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Frequency and availability of herbaceous components in Caatinga enriched with *Urochloa trichopus* grass and grazed by goats, subjected to supplementation

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ABSTRACT: The objective of this study was to evaluate the frequency of herbaceous species, the availability, and supply of dry matter grass goats layer ended in a caatinga enriched with *Urochloa trichopus* grass and submitted to three levels of concentrate supplement (0.5%, 1.0%, and 1.5% over the bodyweight) relative to the control group (0.0%). 24 goats were used crossbreed F1 (Boer x non-descript breed) with an average body weight of 27.00 ± 3.32 kg. The experimental area was 2.4 ha, divided into four paddocks of 0.6 ha. The frequency analysis was carried out by the presence or absence of each species in the sample unit, which expresses the ratio of plots where the sample species were present. For quantification of dry matter availability and delivery of fodder, vegetation was separated into *Urochloa trichopus* grass, other grasses and herbaceous dicots were cut at soil level and weighed. The frequency of herbaceous species in the bush after thinning and enriched with *Urochloa trichopus* grass is more influenced by environmental conditions (rain) than the treatment of scrub, whatever the level of concentrate supplementation utilized the ratio has been above 48%. In the bush after thinning and enriched with *Urochloa trichopus* grass, whatever the season, availability of herbaceous components does not change with supplementation, but as they are characterized the dry period, the availability of dry matter of herbaceous vegetation decreases, and litter increases.

Keywords: Boer; grass; herbaceous; litter; native pasture.

Frequência e disponibilidade de componentes herbáceos em Caatinga enriquecida com capim Urochloa

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trichopus *e pastejada por caprinos, submetidos à suplementação*

RESUMO: *Objetivou-se avaliar a frequência e a disponibilidade dos componentes herbáceos na caatinga enriquecida com capim* Urochloa trichopus*, pastejada por caprinos, submetidos a três níveis de suplementação concentrada (0,5%; 1,0%; e 1,5%, em relação ao PV) mais o grupo controle (0,0%). Vinte e quatro caprinos mestiços F1 (Boer x sem padrão de raça definida) foram utilizados, com peso vivo médio de 27 ± 3,32 kg. A área experimental foi de 2,4 ha, dividida em quatro piquetes de 0,6 ha. A análise da frequência das espécies foi realizada através da presença ou ausência de cada espécie dentro da unidade amostral, expressando a percentagem de parcelas amostrais em que a espécie esteve presente. Para a quantificação da dispon*ibilidade de matéria seca, a vegetação foi separada em capim *Urochloa trichopus, outras gramíneas e dicotiledôneas herbáceas, que foram cortadas rente ao solo e pesadas. Foi avaliada ainda a disponibilidade de serapilheira. A frequência das espécies herbáceas na Caatinga raleada e enriquecida com capim* Urochloa trichopus *é mais influenciada pelas condições ambientais (chuvas) do que pelo manejo da Caatinga e, independentemente do nível de suplementação concentrada utilizada, o coeficiente de similaridade se mantém acima de 48%. Na Caatinga raleada e enriquecida com capim* Urochloa trichopus*, independentemente da época, a disponibilidade dos componentes herbáceos não se altera com a suplementação, mas à medida que se caracteriza o período de estiagem a disponibilidade de matéria seca da vegetação herbácea diminui e a de serrapilheira aumenta..*

Palavras-chave: *Boer; gramínea; herbáceas; pastagem nativa; serrapilheira.*

1 Introduction

Brazilian semiarid is located in the intertropical region, with a total extension of 1.03 million square kilometers (km^2). It occupies 12% of the national territory and covers 1.262 Brazilian municipalities, according to Resolution nº 115 of the Northeast Development Superintendence, of November 23, 2017 (SUDENE, 2017). The vegetation is rich in forage species in its herbaceous, shrub, and tree strata, Araújo Filho (2006), being this vegetation for several purposes such as forage, fruit, wood, honey, and medicinal support Silva, Araújo Filho and Sousa (2007), but its main purpose is as fodder support for ruminants.

The annual animal support capacity per unit area can be increased using techniques that allow the considerable increase of the grave phytomass, of the herbaceous stratum (ARAÚJO FILHO, 2013). The most widespread handling techniques are thinning and enrichment with exotic species, which aim to control undesirable woody species, decrease the ground cover by shrubs and trees and increase the proportion of grasses, being common the use of exotic species adapted to local soil and climate (SILVA *et al*., 2016).

By intensifying the thinning, it is possible to enrich both the herbaceous and woody strata, using native or exotic species adapted to the adverse conditions of the semiarid climate. Species capable of producing good forage quality should be chosen, plus good

nutritional value with good palatability and digestibility for small ruminants (PEREIRA FILHO; BAKKE, 2010).

Among the grasses indicated for enrichment is the bushveld signal grass (*Urochloa trichopus* (Hochst.) Stapf), which is commonly stoloniferous and rarely with rhizomes (THE ALLIANCE OF BIOVERSITY INTERNATIONAL AND CIAT, 2020), besides having tender stems and abundant foliage (OLIVEIRA, 2005). The chain grass is originally from the East and South of Africa and was introduced in the state of Pernambuco in 1975 (SILVA; OLIVEIRA; SOARES, 1984), is this grass well accepted by ruminants and supports grazing close to the soil, Mugabe *et al*. (2017), and, in recent years, it has become popular among producers in the Northeast (PEREIRA FILHO; SILVA; CÉZAR, 2013).

Considering that the supply of a part of the nutrients required by grazing goats is removed from the supplement, the response of vegetation, especially herbaceous plants with greater nutritional value, with possible consequences on the availability and supply of dry matter, the objective of this work was to evaluate the frequency and availability of herbaceous components in Caatinga enriched with *Urochloa trichopus* grass grazed by goats, submitted to three levels of concentrate supplementation (0.5%, 1.0% and 1.5%, according to body weight and the control group (0.0%).

