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Forage supply in thinned Caatinga enriched with buffel grass (*Cenchrus ciliaris* L.) grazed by goats and sheep

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ABSTRACT. Forage supply from herbs was assessed in a thinned Caatinga enriched with buffel grass (*Cenchrus ciliaris* L.) exposed to goat and sheep grazing. The 2.4 ha experimental area, located at the Experimental Station of the Federal University of Campina Grande, in Santa Terezinha, Paraíba State, Brazil, was divided into four 0.6 ha paddocks, which were further subdivided into two 0.3 ha experimental plots. Twelve F1 (Boer x SRD) goats and 12 Santa Inês sheep were divided in four groups of six animals of the same species. The herbaceous vegetation was separated into buffel grass (*Cenchrus ciliaris* L.), dicotyledons and other grass species. Treatments were randomized to plots according to a completely random design with two treatments, four replications, with measures repeated in time (July/1, Aug/1, Sept/1 and Oct/1. Buffel grass dry mater (DM) availability was higher in the sheep grazed than in the goat-grazed area. Buffel grass DM supply did not change from July to September, while dicotyledons DM supply decreased. Grazing affected availability, accumulation rate and supply of the forage produced (DM basis) by dicotyledonous herbs. Buffel grass forage availability was not affected during the experimental period.

Keywords: availability, dicotyledons, frequency, grass, herbs, dry matter accumulation rate.

Oferta de forragem em Caatinga raleada e enriquecida com capim buffel (*Cenchrus ciliaris* L.) pastejada por ovinos e caprinos

RESUMO. Objetivou-se avaliar a oferta de forragem do estrato herbáceo de uma Caatinga raleada e enriquecida com capim buffel (*Cenchrus ciliaris* L.), submetida ao pastejo de caprinos e ovinos. O experimento foi realizado na Universidade Federal de Campina Grande, Estado da Paraíba. A área experimental foi de 2,4 ha, dividida em quatro piquetes de 0,6 ha, nos quais foram alocadas parcelas experimentais de 0,3 ha. Utilizaram-se 12 caprinos F1 (Bôer x SRD) e 12 ovinos Santa Inês, que foram distribuídos em quatro grupos de seis animais. A vegetação herbácea foi separada em capim buffel (*Cenchrus ciliaris* L.), dicotiledôneas e outras gramínea. Utilizou-se um delineamento inteiramente casualizado, com observações repetidas no tempo (1/jul., 1/ago., 1/set. e 1/out.). A disponibilidade de matéria seca (MS) de capim buffel na área pastejadas por ovinos foi superior ao observado na área ocupada por caprinos. A oferta de MS de capim buffel não variou com os períodos de avaliações. Já para as dicotiledôneas foi observado uma redução no decorrer das épocas de avaliações na oferta de MS. O pastejo dos animais afetou a disponibilidade, taxa de acúmulo e oferta de MS das dicotiledôneas herbáceas. O período de avaliação não interferiu na disponibilidade do capim buffel.

Palavras-chave: disponibilidade, dicotiledôneas, frequência, gramínea, herbáceas, taxa de acúmulo de matéria seca.

Introduction

The potential of annual dry matter (DM) production of the Caatinga from the above-ground forage of herbs, shrubs and trees reaches 4 x 10^3 kg ha^{-1} (ARAÚJO FILHO et al., 2002). However, most of it is not available to animals unless certain management practices are used, such as Caatinga thinning and enrichment (BAKKE et al., 2010).

Caatinga enrichment consists of removal, at the end of the dry season, of shrubs and tree species that produce no forage, control of their sprouts in order to reduce tree canopy shading to 15% of the soil surface in the following rainy season, and seeding desirable forage-producing herb species. This management practice allows the growth of the native and introduced herb species, increasing the availability of better quality forage and nutritional factor in animal performance (CARVALHO JÚNIOR et al., 2011). Buffel grass (Cenchrus ciliaris L.) is the most utilized species to enrich semiarid areas of Northeast Brazil. Its use increases grass DM production and availability, while partially

preserving the forage supply of dicotyledonous herbs. Ultimately, more nutrients are made available to improve animal performance.

It has been shown that the carrying capacity of grass-enriched Caatinga sites is increased to 10 sheep or goats ha^{-1}, resulting in an annual live body weight increase of 90 to 110 kg ha^{-1} (ARAÚJO FILHO et al., 2002).

