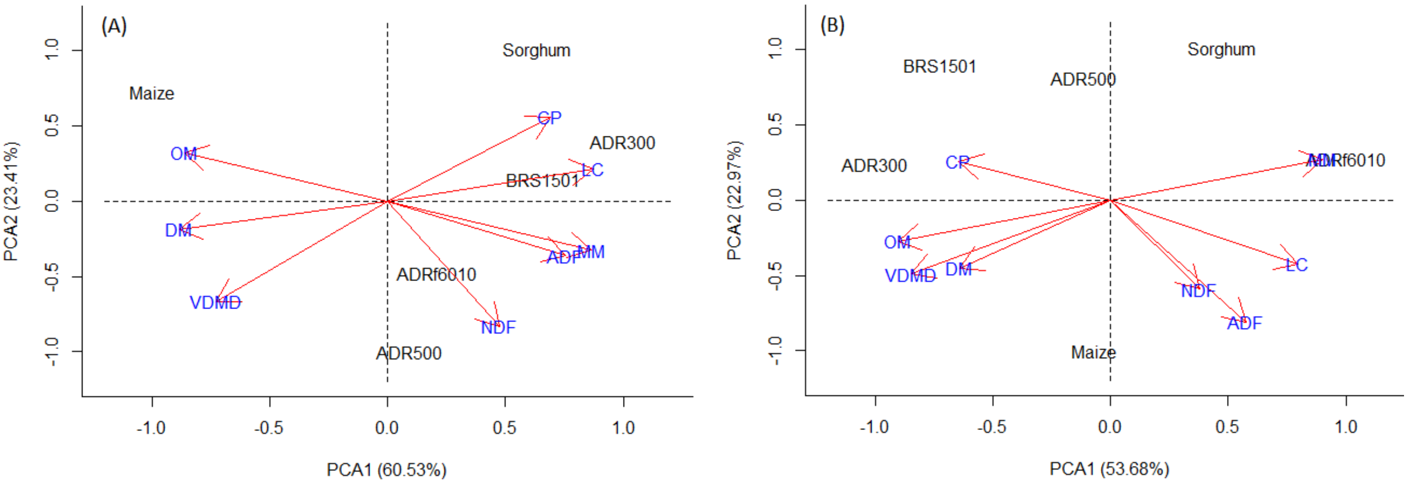
The influence of the two PCs is shown in Figure 4A. Individuals occupying the same quadrant showed similar results, differing for the cultivars represented in the other quadrants. Under 50% irrigation depth conditions, sorghum and pearl millet varieties ADR300 and BRS1501 showed high correlation with the CP and LC variables, while having a low correlation with VDMD, indicating that the materials are difficult for animals to digest, contrary to expectations.

Under 100% irrigation depth conditions, two primary components were sufficient to explain 76.65% of the total variation (Table 3). MM and LC showed a strong positive correlation with CP1, whereas OM and VDMD showed a strong negative correlation. For CP2, ADF showed a strong negative correlation, followed by the other variables. Analysis of Figure 4B shows that the pearl millet cultivars ADR300, ADR500, and BRS1501 showed a strong correlation with CP, whereas sorghum and the ADRf6010 variety showed a strong correlation with MM and a low correlation with OM, DM, and VDMD. Forages with higher crude protein content make it easier for animals to satisfy their protein requirements (BENNET et al., 2008).

Table 3. Correlation values, eigenvalues, and explanations for bromatological variables.

Variable	Irrigation depth (%)			
	50		100	
	PC1	PC2	PC1	PC2
DM	-0.89	-0.19	-0.64	-0.44
OM	-0.86	0.32	-0.9	-0.27
MM	0.86	-0.32	0.9	0.27
CP	0.69	0.56	-0.64	0.26
NDF	0.48	-0.83	0.38	-0.59
ADF	0.76	-0.36	0.58	-0.81
LC	0.87	0.22	0.8	-0.42
VDMD	-0.73	-0.67	-0.85	-0.49
Eigenvalue	4.82	1.87	4.29	1.83
Explanation (%)	60.53	23.41	53.68	22.97

Dry matter (DM, %), organic matter (OM, %), mineral matter (MM, %), crude protein (CP, %), neutral detergent fiber (NDF, %), acid detergent fiber (ADF, %), lignin content (LC, %) and in vitro dry matter digestibility (VDMD, %).



A = 50%; B = 100% irrigation depths

Dry matter (DM, %), organic matter (OM, %), mineral matter (MM, %), crude protein (CP, %), neutral detergent fiber (NDF, %), acid detergent fiber (ADF, %), lignin content (LC, %) and in vitro dry matter digestibility (VDMD, %).

Figure 4. Biplots of principal component analyses.

The pearl millet cultivars under study showed good results when compared with those of corn and sorghum, especially under water deficit conditions (50% irrigation depth). The ADRf6010 pearl millet was grouped together with corn and sorghum in terms of biometric characteristics according to the dendrogram and bromatological results, which characterizes good-quality silage formation, reinforcing the use of millet as an alternative in silage production. Studies conducted in Brazil have shown that it is possible to produce satisfactory quantities and quality of pearl millet silage when the crop is properly grown and managed (JACOVETTI et al., 2018).

CONCLUSIONS

Compared to maize and sorghum, the pearl millet cultivars ADR300, ADR500, BRS1501 and ADRf6010 showed promising results in production and nutritional value, which are interesting alternatives to be explored by producers for silage during critical water deficit periods.

Among the pearl millets, ADRf6010 performed similarly to maize and sorghum, which are commonly used in Brazil as fodder, indicating that it is the best alternative for silage formation.

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