The article will present the methodology of the research, the results and discussion of the data, and the conclusion, regarding the supplementation of goats grazing in enriched Caatinga.

2 Materials and methods

In this section, all the research methodology is described (place, animals used, diets, and the variables studied).

2.1 Experiment location

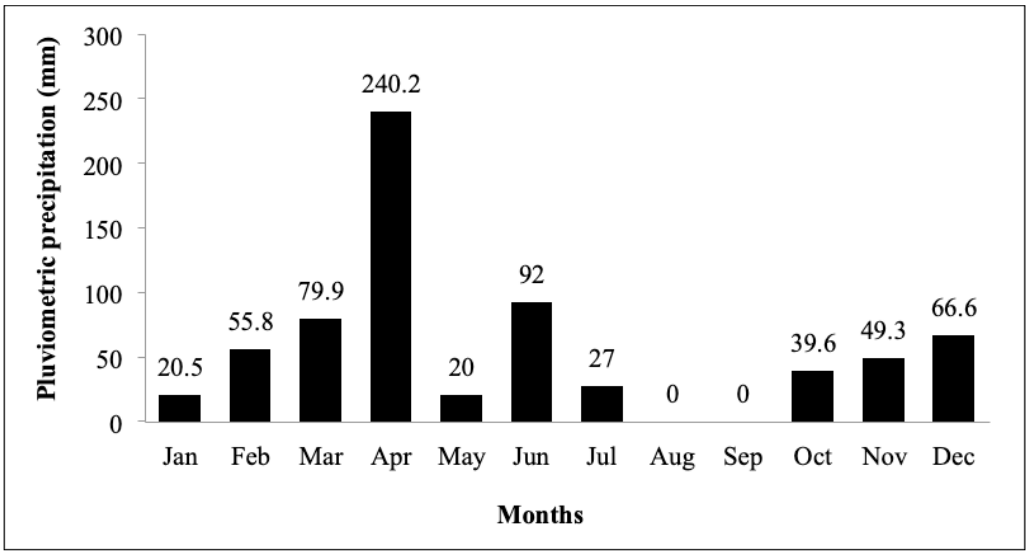
The experiment was accomplished in Lameirão Farm, belonging to the Federal University of Campina Grande (UFCG), geographically located at 7°02'56.8" South and 37°29'36.2" West, in the municipality of Santa Teresinha, state of Paraíba, Brazil. The vegetation of the region presents three different strata: arboreal, shrubby and herbaceous.

According to the Köppen climate classification, the climate of the region is of the As type (tropical hot and humid with autumn-winter rains) (ALVARES *et al*., 2013). The average annual temperature is around 28 ºC, with maximum and minimum temperatures around 35 ºC and 22 ºC, respectively. The average relative humidity in the region is 60%.

2.2 Experiment

In 2013, the year of the experiment, there was a total volume of 690.9 mm of rainfall. In the period preceding the experiment, an accumulation of 396.4 mm of concentrated rain was observed in January and April, with April having the greatest accumulation with 240.2 mm, and during the experimental period from May to October an accumulation of 178.6 mm was recorded (AESA, 2013).

Figure 1 ►
Rainfall (mm) during 2013, in the municipality of Santa Teresinha, Paraíba, Brazil.
Source: experimental data



The vegetation in the experimental area was subjected to selective thinning, aiming at the partial removal of undesirable species, especially plants considered invasive, such as *Mimosa tenuiflora* (Willd.) Poir. and the *Croton sonderiamus* Mull. Arg., as well as the preservation of tree and/or shrub species that are considered plants in the process of extinction and of those that remain green during the dry season, such as the *Zizyphus joazeiro*, maintaining a tree-shrub cover of around 15%, as indicated by Araújo Filho (2013). Subsequently, the Caatinga was enriched in 2012 with the introduction of *Urochloa trichopus* grass, aiming at increasing the herbaceous stratum, consequently increasing the quality of the diet.

2.3 Animals

All procedures for conducting animal research were approved by the Internal Committee for Ethics in the Use of Animals of the Health and Rural Technology Center: Protocol nº 029/2012.

For this study, we used 24 goats (F1 Boer x no racial pattern defined), uncastrated males, with an average body weight of 27.00 ± 3.32 kg. From the acquisition of the animals and during the experimental period, the goats received all routine sanitary treatments and control of endo and ectoparasites. All the animals were maintained in an area of 2.4 ha divided into four paddocks of 0.6 ha, with predominant Caatinga vegetation thinned and enriched with *Urochloa trichopus* grass. The animals were weighed, drawn, and distributed in four treatments, with six repetitions each, the control treatment received the only supplementation with a mineral core, and three more groups, received 0.5%, 1.0%, and 1.5% of the body weight (BW) in dry matter (DM) supplementation with concentrate (ground corn and soybean meal). The paddocks were equipped with a shelter for salt shakers and drinking fountains, in which a complete mineral mixture and water were made available at will.

2.4 Diets

Right after the daytime period, when the animals remained in the paddocks from 8:00 am to 4:00 pm, they were removed and placed in individual stalls equipped with a feeder and drinking fountain, where they received concentrated supplementation (ground corn (80.14%) + soybean meal (19.86%). The supplement was prepared following the recommendations for the nutritional requirements of small ruminants. According to the National Research Council, NRC (2007), to meet the nutritional requirements the animals treated with 1.5% supplementation obtained an average weight of 150 grams per day.

The evaluation of the bromatological composition of the diet was carried out at the Animal Nutrition Laboratory of the Federal University of Campina Grande, Patos, Paraíba, Brazil.

2.5 Sampling

The frequency of herbaceous species was evaluated using a rectangular metal structure measuring 1.00 meters long and 0.25 meters wide (A = 0.25 m^2) (ARAÚJO FILHO *et al*., 1986). The frame was launched from transects drawn according to the North, South, East, and West direction of the central point of the picket. 25 checks were carried out per paddock at different times of evaluation, corresponding to 42 samples/ hectares in each season.

