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HEIGHT MANAGEMENT STRATEGIES OF SUDANGRASS 'BRS ESTRIBO'

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Abstract

The productive, morphological and chemical composition of Sudangrass 'BRS Estribo' submitted to different heights of management was evaluated. The design was in randomized blocks with four replicates in a 3x2 factorial scheme, with three pre-defoliation heights (40, 55 and 70 cm) and two post-defoliation heights (20 and 10 cm). There was no significance between post-defoliation heights for accumulated forage production (AFP), percentages of leaf blades (%F) and of stem and sheath (%S). The AFP at 70 cm pre-defoliation height (10,071.1 kg ha^{-1}) was higher than at 40 cm height (7,471.3 kg ha^{-1}) and did not differ from defoliation at 55 cm (8,562.3 kg ha^{-1}). Pre-defoliation at 40 cm showed a higher %F (67.67%) than at the heights of 55 cm (61.74%) and 70 cm (55.15%), which differed from each other. The %S was higher for pre-defoliation at 70 cm (35.57%) than at the heights of 55 (32.08%) and 40 cm (27.75%), which also differed from each other. The different handling heights did not change the contents of dry matter, insoluble fiber in neutral detergent, insoluble fiber in acid detergent and ash, which presented averages of 15.87; 60.34; 28.53; and 10.48%, respectively. However, there was a significant interaction between pre-and post-defoliation heights for crude protein (CP) contents, which the management heights at 40 x 20 cm and 70 x 10 cm presented, respectively, the highest (18.78%) and lowest (12.22%) CP contents of the study. Pre-defoliation heights of 55 cm with 10 or 20 cm of residual height should be used to improve the botanical composition and crude protein content of Sudangrass BRS Estribo forage.

Keywords bromatological composition, forage production, harvest cycles, leaf:stem ratio

ESTRATÉGIAS DE MANEJO DE ALTURA PARA CAPIM-SUDÃO CULTIVAR BRS

Resumo

Avaliaram-se as características produtivas, morfológicas e a composição bromatológica do capim-sudão BRS Estribo submetido a diferentes alturas de manejo. O delineamento em blocos casualizados com quatro repetições em esquema fatorial 3x2, sendo três alturas de pré-desfolhação (40, 55 e 70 cm) e duas alturas de pós-desfolhação (20 e 10 cm). Não houve efeito de alturas de resíduo pós-desfolhação para a produção total de forragem acumulada (PTA), porcentagens de lâminas foliares (%F) e de colmo e bainha (%C). A PTA das plantas submetidas a pré-desfolhação de 70 cm (10.071,1 kg ha^{-1}) foi maior que aquelas desfolhadas com 40 cm (7.471,3 kg ha^{-1}) e não diferiu estatisticamente das desfolhadas com 55 cm (8.562,3 kg ha^{-1}). A pré-desfolhação à 40 cm apresentou a maior % F (67,67%) que as alturas de 55 (61,74%) e 70cm (55,15%). Já a %C foi maior para altura de pré-desfolhação à 70 cm (35,57%) em relação às alturas de 55 (32,08%) e 40cm (27,75%). As diferentes alturas de manejo não alteraram os teores de matéria seca, fibra insolúvel em detergente neutro, fibra insolúvel em detergente ácido e cinzas da forragem, que apresentou médias de 15,87; 60,34; 28,53; e 10,48%, respectivamente. Houve interação significativa entre as alturas de pré e pós-desfolhação para os teores de proteína bruta (PB), onde o manejo à 40 x 20 cm e 70 x 10 cm, apresentaram, respectivamente, o maior (18.78%) e menor (12,22%) teor de PB do estudo. Alturas de pré-desfolhação de 55 cm de altura deixando-se 10 ou 20 cm de resíduo devem ser preconizadas como forma de melhorar a composição morfológica e o teor de proteína da forragem.

Palavras–chave ciclos de colheita, composição bromatológica, relação folha:colmo, produção de forragem.