In addition to DM availability, studies on forage production in Caatinga should consider other factors, such as plant species frequency, rate of biomass accumulation and forage supply. That is because during the rainy period of the year, seasonal dominant herb species show fast growth and short life cycle, resulting in forage excess and shortage during the wet and dry season, respectively. The continuous grazing system commonly adopted in the semiarid region of Northeast Brazil is unsuitable to this pattern of forage production, and results in quantitative and qualitative losses.

The few studies on sheep and goat grazing effects on Caatinga sites concluded that sheep and goat grazing pressure on grasses and dicotyledonous forage species, respectively, in successive years, can exclude these components from pastures, especially those with higher nutritive value. Thus, it is important to study DM supply from herbs, especially following Caatinga enrichment by an exotic grass species submitted to grazing by small ruminants.

This study evaluated dry matter supply from herb species in a thinned Caatinga site enriched with buffel grass (*Cenchrus ciliaris* L.), under goat and sheep grazing.

Material and methods

The experiment was carried out at the Experimental Station of the Federal University of Campina Grande-CSTR, in Santa Terezinha municipality, in the Sertão Paraibano physiographic zone. Soil types are irregularly mixed or associated with relief conditions. Dominant soil types are non-calcic and planosols, although dystrophic entisols are eventually observed as well.

According to the Köppen classification, the regional climate is BShw' - semiarid with short summer-fall rainy season, with rainfall concentrated in March and April. Total annual precipitation ranges from 150 to 1,300 mm, and mean annual precipitation, based on long-term data, is 500 mm. Average, minimum and maximum temperatures are 28, 22 and 35°C, respectively. Average air moisture is 60%. During the experiment, monthly rainfall values were 88.0, 14.7, 17.2, 0.0, 5.5 and 0.0 for May, June, July, August, September and October, respectively.

Shrubs and trees were selectively cut from the experimental area in December 2007 to ensure 15% of soil cover by the canopies of woody species (BAKKE et al., 2010; PEREIRA FILHO; BAKKE, 2010), while buffel grass seeding occurred in February 2008.

Twelve ½-Boer goats and 12 Santa Inês lambs with 15 kg of live body weight (LW) were used in the experiment. They were identified by numbered colored collars and received routine vaccines and purge treatment for endo- and ectoparasites.

The 2.4 ha experimental area was divided in four 0.6 ha paddocks that received six goats or six lambs when estimated forage DM availability reached 2,000 kg. Animals had *ad libitum* access to containers with complete mineral mixture and water in each paddock.

Vegetation was evaluated by randomly sampling 0.25 x 1.0 m plots in each paddock (ARAÚJO FILHO et al., 2002) on June 1, July 1, August 1, September 1 and October 1. The frequency of each species was determined based on the percentage of plots where each species was observed.

Dry matter availability, accumulation rate and supply were estimated on July 1, August 1, September 1 and October 1. After collection, fresh plant biomass was sorted out in three categories (buffel grass, herbaceous dicotyledons and other grasses), cut into pieces, stored in plastic bags and weighed. Sampling intensity in each paddock and date totaled 20 points randomized on the North-South and East-West transects crisscrossing the central point of each 0.6 ha area.

Forage accumulation rate (TAC_j) and supply were estimated from data collected in 1.0 x 1.0 m exclusion areas where no goat or sheep was allowed to graze, using the following equations:

$TAC_j = (DG - FG)\ n^{-1}$ (CAMPBELL, 1966),

TAC_j = daily DM accumulation rate in kg hA^{-1}, in the j-th replication,

DG=forage biomass inside the exclusion area in kg ha^{-1} (DM basis),

FG=forage biomass outside the exclusion area in kg ha^{-1}, (DM basis), and n=number of days.

Accumulation rate values were estimated on July 1, August 1, September 1 and October 1, and corresponded to the previous 30 days of forage growth.

$$OF = \left[\left(\frac{\frac{MF1 + MF2}{n} + TAC}{CA} \right) \right] x100$$

where:

OF = forage biomass supply (DM basis) in kg 100 kg^{-1} of live body weight;

MF_1 = forage biomass (DM basis) at day 1;

MF2 = forage biomass (DM basis) at the last day (y) of the period;

n = number of days between day 1 and day "y";

TAC = daily DM accumulation rate in kg ha^{-1}, and CA = mean daily animal allotment in the period, in kg of LBW ha^{-1}.