The evaluations to obtain the frequency and availability of herbaceous vegetation were carried out as follows: 1st – before grazing starts (May 2013); 2nd – thirty days before grazing starts (August 2013); 3rd – sixty days after grazing started (September 2013); 4th – the day after the animals leave (October 2013).

The frequency determination was performed through the presence or absence of each species within the sample unit, expressing the percentage of sample plots in which the species was present. After obtaining the frequency of the main herbaceous species, the vegetation similarity was evaluated every grazing cycle. For this, the similarity coefficient described by Bray and Curtis (1957) was used.

To quantify the availability of DM, the vegetation was divided into chain grass, other grasses, and herbaceous dicots, which were cut close to the ground and weighed. The availability of litter was also assessed.

2.6 Statistical analysis

From the similarity coefficient of herbaceous vegetation in the areas, before, during, and at the end of grazing, the cluster analysis was carried out and the results were presented in dendrograms, using the Infostat statistical package (INFOSTAT, 2010).

The methodology used for the distribution of DM availability data for herbaceous vegetation was done through a completely randomized design, with four treatments (levels of concentrated supplementation, 0.0%, 0.5%, 1.0%, and 1.5% of body weight), with repeated observations over time (four evaluation periods), with data submitted to analysis of variance (ANOVA). The effect of the supplementation levels was analyzed by regression and the time averages were compared by the Tukey test, all at the 5% probability level using the PROC GLM of the SAS statistical package (2007).

3 Results and discussion

The *Urochloa trichopus* grass presented greater frequencies in the treatments 0.0%, 0.5%, and 1.5% between the 1st (grazing start) and 2nd (30 days after grazing). Lesser frequency was observed in the 1.0% treatment, which may be related to an uneven distribution of seeds in the area (Table 1).

Table 1 ▼
Frequency (%) of the main herbaceous species in thinned Caatinga and enriched with *Urochloa trichopus* grass, under goat grazing receiving different levels of supplementation.
Source: experimental data

Species	Supplementation levels (% of body weight)															
	0.0				0.5				1.0				1.5			
	Collections															
Grasses	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Urochloa trichopus (Hochst.) Stapf	44	36	12	12	52	52	4	16	28	4	4	4	48	32	12	16
Cyperus compressus	8	--	--	--	16	--	--	--	52	4	--	--	36	12	--	--
Axonopus purpusii	--	8	--	--	--	8	--	--	--	--	--	--	8	--	--	--
Aristida setifolia H.B.K.	--	16	--	--	--	36	--	--	12	4	12	--	--	8	--	--
Herbaceous dicots																
Stylosanthes captata	--	--	--	--	--	8	--	--	16	4	--	--	36	12	--	--
Centrosema brasilianum Benth.	64	6	8	--	44	24	--	--	44	--	--	--	44	68	--	--
Phaseolus patyroides L.	--	4	--	--	8	16	--	--	--	28	--	--	4	32	--	--
Ipomoea purpurea Roth	68	28	--	--	72	40	8	--	68	12	--	--	6	44	8	--
Sida spinosa L.	48	4	4	--	76	36	4	--	4	12	4	--	2	24	--	--
Hyptis suaveolens L. Poit	25	52	--	--	100	52	8	--	88	32	--	--	96	56	--	--
Sida cordifolia L.	8	92	76	52	16	88	84	56	8	36	56	12	8	84	60	44
Senna obtusifolia	--	8	--	--	16	--	--	--	--	--	--	--	--	--	--	--
Boerhavia difussa L.	--	4	--	--	--	--	--	--	--	4	--	--	--	--	--	--
Lippia sidoides	16	--	--	--	24	12	--	--	28	8	--	--	12	--	--	--
Desmodium tortuosum (Sw.) DC.	--	--	--	--	--	--	--	--	--	4	--	--	4	4	--	--
Turnera ulmifolia L	--	--	--	--	--	--	--	--	--	--	--	--	12	4	--	--
Floehlichia humboldtiana	--	8	--	--	--	4	--	--	12	4	--	--	12	2	--	--
Senna corymbosa	--	8	--	--	4	2	--	--	16	4	--	--	4	12	--	--

This lower frequency of *Urochloa trichopus* grass was not expected, as it was the grass inserted by enrichment, however, in the year it was implemented (2012), when sowed it did not emerge due to lack of moisture in the soil, due to the seasonality of the period rainy, which resulted in only 221.4 mm. However, in June 2012 the region had a short rainfall, with a volume of 15.6 mm, allowing the emergence of some plants that soon disappeared due to lack of humidity. In January and February 2013, pulses with a volume of 76.3 mm were observed, but of short duration, which again caused the germination of the seeds and, due to lack of humidity, soon disappeared. In March 2013, more expressive pulses were observed, reaching 79.9 mm and with better distribution,

causing the germination of seeds still present, being responsible for the frequency presented in this study.

Despite the decrease in the propagation material in the seed bank of native species disposed of in the soil, these still showed significant diversity, with at least three native grasses being verified, four dicotyledonous herbaceous with greater nutritional value, and ten of lesser or no forage interest during grazing, thus showing the ability of these species to overcome water problems, as these possibly presented different dormancy for their seeds. In addition, herbaceous dicotyledon species from the Caatinga can also anticipate their reproductive cycle to ensure the maintenance of the seed bank (ARAÚJO FILHO, 2013).

Sida cordifolia L. presented greater frequency in all the treatments and evaluation times, a condition that may compromise the emergence of other species since it presents rapid growth and a high density of individuals per area (Table 1).

Sida cordifolia L. had greater frequency in all the treatments and evaluation seasons, conditions that can compromise the emergence of other species, as it has rapid growth and a high density of individuals per area. Species are little or not sought after in grazing, given the high concentrations of phenolic compounds, which inhibit consumption and digestion. It is a species of low forage value, causing little grazing by the animals, reinforcing the importance of evaluating the botanical composition of the Caatinga herbaceous vegetation and the diet of goats and its reflexes in the participation of each herbaceous species in the grazing areas of these animals, Pereira Filho and Bakke (2010), a reason to be present until the end of the experiment.