INTRODUCTION

Sudangrass BRS Estribo cultivar can be used in animal nutrition (Embrapa, 2014). Silva (2020) reported a dry mass (DM) production of up to 6,512.40 kg ha^{-1} during approximately 45 days of growth, which provides an accumulation rate of 144.7 kg ha^{-1} of DM/day. According to Silveira et al. (2015), this cultivar also tolerates grazing and trampling, has high tillering capacity and absence of anti-nutritional factors such as hydrocyanic acid, common in Sudangrass varieties.

Due to the potential use of Sudangrass BRS Estribo cultivar, defining management strategies based on pre- and post-defoliation heights is essential. In fact, studies with tropical perennial grasses showed that the use of pre-defoliation targets based on light interception provided a high rate of forage accumulation with good nutritional value (DIFANTE et al., 2011; FREITAS et al., 2012). Height management in annual cycle tropical forages showed that lower pre-defoliation heights do not affect total production, but increase the participation of leaves in forage composition (COMASSETO et al., 2021). The determination of post-defoliation targets can also impact forage growth, as it is directly related to residual leaf area and efficiency in forage use (GASTAL; LEMAIRE, 2015).

Therefore, the present study aimed to identify which pre and post-defoliation heights are most suitable for the management of Sudangrass BRS Estribo cultivar.

MATERIAL AND METHODS

The experiment was carried out between February and June 2017 in Montes Claros, in the state of Minas Gerais (Latitude 16°40'59.35"S and longitude 43° 50'17.27"W). According to Köppen's climate classification, the region has a AW type climate, megathermal, tropical, with dry winters and hot, rainy summers.

The experiment was conducted to determine pre and post-defoliation management heights for Sudangrass BRS Estribo cultivar. This forage is of the *Sorghum sudanense* L. species, and the cultivar was developed and provided by *Programa de Melhoramento Vegetal of Embrapa Pecuária Sul-RS* and *Sul Pasto.*

The design was in randomized blocks with four replicates. As for the treatments, the pattern was a 3x2 factorial scheme, with three pre-defoliation heights (40, 55 and 70 cm) and two post-defoliation heights (20 and 10 cm), totaling six treatments. The blocks were placed perpendicular to the slope of the area.

Sampling and analysis of the soil was first carried out, for chemical and physical characterization according to the methodology of Embrapa (1997) (Table 1).

Table 1 - Soil characterization of the experimental area

Chemical Characterization							
pH	P	K	Al	H+Al	Ca	Mg	O.M.
	mg/kg		cmol$_c$/dm^3				dag/kg
6.7	10.25	233	0.0	1.19	8.0	1.2	4.4

Physical Characterization				
Clay	Silt	Fine Sand	Coarse Sand	Texture Class
		dag/kg		
32.0	40.0	16.4	11.6	Medium Texture

Conventional tillage was used in soil preparation with plowing, harrowing for clod-breaking, without the need for application and incorporation of limestone, according to the results of the soil analysis.

Mechanized sowing was performed, with 25 cm between rows and a seed rate of 25 kg ha^{-1}, according to the recommendation of Embrapa Pecuária Sul (SILVEIRA et al., 2015). Germination rate was 90%. In the planting rows, the equivalent of 90 kg ha^{-1} of simple superphosphate (17% P2O5) was applied.

The experimental units consisted of 12 m² (4 x 3m) plots, with assessments carried out in the central part, with disregard of 1 m border row.

The experimental units were irrigated with a sprinkler system in order to replace 100% of the crop's evapotranspiration. Reference evapotranspiration data were obtained by evaporation from a class A tank located approximately 300 m far from the experimental area. Crop evapotranspiration was calculated based on daily reference evapotranspiration using the Penman-Monteith method (ALLEN et al., 2006).