Treatments were assigned to plots (paddocks) according to a completely random design with two treatments (goat and sheep) and four replications of six animals, and repeated measures over time (four dates in July, August, September and October) and data were analyzed by the ANOVA technique, and means were compared by the ANOVA F test or by Tukey's test methodology ($p < 0.10$) using SAS (2004).

Results and discussion

Herb species were more frequent in June than later in the year, due to better environmental conditions (soil moisture from rainfall) (Table 1). More than one species showed high frequency and was present in more than 50% of the samples, especially buffel grass in both goat- and sheep-grazed areas, demonstrating its resistance to grazing, adaptation to regional climate and suitability to enrich thinned Caatinga sites. *Andropogon gayanus*, an exotic grass species, was observed in all dates and increased frequency (5 to 20%) in goat-grazed areas, while decreasing its frequency (0 to 10%) in sheep-grazed areas. This trend was expected, as goats prefer forage from shrubs, trees, herbaceous dicotyledons and grasses, in that order (PEREIRA FILHO; BAKKE, 2010).

Table 1. Frequency (%) of herb species in thinned Caatinga enriched with buffel grass, under sheep or goat grazing, during five months of a year.

Species	Month									
	Jun. 1		Jul. 1		Aug. 1		Sept. 1		Oct. 1	
	S*	G**	S	G	S	G	S	G	S	G
Grasses										
Andropogon gayanus	-	5	5	5	-	5	-	10	-	20
Aristida setifolia	15	40	50	55	25	55	55	35	40	25
Brachiaria mollis	-	20	-	-	-	-	-	-	-	-
Cenchrus ciliaris	100	95	85	90	85	60	45	60	55	65
Urochloa mosambicensis	-	-	-	20	-	-	-	5	5	10
Dicotyledons										
Arachis pintoi	20	45	5	35	-	-	-	-	-	-
Centrosema sp.	95	80	75	95	45	85	-	-	-	-
Desmodium sp.	25	20	-	-	-	-	-	-	-	-
Indigofera anil	45	50	55	40	5	45	10	5	-	-
Mimosa pudica	10	10	10	5	5	-	5	-	-	-
Rhychosia minima	100	100	90	95	20	35	15	20	10	5
Stylosanthes guianensis	60	65	30	45	-	-	-	-	-	-
Tibouchina grandifolia	20	5	20	-	10	10	5	-	5	-
Amaranthus deflexus	85	65	65	25	-	30	-	-	-	-
Hyptis suaveolen	90	65	95	90	65	75	55	55	75	70
Ipomoea sp.	45	70	70	80	-	-	35	30	20	10
Malvastrum coromandelianum	20	40	30	45	10	45	10	35	-	5
Merremia aegypti	5	-	20	5	40	50	-	-	-	-
Turnera ulmifolia	10	5	5	20	15	25	-	5	5	15

*S- sheep; **G- Goat.

Other grass species, except *Cenchrus ciliaris* and *Aristida setifolia*, were not observed on sheep-grazed areas from August onward, as a result of the grass preference of this animal species and reduced soil moisture.

Changes in herb community were characterized by a general frequency increase of undesirable species. For example, *Aristida setifolia*, a grass that produces low quality forage, increased frequency from 15% in June to 55% in September, in sheep-grazed areas. *Malvastrum coromandelianum*, a dicotyledonous bush, showed a similar trend, and was observed during the dry season.

Grass frequency was higher in the goat grazed paddocks, as these animals prefer to forage on dicotyledons. Frequency change of dicotyledons was not observed in such a high degree in either sheep or goat-grazed areas. This may be explained by the findings of Bartolomé et al. (1998). These authors state that sheep and goat are opportunistic grazers (i.e.: they change their feeding behavior according to plant diversity). Also, it can be explained by the higher drought resistance and low nutricional value (FORMIGA et al., 2011), or longer phenological cycle (PEREIRA FILHO; BAKKE, 2010).

The main legume species were *Rhychosia minima*, *Centrosema* sp., *Indigofera anil*, *Arachis pintoi*, *Stylosanthes guianensis*, and other non-legume species such as *Hyptis suaveolens*, *Amaranthus* sp. and *Ipomoea* sp. showed higher frequency in June, at the end of the raining season, afterwards diminished their participation, and ultimately some of them disappeared after August. Probably, this is a negative effect associated with climate, soil, trampling and short life cycle of plants.