It is observed that the similarity of vegetation at the time of May/August presented an average percentage for treatments of 0.0%, 0.5%, 1.0%, and 1.5% of 38.56%, 60.05%, 33.08%, and 51.77%, respectively (Figure 2). In this period of May, before the animals were placed in the areas, compared to August, after the animals entered the area, the similarity of the herbaceous vegetation was 45.87%, which shows a high similarity of the herbaceous vegetation, with similarity with great botanical diversity.

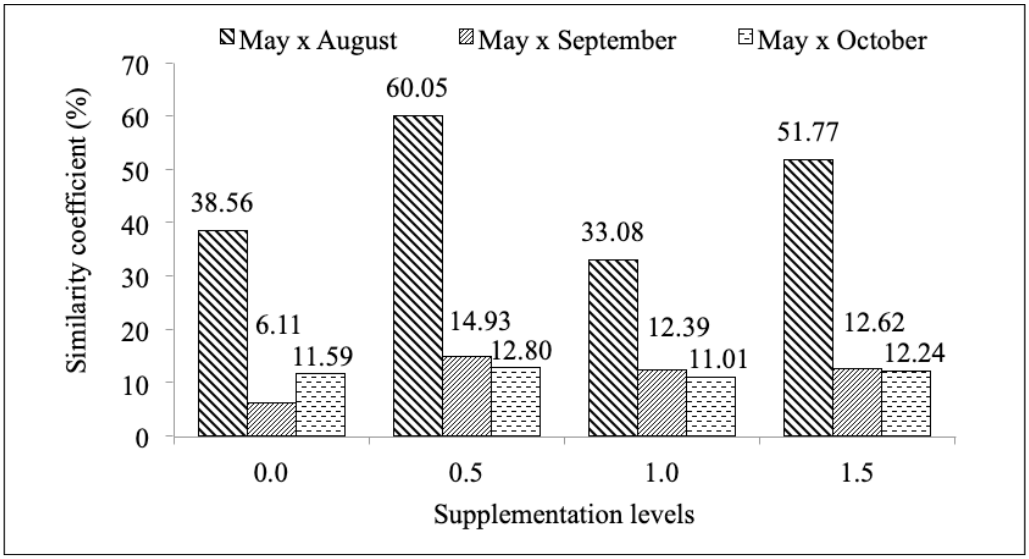


Figure 2 ► Similarity coefficient of herbaceous vegetation in an area of thinned Caatinga and enriched with *Urochloa trichopus* grass grazed by goats in each treatment in the different evaluation periods (May x August; May x September; May x October).
Source: experimental data

In the periods' May/September and May/October, a reduction of plants occurred, probably because the animals grazed the most palatable species, reducing their frequencies and consequently increasing the presence of plants of lower forage value. Other factors that may have contributed were the reduction that may be linked to the beginning of grazing of animals in the paddocks and the high availability and diversity of species present, offering the animals a choice and increasing grazing pressure on plants of greater forage value, resulting in a decrease in the availability of these species, intensified by the end of their phenological cycle.

The reduction in the similarity of the herbaceous vegetation with the drought can be related to the selection of the most palatable species by the animals at the beginning of the experiment, which reduces the possibility of choosing over the other evaluation periods. This result corroborates the statement by Santos *et al*. (2008), that the feeding preferences of sheep and goats are influenced by the frequency and availability of herbaceous plants. The higher the vegetation similarity coefficient in the grazed areas, the more similar the selection of species consumed by sheep and goats must have been.

The dendrogram was based on the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass before the experiment (Figure 3). It is observed the formation of six groups, and the longest distance is 0.78 m and groups most of the fodder. On the other hand, in the dendrogram using the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass during the experiment (Figure 4) it was observed the formation of five groups of forages very similar to that of the first dendrogram and the distance was reduced to 0.72.

Figure 3 ►
Dendrogram based on the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass before the experiment.
Source: experimental data