Thirty days after sowing, plot uniformity cuts were made at 10 cm above soil level, followed by topdressing with ammonium sulfate (22%), equivalent to 50 kg ha^{-1} of nitrogen (N). Two other applications with urea (45%) equivalent to 25 kg ha^{-1} of N were made after the second and third cuts of each experimental unit. After the uniformity cut, pre-defoliation heights were measured, every two days, at 10 random points of the usable area of the plots with a centimeter-graduated ruler.

After the defined defoliation heights were reached, the plants were defoliated manually using a cleaver. Samples were collected along two linear meters in the central area of the plot, cuts were made in the area 10 or 20 cm above the soil level, according to the treatments. The fresh forage mass was weighed, packed in labeled plastic bags and sent to the Laboratory, where two subsamples of 100 grams were weighed. After sampling, the remaining forage in the plot was harvested and discarded.

The assessments were carried out over 110 days. The experimental assessment period was ended due to the increase in forage flowering with consequent reduction in its growth.

For estimation of the dry matter (DM) content of the whole plant, a subsample was packed in a paper bag, placed in a forced-ventilation oven at 55º C for 72 hours. After pre-drying, the samples were ground in a knife mill through a 1 mm sieve and submitted to definitive drying in an oven at 105º C for 24 hours. When the production of fresh mass and the DM content were obtained, the average forage mass per cycle was estimated with extrapolation to one hectare (DMP in Kg ha^{-1}). The total accumulated forage production (AFP in kg ha^{-1}) was estimated through the sum of the DMP of each cycle.

The second subsample was used to evaluate the morphological composition of the forage. Thus, leaf blades, stems and sheaths and the senescent material were manually separated and dried in a forced ventilation oven at 55º C for 72 hours. Based on the dry weight of each component and its percentage in relation to the total, the percentage of leaf blade (%F), stem and sheath (%S) and dead material mass (%DMM) was estimated. The leaf-to-stem ratio was obtained by dividing the dry matter of leaf blades by the dry matter of stems and sheaths.

In bromatological analysis, the pre-dried samples were ground in a Willey type mill with a 1 mm sieve and analyzed for the contents of: DM at 105 ºC, crude protein (CP), ether extract and mineral matter (SILVA and QUEIROZ, 2002) neutral detergent insoluble fiber (NDF) (MERTENS, 2002), acid detergent insoluble fiber (ADF) (VAN SOEST and ROBERTSON, 1985).

The cutting intervals were estimated based on the sum of days between each cut, the number of cycles (NC) was determined by dividing the total period of the experiment by the number of days between cuts.

Bulk density (DEN in mg cm^{-3}) of the grazing extract was determined by dividing the mass harvested in a known pasture volume (area x height of grazing horizon) by the respective volume in cm^3.

Data were submitted to analysis of variance and treatment means were compared by Tukey's test at 5% significance. The interaction between pre- and post-defoliation heights was tested and breakdown was performed when a significant interaction was noted. Statistical analyzes were performed using the R software, version 3.3.1 (R CORE TEAM, 2019).

RESULTS AND DISCUSSION

There was interaction (P<0.05) between pre- and post-defoliation heights on the cutting intervals and the number of NC cycles of Sudangrass BRS Estribo cultivar (Table 2). The 40 x 20 cm treatment had a lower (P<0.05) cutting interval compared to the mean of the 55 x 20 cm and 70 x 20 cm treatments (13.0 vs 20.61 days) that did not differ from each other (P>0, 05). The effect of pre-defoliation residual heights of 10 cm showed differences only between the 70 x 10 and 55 x 10 treatments, with the first value being significantly higher (P<0.05).

Table 2: Cutting interval and number of harvest cycles of Sudangrass BRS Estribo cultivar submitted to different management heights

Pre-defoliation heights (cm)	Post-defoliation height (cm)			Number of Cycles		
	10	20	CV	10	20	CV
40	20.15^{abA}	13.00^{bB}		5.50^{aB}	8.50^{aA}	
55	19.22^{bA}	20.15^{aA}	10.13%	5.75^{aA}	5.50^{bA}	9.62%
70	23.37^{aA}	21.07^{aA}		4.75^{aA}	5.25^{bA}	

Means followed by the same lowercase letters in columns and uppercase letters in rows do not differ by the Tukey test at the 5% significance level. CV: coefficient of variation.