The only two plant species observed in the sheep and goat-grazed areas at all data collection dates were *Cenchrus ciliaris* and *Aristida setifolia* (grasses), and *Rhychosia minima* and *Hyptis suaveolens* (dicotyledon), probably a direct effect of the good resistance of these species to the environmental conditions of the region. In general, disappearance of herb species in either sheep or goat grazed paddocks proved to be related to the dry season.

Dry matter availability and buffel grass frequency were higher in the sheep-grazed area than in the goat-grazed area ($p < 0.10$) (Table 2). This is unexpected, and was likely due to a change in the feeding behavior of those animals. According to Piazzetta et al. (2009), grazing lambs are able to balance their diet with grasses and dicotyledons in order to improve the quality of ingested food, especially when there is floristic diversity (ANIMUT et al., 2005). This kind of behavior was

observed by Champion et al. (2004) in sheep grazing on clover or ilex. The animals spent 57% of the time grazing on clover, which resulted in 62% of the total ingested food. On the other hand, it is possible that goats, due to their food intake ability, learned to selected more leafy forage from grasses than sheep (TAVARES et al., 2005), corroborating reports by Bremm et al. (2005) that higher levels of leaf availability affect grazing behavior and animals ingest a higher-quality diet to fulfill their nutrient requirements.

Table 2. Dry mater availability, accumulation rate and supply of buffel grass, dicotyledons and other grasses in sheep or goat-grazed áreas.

Variable	Sheep-grazed area	Goat-grazed area	CV (%)
Forage availability (kg DM ha^{-1})			
Buffel grass	1295.6 A	495.5 B	49.6
Other grasses	129.3 A	148.3 A	72.6
Total	2461.1 A	1984.5 B	20.4
Buffel grass (%)	45.5 A	28.5 B	33.4
Dicotyledons (%)	47.4 B	59.4 A	22.7
Other grasses (%)	7.1 B	12.0 A	76.4
Accumulation rate (kg DM ha^{-1} day^{-1})			
Buffel grass	5.0 A	4.5 A	98.1
Dicotyledons	11.2 A	18.6 A	61.3
Other grasses	2.1 B	4.4 A	54.9
Total	18.3 A	27.6 A	40.4
Buffel grass (%)	34.8 A	16.5 A	93.7
Dicotyledons (%)	54.1 A	65.5 A	47.9
Other grasses (%)	11.1 A	18.0 A	54.6
Forage supply (kg DM 100 kg^{-1} LW day^{-1})			
Buffel grass	32.9 A	13.3 B	30.1
Dicotyledons	31.7 B	48.2 A	24.3
Other grasses	4.7 A	7.0 A	49.1
Total	69.3 A	68.4 A	19.8

Means followed by different letters in the same row differ significantly ($p < 0.10$) by Student's t test.

In general, DM availability (kg ha^{-1}) of grasses other than buffel grass was low (maximum of 148 kg ha^{-1}), and showed no differences between sheep or goat-grazed areas. It is possible that enrichment with buffel grass reduced the contribution from other grasses, although it provided a great amount of total available forage.

The greater participation (%) of dicotyledons and other grasses in goat-grazed areas (Table 2) should be due to the great quantity of buffel grass. This induced or allowed a more intense selection of this forage instead of that from dicotyledons. Also, goats are known to be opportunistic grazers (BARTOLOMÉ et al., 1998) and may change their feeding behavior depending on pasture composition.

This may be related to animal forage selection, especially considering the presence of grass species of low nutritive value, such as Aristida setifolia, (FORMIGA et al., 2011).

There was no significant ($p > 0.10$) effect of sheep or goat on DM accumulation rate of buffel grass, dicotyledons and other grasses, however the 4.4 DM accumulation rate of other grasses in goat-grazed areas showed to be higher ($p < 0.10$) than the 2.2 rate value estimated for the sheep-grazed areas, showing sheep preference to forage from native grasses, while goats prefer buffel grass forage.

Buffel grass forage supply was higher ($p < 0.10$) in sheep-grazed areas than in goat-grazed areas: 32.9 vs. 13.3 kg DM 100 kg^{-1} LW day^{-1}. This may be associated with sheep refusal to consume this grass forage and preference to ingesting more nutritive dicotyledonous forage. In goat-grazed areas, dicotyledon supply was significantly ($p < 0.10$) higher than in sheep-grazed areas.

Interaction was significant ($p < 0.10$) for DM availability of dicotyledons (Table 3). In July and August it was higher in goat-grazed areas, while in October it was higher in sheep-grazed areas.