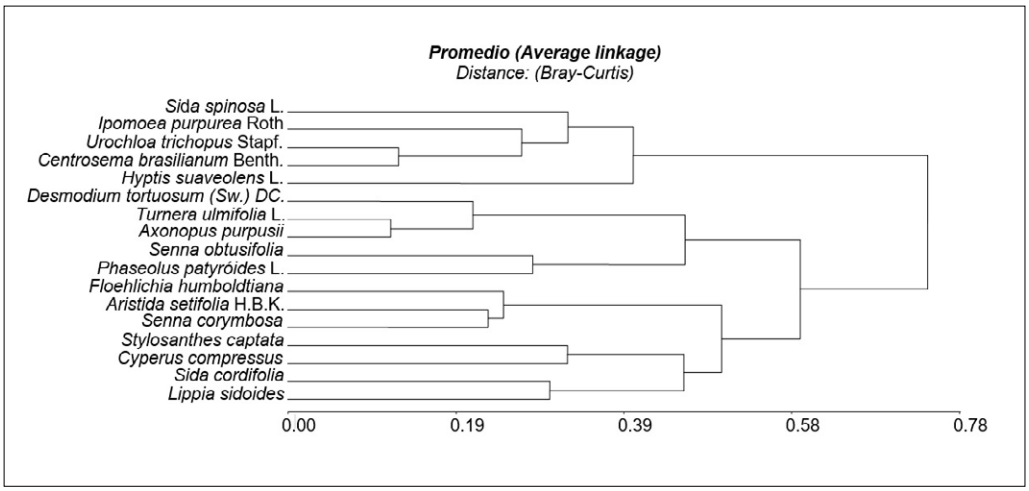
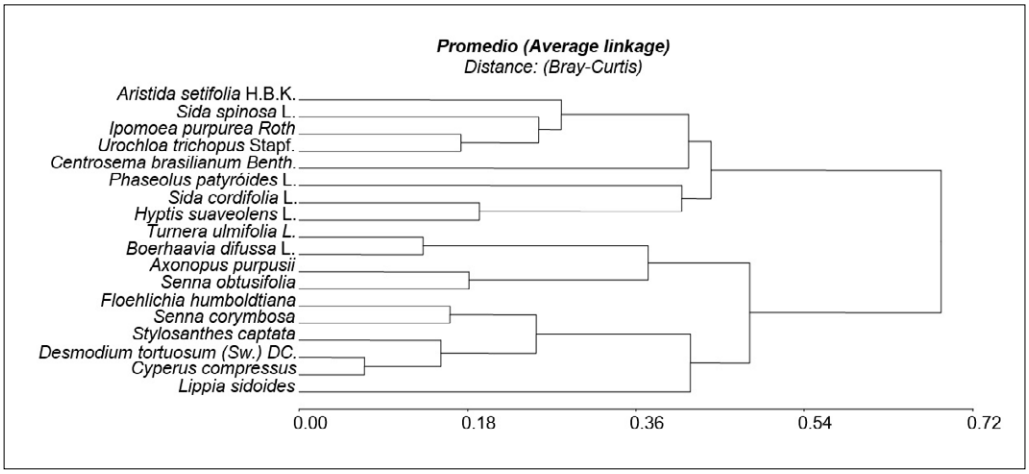
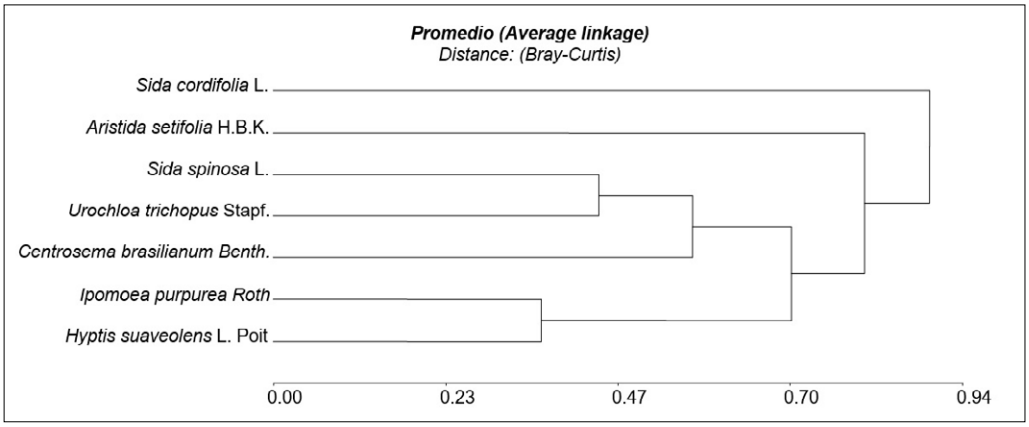


Figure 4 ▶
Dendrogram based on the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass, during the experiment.
Source: experimental data



In the dendrogram based on the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass at the end of the experiment (Figure 5), the formation of three groups and the distance increased to 0.94.

Figure 5 ▶
Dendrogram based on the similarity coefficient (Bray-Curtis) of herbaceous vegetation in areas grazed by goats at different levels of supplementation in thinned Caatinga and enriched with *Urochloa trichopus* grass at the end of the experiment.
Source: experimental data



Urochloa trichopus grass formed a group with *Sida cordifolia* L., whereas *Centrosema brasilianum*, however, maintained a small Bray-Curtis distance between the first two (0.47).

The availability of initial DM of *Urochloa trichopus* grass was 144.20 kg ha^{-1} (Table 2). Concerning plant components for the treatments, they totaled 2691.95, 2091.64, 1697.26, and 2341.8 kg ha^{-1} (Table 3), for the areas that received the levels 0.0%, 0.5%, 1.0%, and 1.5%, respectively.

Table 2 ▶
Availability (kg DM ha^{-1}) of *Urochloa trichopus* grass, dicots, other grasses, and litter among months of the year 2013.
Source: experimental data

Months	*Urochloa trichopus*	Dicots	Other grasses	Litter
May	144.20a	1.886a	149.47a	0.0c
August	27.19b	510b	0.0b	2.545a
September	21.51b	472b	0.0b	1.897b
October	13.28b	540b	0.0b	1.798b

Averages with different letters in the column differ by the Tukey test ($p < 0.05$)

Concerning the treatments, analyzing the percentage of each component, no effect was found ($p > 0.05$) for *Urochloa trichopus* grass, herbaceous dicots, other grasses, and litter (Table 3). The forage availability decreased according to the climatic variation, according to the evaluations. During the rainy season, when the plants grow, the Caatinga vegetation reaches its maximum production and the animals take advantage of the renewed herbaceous stratum. At that time, there is a great diversity of native and exotic naturalized plants that arise because of the appropriate rainfall for their development. However, during the dry season, the dormancy period of some species (ranging from 6 to 8 months), the forage production is reduced and, even without the presence of animals (e.g. deferred areas), losses occur (SAMPAIO, 2010).

Souza *et al*. (2013) found average dry matter (DM) levels ranging from 727.8 to 895.3 g kg^{-1}; mineral matter (MM) from 104.0 to 171.0 g kg^{-1}; crude protein (CP) from 72.5 to 85.4 g kg^{-1}; ether extract (EE) from 29.3 to 54.0 g kg^{-1}; neutral detergent fiber (NDF) from 684.6 to 767.9 g kg^{-1}; acid detergent fiber (ADF) from 605.8 to 720.8 g kg^{-1}; total carbohydrates (TCHO) from 690.7 to 783.5 g kg^{-1}; non-fibrous carbohydrates (NFC) from 80.9 to 118.4 g kg^{-1} and dry matter in vitro digestibility (DMIVD) ranging from 447 to 560 g kg^{-1}, in native Caatinga vegetation in transition from the rainy season to the dry season.