In fact, the smaller the difference between pre- and post-defoliation heights, the shorter the time needed to reconstitute the shoot and the height for cutting the forage. Thus, the 70 x 10 cm treatment had the highest cutting interval and took 10.37 days (23.37 vs 13.00 days) longer than the 40 x 20 cm treatment to defoliate. Sales et al. (2014) found a higher cutting interval (51.5 vs 41.5 days) and lower number of leaves per tiller (9.0 vs 11.53) and leaf area index (3.19 vs 4.38), respectively, for Tanzania grass submitted to 30 and 50 cm post-defoliation height. According to Fontes et al. (2014), the defoliation regime determines the remaining leaf area and, consequently, forage regrowth.

Analysis of the post-defoliation height effect for each pre-defoliation height treatment allowed us to visualize significant differences only between 10 and 20 cm residual heights in plants defoliated at a 40 cm height (Table 2). Thus, it is possible that the association of the lowest pre-defoliation height with the lowest residual height caused physiological stress in plants that needed a significantly longer period to reconstitute their leaf area and reach harvest condition. In fact, like in other studies, the forage grass canopy is able to adapt its structure to defoliation, particularly in terms of tiller size and density, thus allowing the maintenance of yield up to a certain point within a LAI range (GASTAL; LEMAIRE, 2015).

It can be seen that the managements with 40 x 10, 55 x 10, 55 x 20 and 70 x 20 defoliation had values close to the cutting interval, which demonstrates plant flexibility in relation to defoliation managements. Knowing the amplitude of plant responses can help in decision making in pasture management.

The NC is determined by the interval between cuts and it is expected that the smaller this interval, the greater the NC. This behavior was observed for the Sudangrass BRS Estribo grass submitted to the 40 x 20 cm treatment, which presented the smallest cutting interval and the largest NC ($P<0.05$) compared to the other treatments. In general, the interactions observed for the NC are explained by the effects that occurred in the cutting interval.

There was no interaction ($P>0.05$) between pre- and post-defoliation heights for AFP, DMP, %F, %S, %DM, and F:S. The AFP, %F and F:S variables AFP, %F and F:S were influenced only by pre-defoliation heights ($P<0.05$) (Table 3).

AFP of Sudangrass BRS Estribo cultivar cut at the pre-defoliation height of 40 cm was lower ($P<0.05$) in relation to the cut at 70 cm. However, when the cultivar was submitted to the 55 cm cut, there was no ($p>0.05$) among the other treatments. However, when the cultivar was submitted to the 55 cm cut, there was no difference ($p>0.05$) between the other treatments. Forage cutting management with pre-defoliation height of 70 cm provided higher AFP, respectively, 15.28 and 25.81% higher than the management at 55 and 40 cm of height, regardless of the post-defoliation height. In practice, this may represent higher food production and/or higher stocking rate in BRS Estribo Sudangrass cultivar when managed at an initial height of 70 cm.

The AFP of the canopies defoliated at 40 cm height was significantly lower ($P<0.05$) than the canopies defoliated at 70 cm (Table 3). However, canopies defoliated at 55 cm height did not differ (P>0.05) from the other treatments. The cutting management of forage with a pre-defoliation height of 70 cm provided an AFP 25.81% higher than the one of the forage managed at a height of 40 cm, regardless of the post-defoliation height. In practice, this may represent higher food production or stocking rate in Sudangrass BRS Estribo pasture when higher initial heights of 55 or 70 cm are used.