Table 3. Availability of forage from dicotyledons in thinned Caatinga enriched with buffel grass, in sheep - or goat-grazed areas, estimated in four months of the year.

Species	Months			
	Jul. 1	Aug. 1	Sept. 1	Oct. 1
Sheep	2079.0 Ba	888.5 Bb	539.8 Ac	637.4 Abc
Goat	2652.6 Aa	1794.3 Ab	579.3 Ac	336.6 Bc

Means followed by different uppercase letters in the same column are different ($p < 0.10$) by Student's t test. Means followed by different lowercase letters in the same line are different ($p < 0.10$) by Student's t test.

Sheep - or goat-grazed areas showed higher forage availability in July 1 than in the other months, possibly as a consequence of the decrease in soil moisture from July onward, which can be corroborated by the gradual decrease in dicotyledon frequency. According to Animut et al. (2005), this dynamic balance between grass and dicotyledonous herbaceous forage may change selectivity by sheep and goats during the year.

Buffel grass DM availability (Table 4) did not change significantly from July to October, and ranged from 682.5 (October 1) to 1091.3 kg ha^{-1} (September 1). Moreira et al. (2007), in a rotational grazing study with cattle, reported buffel grass dry mater availability ranging from 5908.1 to 3076.5 kg ha^{-1}. These values for dry mater availability in grazed or ungrazed areas indicate the high resistance of buffel grass to the environmental conditions of the semiarid region of northeast Brazil, and its exceptional sprouting capacity after grazing (ALBUQUERQUE et al., 2002). Depending on rainfall quantity and distribution, forage maturation is accelerated or retarded (ARAÚJO FILHO et al., 2002).

Table 4. Buffel grass, dicotyledons and other grasses dry matter (DM) availability, accumulation rate and supply, in a thinned Caatinga enriched with buffel grass grazed by sheep and goats, from June to October.

Variable	Month			
	Jul. 1	Aug. 1	Sept. 1	Oct. 1
Forage availability (kg DM ha^{-1})				
Buffel grass	956.8 A	851.6 A	1091.3 A	682.5 A
Dicotyledons ϕ	2366.0	1341.3	559.6	486.9
Other grasses	74.8 B	128.2 AB	108.5 AB	243.6 A
Total	3397.6 A	2321.1 B	1759.4 BC	1413.0 C
Buffel grass (%)	22.7 C	31.7 BC	52.8 A	40.9 AB
Dicotyledons (%)	74.8 A	62.6 A	40.3 B	36.2 B
Other Grasses (%)	2.6 B	5.7 B	6.8 B	23.0 A
Accumulation rate (kg DM ha^{-1} day^{-1})				
Buffel grass	3.7 A	6.5 A	4.8 A	3.9 A
Dicotyledons	15.6 AB	11.5 AB	23.4 A	9.1 B
Other grasses	2.1 B	1.4 B	3.8 AB	5.9 A
Total	21.4 AB	19.4 AB	32.0 A	18.9 B
Buffel grass (%)	36.6 A	39.8 A	13.1 A	23.1 A
Dicotyledons (%)	64.7 A	52.4 A	75.7 A	46.5 A
Other grasses (%)	8.7 B	7.8 B	11.2 B	30.4 A
Forage supply (kg DM 100 kg^{-1} LW day^{-1})				
Buffel grass	19.9 A	23.3 A	24.2 A	25.0 A
Dicotyledons	66.1 A	43.6 B	33.6 B	16.5 C
Other grasses	8.3 A	2.8 B	4.8 AB	7.5 A
Total	94.2 A	69.7 B	62.6 BC	49.0 C

Means followed by a different uppercase letter in the same row differ by Student's t test ($p < 0.10$). ϕ= indicates grazing x date interaction effect, referred to in Table 2.

Dry mater availability of the other grasses averaged 74.8 kg ha^{-1} in July, significantly ($p < 0.10$) lower than the 243.6 kg ha^{-1} average observed in October, and similar to the values reported for August and September. This may be related to animal forage selection, especially considering the presence of grass species of low nutritive value, such as *Aristida setifolia*.

Total DM availability on July 1 (3397.6 kg ha^{-1}) was higher ($p < 0.10$) than in August, September and October. That value was close to the 4000 kg ha^{-1} reported by Araújo Filho et al. (2002) as the potential of DM production in thinned Caatinga sites. Although dry mater availability decreased between July and August, and from August to October ($p < 0.10$) when it reached a minimum value of 1413.0 kg ha^{-1}, forage availability are considerably high for semiarid regions.