Table 3 ►
Availability (kg DM ha-1) of *Urochloa trichopus* grass, dicots, other grasses, and litter within each treatment.
Source: experimental data

Species	Supplementation levels (% of body weight)				Equation	R^2
	0.0	0.5	1.0	1.5		
Urochloa trichopus	42.95	58.91	44.87	59.45	Y=51.55	0.003
Dicots	886	1.181	559	782	Y=0.852	0.01
Other grasses	0.0	15.73	83.39	50.35	Y=37.37	0.04
Litter	1.763	2.017	1.010	1.450	Y=1.560	0.04

Forage availability decreased throughout evaluations (Table 2). The variation was 3082.19 a 2351.28 kg DM ha^{-1}. This reduction is related to the departure of animals and is associated with the absence of rain in August and September (Figure 1). Rainfall is therefore extremely important for the production of forage plants.

Urochloa trichopus grass availability in pasture decreased until the evaluations on August/2013, September/2013, and October/2013 (Table 2). This result is possibly associated with the period's rainfall and low rainfall (Figure 1). At the beginning of the experiment, this greater availability is directly related to the rainy season (Figure 1) or the absence of animals in the area.

In this context, supplementation of these animals is suggested, avoiding low performances in the dry season. Santos *et al*. (2018) evaluating the concentrated supplementation in the productive performance of lambs and lactating sheep in ryegrass pasture (*Lolium multiflorum*), observed that the use of the concentrate increased the average daily gain by 19.95% over the control treatment – ryegrass pasture without supplementation, in this sense, contributed to minimizing fluctuation in forage quality and providing greater stability of the average daily gain, especially when the nutritional content and digestibility of the pasture decreased.

The greatest availability of *Urochloa trichopus*, dicotyledonous and other grasses occurred in May, with 144.20, 1.886 e 149.47 kg DM/ha, respectively, which must be related to the high frequency identified in the areas, and the lowest availability occurred

in October: 13.28, 540 and 0.0 kg DM/ha, due to the reduction of some species, like the ones belonging to the group of vegetables. Regarding the other grasses, an occurrence was observed at the beginning of the experiment, however, disappearance occurred, which can be explained based on several factors, such as the phenology of most species found in this group, of the annual cycle, which may have accelerated its disappearance. Similar results to those observed in the study were reported by Pessoa *et al*. (2022), who evaluate forage availability and performance of goats in thinned caatinga enriched with *Urochloa trichopus* subjected to fallowing and fertilized with phosphorus, and found an initial availability for *Urochloa trichopus* grass, herbaceous dicots, and other grasses, with values of 18.59, 2.379 and 135.80 kg DM/ha, respectively.

The availability of dry matter in the Caatinga varies according to the time of year. The availability of dry matter in the Caatinga vegetation highlights values from 1.500 to 4.000 kg/ha and, depending on the soil cover by woody plants, the time of evaluation, the participation of grasses and herbaceous dicots, marked variations occur (PEREIRA FILHO *et al*., 2007). In thinned Caatinga submitted to alternate grazing of sheep and goats in the state of Ceará, yields ranging from 1263.2 to 1677.2 kg DM/ha of grasses, 258.6 to 525.9 kg DM/ha of herbaceous dicots were observed (PEREIRA FILHO *et al*., 2007). In turn, Formiga *et al*. (2012) observed a decrease in total forage production from 3,397 kg DM/ha in the rainy season to 1.413 kg DM/ha in the dry season, showing the effect of climatic factors on forage production in the Caatinga.

Mota *et al*. (2018) observed an average yield of 1713.6 kg DM/ha of grasses and 1469.3 kg DM/ha of dicotyledons in Caatinga pasture enriched with buffel grass (*Cenchrus ciliaris* L.).

In the rainy season, leaves located in higher strata of vegetation (e.g., shrub and tree plants) become available to animals, Oliveira *et al*. (2015), via litter deposition, promoting increased participation of higher strata vegetation in the diet of ruminants. In the soil, litter deposition, besides allowing consumption by animals, considerably reduces the risks of soil erosion, protecting it from the impacts of the first raindrops, besides is an excellent way of incorporating mineral nutrients into the soil (LOPES *et al*., 2009). Most of the forage is provided by the herbaceous stratum, with low participation of the foliage of trees and shrubs. However, as the dry season progresses, the foliage of woody species becomes the main source of forage for animals.

According to Araújo Filho (2013), litter provides the largest portion of forage available to the animal, especially at the beginning of the dry season, when the ruminant can select its best components. In addition, litter, at some times of the year, is considered an important component of available forage. Its constituents are leaves of trees and shrubs and stem and leaves of herbaceous species, loose in the soil, produced in the current year, and easily identifiable. Under the climatic conditions of the Caatinga, the degradation of the stubble is rapid. Accumulation occurs in the first months of the dry season, with substantial losses over the period and almost total disappearance in the middle of the wet season. For many areas of native pasture, litter is the basic component of soil protection and maintainer of organic matter and fertility.

4 Conclusion

The frequency of the species is more influenced by the environmental condition (rains) than by the management of Caatinga and, regardless of the level of concentrated supplementation used, the similarity coefficient remains above 48%.

In the thinned Caatinga and enriched with chain grass, regardless of the season, the availability of herbaceous components does not change with concentrated supplementation, but as the dry season is characterized, the availability of dry matter in herbaceous vegetation decreases, and that of litter increases.

More research should be done on which herbaceous plants can be used to enrich the Caatinga, to obtain better results at critical times of the year.

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References

AESA – AGÊNCIA EXECUTIVA DE GESTÃO DAS ÁGUAS DO ESTADO DA PARAÍBA. **Meteorologia – Chuvas.** Município: Santa Teresinha. 2013. Available at: http://www.aesa.pb.gov.br/aesa-website/meteorologia-chuvas/ . Accessed on: 14 May 2020. In Portuguese.