Table 3: Production of total accumulated forage production (AFP), dry matter per cycle (DM), percentage of leaf blade (%F), stem and sheath (%S), dead material mass (%DMM) and F:S ratio of Sudangrass BRS Estribo grass submitted to different handling heights

Pre-defoliation height (cm)	AFP (kg ha-1)	DM	%F	%S	%DMM	F:S
40	7,471.34^{b}	1,281.96^{c}	67.67^{a}	27.75^{c}	4.58^{b}	2.85^{a}
55	8,562.35^{ab}	1,813.81^{b}	61.74^{b}	32.08^{b}	6.18^{ab}	2.13^{b}
70	10,071.16^{a}	2,474.76^{a}	55.15^{c}	35.57^{a}	9.28^{a}	1.82^{b}
CV	19.92%	14.70%	7.09%	8.37%	43.12%	14.96%

Means followed by different letters in the column differ from each other by Tukey's test at a 5% significance level. CV: coefficient of variation.

On the other hand, the DM of plants defoliated at 70 cm height was statistically higher than that of those defoliated at 55 and 40 cm heights, which also differed from each other (P<0.05). The pre-defoliation height at 70 cm showed higher DM by 26.70 and 48.19% at heights of 55 and 40 cm, respectively. DM is the amount of forage available in each grazing cycle, regardless of the total number of cycles, and indicates that longer periods of growth, associated with higher heights of defoliation, are followed by higher stocking rates to ensure harvest and proper use of forage.

Silva (2020) found a positive linear effect on the daily accumulation of DM according to the increase in pre-defoliation height of Sudangrass BRS Estribo. Ferreira et al. (2017) estimated the total production accumulated between 7,471.34 kg/ha to 10,071.16 kg/ha when evaluating different management heights for Sudangrass BRS Estribo cultivar in the dry-water transition period. The AFP observed in the present study indicates the potential of this cultivar to increase forage supply compared to other Sorghum hybrids, despite the different experimental conditions.

The percentages of leaf blades (% F) and stem and sheath (%S) of Sudangrass BRS Estribo cultivar responded in the opposite way to pre-defoliation heights (Table 3). The %F was higher at the pre-defoliation height of 40 cm than at the heights of 55 and 70 cm, which also differed from each other (P<0.05). Conversely, %S was higher for pre-defoliation height of 70 cm than for heights of 55 and 40 cm, which also differed from each other (P<0.05). As for the percentage of dead material mass (% DMM), it was significantly higher in the Sudangrass BRS Estribo grass defoliated at a 70 cm height than at the one defoliated at a 40 cm height (P<0.05).

The percentage of leaf blades (%F) of Sudangrass BRS Estribo cultivar defoliated at 40 cm height was 5.93 and 12.52% higher than in the treatments at 55 and 70 cm heights, respectively. The percentage of stem and sheath (%S) of the same treatment was 4.33 and 7.82% higher than the treatments at 55 and 70 cm heights, respectively.

The effect observed for the morphogenic characteristics of Sudangrass BRS Estribo can be explained by the intervals between cuts, since a higher pre-defoliation height (70 cm) resulted in a longer growth cycle (Table 2) compared to the managements at 40 and 55 cm. In addition, the cuts at pre-defoliation heights of 70 and 55 cm probably promoted greater shading for a longer period in the lower leaves, which favored senescence, compared to grass cut at 40 cm height, which explains the effect observed for % DMM. Corroborating this hypothesis, Cândido et al. (2014) reported that shading within the Tanzania grass canopy contributed to the onset of senescence of the first leaf formed at regrowth. As reported by other authors, in the third phase of the regrowth curve, the average rates of accumulation begin to fall, causing a reduction in the growth rate, as a consequence of the increase in senescence of leaves that have reached the limit of life duration, and an increase in the shading of the lower leaves (Hodgson et al., 1981).

There may have been a synergistic response of the percentage of stem and sheath (%S) of plants defoliated at a 70 cm height. In this regard, caespitose grasses such as Sudangrass, tend to have a higher percentage of stems in the lower strata of the canopy, which, associated with the increase in pre-defoliation management height, resulted in a substantially greater accumulation of stems compared to the other management heights. The results obtained for %S are close to those observed by Neumann et al. (2010), between 47.9 and 45.9%, respectively, for sorghum hybrids BRS 800 and AG 2501C subjected to cuts on different days after planting.