Buffel grass accounted for 22.7% in July, significantly ($p < 0.10$) less than September and October values (52.8 and 40.9%, respectively). Dicotyledons showed an opposite trend: higher ($p < 0.10$) participation in July (74.8%) than in September (40.3%) or October (36.2%), probably due to high diversity especially of legume species (PEREIRA FILHO et al., 2007) that normally show a high nutritive value and, for that reason, were grazed more intensely by sheep and goats, and thus grass forage increased its participation. Also, soil moisture is expected to decrease continuously from July to October after the end of the rainy season in late June to early July, and grasses demand less water to grow than herbaceous dicotyledons. These climate and plant characteristic can further explain the reported changes in grasses and dicotyledons DM availability from July to October.

Buffel grass dry mater accumulation rate did not change significantly ($p > 0.10$) from July to October. Dry mater accumulation rates of dicotyledons were similar ($p > 0.10$) from July to September, but decreased ($p < 0.10$) from September to October. Certainly, this results from the decrease in soil moisture after the end of the rainy season in late June to early July. Also, physiological maturation also affects DM accumulation rate of plants. For example, according to Cauduro et al. (2006), the accumulation rate of leaves decreases after flowering.

The highest DM accumulation rate value of other grasses was observed in October, and this value was significantly ($p < 0.10$) higher than July and August values, which were similar ($p > 0.10$). This higher value observed in October results from the expected maturation of forage from other grasses and the high frequency of *Aristida setifolia* among other grasses. Together, these factors render forage unpalatable and induce animals to express their selective ability to consume leaf and tender grass stalks (PARIS et al., 2008).

No significant ($p > 0.10$) differences were observed between months for buffel grass dry mater supply. This grass has proved to be highly adapted to soil and climate conditions of the semiarid region of northeast Brazil, persisting in pasture under adequate grazing pressure and showing stable forage production during almost all of the year (DANTAS NETO et al., 2000; SANTOS et al., 2005).

Dicotyledon dry mater supply decreased ($p < 0.10$) progressively from July (66.1 kg DM 100 kg^{-1} LV day^{-1}) to August-September and October (16.5 kg DM 100 kg^{-1} LW day^{-1}). Probably, this decrease results from preferable grazing of the more palatable and nutritive value of dicotyledons and from natural disappearance of dicotyledons with short life cycles. Aroeira et al. (2005) explain that decreases in legume species in mixed pastures may result from water, light and nutrients competition exerted by grasses.

Dry matter supply from other grasses decreased ($p < 0.10$) from July (8.3kg DM 100 kg^{-1} LW day^{-1}) to August (2.8 kg DM 100 kg^{-1} LW day^{-1}) and returned to July levels in October (7.5 kg DM 100 kg^{-1} LW day^{-1}). This reflects the drought resistance of grasses (RIBASKI; MENEZES, 2002) or the presence of nutritionally poor or less palatable grasses (NEVES et al., 2009).

Total DM supply in July (94.2 kg DM 100 kg^{-1} LW day^{-1}) was higher ($p < 0.1$) than that observed in

August (69.7 kg DM 100 kg^{-1} LW day^{-1}), September (62.6 kg DM 100 kg^{-1} LW day^{-1}) and October (49.0 kg DM 100 kg^{-1} LW day^{-1}). August total DM supply was similar ($p > 0.10$) to September and higher ($p < 0.10$) than the October value, while September and October values were similar ($p > 0.10$). This decrease may be associated to a high pressure grazing on the most preferable plant species, which also affects diet quality and the persistence of the overgrazed species (CARVALHO; MORAES, 2005). Again, total dry mater supply followed the same trend observed for dicotyledons, showing how important these species were on determining forage supply.

Conclusion

Termination of sheep and goats in thinned Caatinga enriched with *Cenchrus ciliaris* favored some undesired species such as the grass *Aristida setifolia* and decreased availability, accumulation rate and DM supply of herbaceous dicotyledons, but did not decrease forage availability of *Cenchrus ciliaris*, and forage accumulation rate and DM supply. Availability of *Cenchrus ciliaris* forage was not affected between July and October, while changes in DM accumulation rate and supply of dicotyledon and other grasses were observed in that period.

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