ALVARES, C. A.; STAPE, J. L.; SENTELHAS, P. C.; GONÇALVES, J. L. M.; SPAROVEK, G. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift**, v. 22, n. 6, p. 711-728, 2013. DOI: https://doi.org/10.1127/0941-2948/2013/0507 .

ARAÚJO FILHO, J. A. **Manejo pastoril sustentável da Caatinga**. Recife: Projeto Dom Helder Câmara, 2013. 200 p. Available at: http://repositorio.iica.int/bitstream/11324/4209/1/BVE17099221p.pdf . Accessed on: 11 June 2020. In Portuguese.

ARAÚJO FILHO, J. A. Manipulação da vegetação nativa da Caatinga com fins pastoris. *In*: MANEJO DE LA VEGETACIÓN NATIVA PARA LA PRODUCCIÓN DE RUMIANTES MENORES EM LAS ZONAS ARIDAS DE LATINO AMÉRICA, 2006, Fortaleza. **Taller de metodologías**. Fortaleza: Embrapa Caprinos: ICARDA, 2006. Available at: https://www.alice.cnptia.embrapa.br/handle/doc/532068 . Accessed on: 26 Sept. 2020. In Portuguese.

ARAÚJO FILHO, J. A.; VALE, L. V.; ARAUJO NETO, R.; BARBOSA, P.; SERPA, M. S. M. Dimensões de parcelas para amostragem do estrato herbáceo da Caatinga raleada. *In*: REUNIÃO ANUAL DA SOCIEDADE BRASILEIRA DE ZOOTECNIA, 23., 1986, Campo Grande. **Anais** [...]. Campo Grande: Sociedade Brasileira de Zootecnia, 1986. Resumo 228. p. 268. Available at: https://www.alice.cnptia.embrapa.br/handle/doc/514429 . Accessed on: 26 Sept. 2020. In Portuguese.

BRAY, J. R.; CURTIS, J. T. An ordination of the upland forest communities of Southern Wisconsin. **Ecological Monographs**, v. 27, n. 4, p. 325-349, 1957. DOI: https://doi.org/10.2307/1942268 .

FORMIGA, L. D. A. S.; PEREIRA FILHO, J. M.; SILVA, A. M. A.; OLIVEIRA, N. S.; SOARES, D. C.; BAKKE, O. A. Forage supply in thinned Caatinga enriched with

buffel grass (*Cenchrus ciliaris* L.) grazed by goats and sheep. **Acta Scientiarum. Animal Sciences**, v. 34, n. 2, p. 189-195, 2012. DOI: https://doi.org/10.4025/actascianimsci.v34i2.12548 .

INFOSTAT. Software estadístico. **InfoStat versión**. Córdoba: Universidad Nacional de Córdoba, Argentina, 2010. Available at: http://www.infostat.com.ar . Accessed on: 16 Mar. 2022.

LOPES, J. F. B.; ANDRADE, E. M.; LOBATO, F. A. O.; PALACIO, H. A. Q.; ARRAES, F. D. D. Deposição e decomposição de serapilheira em área da Caatinga. **Revista Agro@mbiente On-line**, v. 3, n. 2, p. 72-79, 2009. DOI: http://dx.doi.org/10.18227/1982-8470ragro.v3i2.252 . In Portuguese.

MOTA, N. S. O.; PEREIRA FILHO, J. M.; FORMIGA, L. D. A. S.; SILVA, A. M. A.; CÉZAR, M. F.; BAKKE, O. A.; BORBUREMA, J. B.; OLIVEIRA, R. L.; BEZERRA, L. R. Comparison between lambs and goat kids meat production of animals fed Caatinga vegetation enriched with buffel (*Cenchrus ciliaris* L.) grass. **Semina: Ciências Agrárias**, v. 39, n. 6, p. 2795-2806, 2018. DOI: http://dx.doi.org/10.5433/1679-0359.2018v39n6p2795 .

MUGABE, W.; MOATSWI, B.; NSINAMWA, M.; AKANYANG, L.; DIPHEKO, K.; MATTHEWS, N.; NAZAR, M.; SHAH, I. A.; SHUAIB, M.; SHAH, A. A. Dry matter biomass productivity and composition of grasses along grazing gradient in fenced and unfenced grazing areas of the Gaborone North, Botswana. **Journal of Animal Research and Nutrition**, v. 2, n. 2, p. 1-6, 2017. DOI: http://dx.doi.org/10.21767/2572-5459.100031 .

NRC – NATIONAL RESEARCH COUNCIL. **Nutrient requirements of small ruminants**: sheep, goats, cervids, and new world camelids. Washington, D.C.: National Academy Press, 2007. 384 p.

OLIVEIRA, M. C. Capim-urocloa. *In*: KIILL, L. H. P.; MENEZES, E. A. (ed.). **Espécies vegetais exóticas com potencialidades para o semiárido brasileiro**. Brasília, DF: Embrapa Informação Tecnológica, 2005. p. 219. In Portuguese.

OLIVEIRA, O. F.; SANTOS, M. V. F.; CUNHA, M. V.; MELLO, A. C. L.; LIRA, M. A.; BARROS, G. F. N. P. Características quantitativas e qualitativas de Caatinga raleada sob pastejo de ovinos, Serra Talhada (PE). **Revista Caatinga**, v. 28, n. 3, p. 223-229, 2015. Available at: https://periodicos.ufersa.edu.br/index.php/caatinga/article/view/3671 . Accessed on: 16 Mar. 2022. In Portuguese.