The values of leaf blades (%F) observed for Sudangrass BRS Estribo cultivar (55.15 to 67.67%) under different pre-defoliation managements support the assertion that this plant is capable of producing high quality forage. (SILVEIRA et al., 2015). In fact, the leaves have a higher protein content, lower fiber content and greater digestibility than the stems (FREITAS et al., 2012; SIMILI et al., 2014). However, the lower %F observed in canopies defoliated at 70 cm height can be considered a disadvantage compared to the other pre-defoliation management heights.

When %F was related to AFP, the values of leaf mass accumulated in each treatment were obtained, with yields of 5,656.6; 5,980.8 and 5,775.2 kg ha^{-1} of leaves, respectively, for the managements at 40, 55 and 70 cm heights. These values did not differ from each other and showed that the same leaf mass can be obtained with lower pre-defoliation management heights. Thus, numerically, the yield of Sudangrass BRS Estribo cultivar managed at 70 and 55 cm heights in pre-defoliation stage compensated for the lower % F compared to the plant cut at a 40 cm height.

These results probably contributed to the effect observed in the F:S of Sudangrass BRS Estribo, which, when defoliated at a height of 40 cm, had higher F:S ($P<0.05$) than plants defoliated at 55 and 70 cm heights, which did not differ from each other ($P>0.05$). This result can be explained by the fact that the grass harvested at 40 cm was younger and probably had not reached the critical leaf area index. The increase in F:S is achieved with the lowest cutting height, since increase in the share of the stem in the plant composition is expected with the higher pre-grazing height (DIFANTE et al., 2011).

Neumann et al. (2010) studied different sorghum cultivars and found values for the F:S ratio between 0.85 and 1.0 for cultivar BRS 800 and 0.57 to 0.81 for cultivar AG 2501C, when performing the cut on different days after planting (40;75;110 and 145 days). (Orth et al. (2012) obtained higher values for F:S (2.0 and 2.4) for the same cultivars managing initial and final heights, respectively, of 60 and 15 cm.

The bulk density (DEN) of Sudangrass BRS Estribo cultivar (Table 4) was influenced only by initial heights and residual heights ($P<0.05$).

Table 4: Bulk density (DEN) of Sudangrass BRS Estribo managed under different management heights

Pre-defoliation height (cm)	DEN ($mg.cm^{-3}$)
40	4.85^{a}
55	4.25^{ab}
70	3.90^{b}
Post-defoliation height (cm)	
10	3.98^{b}
20	4.69^{a}
CV	11.73

Means followed by different letters in the column differ from each other by Tukey's test at a 5% significance level. CV: coefficient of variation.

The bulk density (DEN) of Sudangrass BRS Estribo cultivar defoliated at a 40 cm height was higher ($P<0.05$) than the one obtained with cut at a 70 cm height. In turn, DEN of Sudangrass BRS Estribo cultivar submitted to a pre-defoliation height of 55 cm did not differ ($P>0.05$) between the other treatments. Likewise, bulk density (DEN) differed between residual heights ($P<0.05$), being higher for the 20 cm height compared to the 10 cm height. In fact, increase in canopy height results in lower forage bulk density, especially in the upper strata. This can have an impact on forage consumption by grazing animals, as a lower density can reduce the bite mass. Decrease in DEN with increase in cutting height was also observed by Fontes et al., 2014, in their assessment of different species of grass of genus *Urochloa*.

The different management heights did not change ($P>0.05$) DM, NDF, ADF and Ash contents, which had averages of 15.87; 60.34; 28.53; and 10.48%, respectively. According to these results, Sudangrass BRS Estribo, regardless of the treatment applied, was found to have good quality in terms of NDF levels, as follows: 77.93, 65.25, 71.67, 68.67, 69, 90 75.30%, respectively, in Decumbens, Marandu, Coast Cross, Colonião, Napier, and Mombasa grasses cut within 30 days of growth (VALADARES FILHO et al., 2015). The NDF content of tropical grasses generally has values greater than 60% and, as this value increases, there is a tendency of reduction of digestibility and dry matter intake of the diet (DETMANN et al., 2014).

A significant interaction was observed between pre- and post-defoliation heights for CP and EE ($P<0.05$) in Sudangrass (Table 5).

Table 5: Crude protein and ether extract levels of Sudangrass BRS Estribo submitted to different management heights

Pre-defoliation height (cm)	Crude Protein (% of DM)			Ether Extract (% of DM)		
	10	20	CV	10	20	CV
40	15.30^{aB}	18.78^{aA}		5.26^{aA}	5.38^{aA}	
55	14.67^{aA}	14.71^{bA}	8.44%	4.09^{bB}	5.30^{aA}	9.89%
70	12.22^{bB}	14.54^{bA}		4.66^{abA}	4.19^{bA}	

Means followed by the same lowercase letters in columns and uppercase letters in rows do not differ from each other by the Tukey test at the 5% significance level. MS = dry mass. CV: coefficient of variation.

Analysis of the effect of pre-defoliation height on the residual height of 10 cm shows that crude protein (CP) levels of treatments defoliated at 40 and 55 cm did not differ from each other and were statistically higher than those of plants defoliated at a 70 cm height. On the other hand, at residual height of 20 cm, there were no significant differences between plants defoliated at 55 and 70 cm heights for CP levels, which were statistically lower than those in plants defoliated at 40 cm (Table 5). These results showed that plant management that provides higher %F in its morphological composition tends to increase CP levels.

Analysis of the effect of residual height within the pre-defoliation height showed that the plants submitted to residual height of 20 cm had CP levels higher than those with residual height of 10 cm in the pre-defoliation managements of 40 and 70 cm. This difference was not observed in the treatment of defoliation at 55 cm. Therefore, it is believed that the increase in residual height resulted in a younger forage harvest and, consequently, with a higher percentage of cell content.

Sudangrass BRS Estribo cut at 40 x 20 cm height had the highest CP content (18.78%) and the lowest % F (28.78%) in the study. However, regardless of the defoliation managements, the Sudangrass BRS Estribo cultivar showed adequate CP contents that ranged from 12.22 to 18.78%, respectively, for the treatments 40 x 20 cm and 70 x 10 cm. If the average of 15.03% CP and 60.34% of NDF is considered, it can be inferred that Sudangrass BRS Estribo is a tropical forage with good nutritional value.

In their assessment of the hay of nineteen sorghum hybrids with Sudangrass, Lima et al., (2017) found crude protein contents that ranged from 11.84 to 15.57% with an average value of 12.98%. In turn, Orth et al. (2012) found values of 15.2, 14.5 and 16.0% CP for common Sudangrass and hybrids AG 2501C and BRS 800, respectively, at initial height of 60 cm and final height of 15 cm.

As for EE content, it was influenced by the residual height (P<0.05) of Sudangrass BRS Estribo only for the cut at 55 cm height, being 4.09 vs 5.30%, respectively , for the treatments 55 x 10 cm and 55 x 20 cm (Table 5). For the cutting heights, it was found that the 70 x 20 cm treatment provided a lower (P<0.05) EE content (4.19%) for Sudan residual height, respectively, 55 x 20 cm and 40 x 20 cm, which were similar to each other (5.34% EE).

CONCLUSION

Pre-defoliation heights between 55 and 70 cm increase the production of Sudangrass BRS Estribo. However, defoliation at 55 cm should be recommended as a way to improve the morphological composition and protein content of the forage.

The use of residual heights of 10 or 20 cm has no impact on forage production and morphological composition. However, if residual height of 20 cm is maintained, higher crude protein contents are obtained in the forage harvested at 40 or 70 cm.

It is recommended that Sudangrass is defoliated at a height of 55 cm, leaving 10 or 20 cm of residual height.

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