PEREIRA FILHO, J. M.; ARAÚJO FILHO, J. A.; CARVALHO, F. C.; REGO, M. C. Disponibilidade de fitomassa do estrato herbáceo de uma Caatinga raleada submetida ao pastejo alternado ovino-caprino. **Livestock Research for Rural Development**, v. 19, n. 1, p. 1-14, 2007. Available at: http://www.lrrd.org/lrrd19/1/pere19002.htm . Accessed on: 16 Mar. 2022. In Portuguese.

PEREIRA FILHO, J. M.; BAKKE, A. O. Produção de forragem de espécies herbáceas da Caatinga. *In*: GARIGLIO, M. A.; SAMPAIO, E. V. S. B.; CESTARO, L. A.; KAGEYAMA, P. Y. (ed.) **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília, DF: Serviço Florestal Brasileiro, 2010. p. 145-159. Available at: https://www.florestal.gov.br/publicacoes/563-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga . Accessed on: 16 Mar. 2022. In Portuguese.

PEREIRA FILHO, J. M.; SILVA, A. M. A.; CEZAR, M. F. Manejo da Caatinga para produção de caprinos e ovinos. **Revista Brasileira de Saúde e Produção Animal**, v. 14, n. 1, p. 77-90, 2013. DOI: https://doi.org/10.1590/S1519-99402013000100010 . In Portuguese.

PESSOA, R. M. S.; SILVA, D. S.; PEREIRA FILHO, J. M.; SILVA, A. M. A.; FERREIRA, J. M. S.; NASCIMENTO, G. V. Forage availability and weight gain of goats on caatinga enriched with *Urochloa trichopus* (Hochst.) Stapf subjected to fallowing and fertilized with phosphate. **Ciência Animal Brasileira**, v. 23, e-70080, 2022. DOI: https://doi.org/10.1590/1809-6891v22e-70080 .

SAMPAIO, E. V. S. B. Características e potencialidades. *In*: GARIGLIO, M. A.; SAMPAIO, E. V. S. B.; CESTARO, L. A.; KAGEYAMA, P. Y. (ed.). **Uso sustentável e conservação dos recursos florestais da Caatinga**. Brasília, DF: Serviço Florestal Brasileiro, 2010. p. 29-48. Available at: https://www.florestal.gov.br/publicacoes/563-uso-sustentavel-e-conservacao-dos-recursos-florestais-da-caatinga . Accessed on: 16 Mar. 2022. In Portuguese.

SANTOS, G. R. A.; BATISTA, A. M. V.; GUIM, A.; SANTOS, M. V. F.; SILVA, M. J. A.; PEREIRA, V. L. A. Determinação da composição botânica da dieta de ovinos em pastejo na Caatinga. **Revista Brasileira de Zootecnia**, v. 37, n. 10, p. 1876-1883, 2008. DOI: https://doi.org/10.1590/S1516-35982008001000023 . In Portuguese.

SANTOS, S. K.; FALBO, M. K.; SANDINI, I. E.; PACENTCHUK, F.; NEUMANN, M.; GARBOSSA, G. Concentrate supplementation strategies in ryegrass pasture for productive performance in lambs. **Spanish Journal of Agriculture Research,** v. 16, n. 1, p. 1-6, 2018. DOI: https://doi.org/10.5424/sjar/20181614-11067 .

SAS – STATISTICAL ANALYSIS SYSTEM. **General Linear Model**: 8.2. Cary, NC, USA: SAS Institute, 2007.

SILVA, C. M. M. S.; OLIVEIRA, M. C.; SOARES, J. G. G. **Avaliação de forrageira nativas e exóticas para região semiárida do Nordeste**. Petrolina PE: Embrapa-CPATSA, (Embrapa-CPATSA. Documento número 27). 1984, 38 p. Available at: https://ainfo.cnptia.embrapa.br/digital/bitstream/CPATSA/2878/1/SDC27.pdf . Accessed on: 20 Aug. 2020. In Portuguese.

SILVA, D. C.; GUIM, A.; SANTOS, G. R. A.; SOUZA, E. J. O. URBANO, S. A.; MESQUITA, F. L. T.; LAFAYETTE, E. A. Intake and digestibility of crossbred goats finished on Caatinga grassland receiving feed supplementation during dry season. **Revista Brasileira de Saúde e Produção Animal**, v. 17, n. 3, p. 484-496, 2016. DOI: http://doi.org/10.1590/S1519-99402016000300014 .

SILVA, N. L.; ARAÚJO FILHO, J. A.; SOUSA, F. B. **Manipulação da vegetação da Caatinga para produção sustentável de forragem**. Sobral: Embrapa Caprinos e Ovinos, 2007. 11 p. (Circular Técnica, 34). Available at: https://www.embrapa.br/busca-de-publicacoes/-/publicacao/521357/manipulacao-da-vegetacao-da-caatinga-para-producao-sustentavel-de-forragem . Accessed on: 16 Mar. 2022. In Portuguese.

SOUZA, C.; BARRETO, H. F.; GURGEL, V.; COSTA, F. Disponibilidade e valor nutritivo da vegetação de Caatinga no Semiárido norte-rio-grandense do Brasil. **Revista**

Holos, v. 3, p. 196-204, 2013. DOI: https://doi.org/10.15628/holos.2013.1332 . In Portuguese.

SUDENE – SUPERINTENDÊNCIA DO DESENVOLVIMENTO DO NORDESTE. **Resolução nº 115, de 23 de novembro de 2017**. Brasília, DF: SUDENE, 2017. Available at: https://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/739568/do1-2017-12-05-resolucao-n-115-de-23-de-novembro-de-2017-739564 . Accessed on: 16 Mar. 2022. In Portuguese.

THE ALLIANCE OF BIOVERSITY INTERNATIONAL AND CIAT. *Urochloa mosambicensis*. **Tropical forages**: an interactive selection tool. [*online version*], Brisbane, Australia: CSIRO, DPI&F (Qld), CIAT, ILRI, 2020. Available at: https://www.tropicalforages.info//text/entities/urochloa_mosambicensis.htm . Accessed on: 14 Mar. 2022.