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Does the lowering strategy before the stockpiling period modify the marandu palisade grass production and structure?

[*A estratégia de desfolhação prévia ao período de diferimento modifica a produção e a estrutura do capim-marandu?*]

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ABSTRACT

The objective was to identify lowering strategies for *Urochloa brizantha* cv. Marandu in the beginning of the stockpiling period that increase forage production and improve the structure of stockpiled canopies. Three lowering strategies were evaluated: maintenance of marandu palisade grass with 15cm four months before the stockpiling period; maintenance of palisade grass with 30cm for four months, and lowering to 15cm before the stockpiling period; and maintaining of palisade grass at 45cm for four months, and lowering to 15cm before the stockpiling period. The experimental design was completely randomized, with four replications. At the end of stockpiling, the number of reproductive tillers and forage mass were higher in the canopy under 15/15cm than in the others; the percentage of live leaf was higher in the canopy under 45/15cm than under 15/15cm. Forage production during the stockpiling period was higher in the canopy under 15/15cm and lower in the under 45/15cm. Maintaining 15cm marandu palisadegrass for four months before the stockpiling period increases forage production during this period. The lowering of the marandu palisadegrass from 45 to 15cm at the beginning of the stockpiling period improves the structure of the stockpiled canopy.

Keywords: Horizontality index, leaf area index, morphological composition, tiller number, *Urochloa brizantha*

RESUMO

Objetivou-se identificar estratégias de rebaixamento da Urochloa brizan*tha cv. Marandu no início do diferimento, as quais resultem em aumento da produção e em melhoria da estrutura do dossel diferido. Foram avaliadas três estratégias de rebaixamento no início do diferimento: manutenção do capim-marandu com 15cm por quatro meses antes do início do diferimento; manutenção do capim-marandu com 30cm por quatro mese, e rebaixamento para 15cm no início do diferimento; e manutenção do capim com 45cm por quatro meses e rebaixamento para 15cm no início do diferimento. O delineamento foi inteiramente ao acaso, com quatro repetições. No fim do diferimento, o número de perfilho reprodutivo e a massa de forragem foram superiores no dossel sob 15/15cm do que nos demais; a percentagem de folha viva foi maior no dossel sob 45/15cm do que sob 15/15cm. A produção de forragem durante o diferimento foi superior no dossel sob 15/15cm e inferior no sob 45/15cm. A manutenção do capim-marandu com 15cm por quatro meses antes do período de diferimento aumenta a produção de forragem neste período. O rebaixamento do capim-marandu de 45 para 15cm no início do diferimento melhora a estrutura do dossel diferido.*

Palavras-chaves: composição morfológica, índice de área foliar, índice de horizontalidade, número de perfilho, Urochloa brizantha

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INTRODUCTION

The stockpiling of pasture consists of selecting a certain pasture area and excluding it from grazing, usually in late summer and/or, in autumn in the Southeast and Midwest regions of Brazil. In this way, it is possible to guarantee accumulation of forage to be grazed during the period of its scarcity and, with this, to minimize the negative effects of the seasonality of forage production (Santos *et al*., 2009; Santos *et al*., 2020; Rocha *et al*., 2020).

One of the first management recommendations that should be followed in stockpiling pasture is the evaluation of the forage plant characteristics that will be used. It is recommended to use grasses of small size, with thin stem, with high potential for forage accumulation during autumn and that do not flower intensely during the stockpiling period (Euclides *et al*., 1990; Euclides and Queiroz, 2000). In general, most of these characteristics are present in grasses of the *Urochloa* genus, such as *U. brizantha* cv. Marandu.

Another recommended management action is to perform intense grazing at the beginning of stockpiled period, aiming to lower the pasture and, thus, increase the incidence of light at the base of the forage canopy, in order to stimulate the appearance of new tillers (Sousa *et al*., 2012). Thus, the stockpiled pasture presents the structure better in winter and, in effect, increases the performance of the animals (Afonso *et al*., 2018).

The management of lowering the pasture at the beginning of the stockpiling period can be done in different ways. It is possible that the lowering will occur a few months in advance, with the pasture being kept low until the beginning of the stockpiling period. This management would result in the plant's morphological adaptation to more intense and frequent grazing, which would determine a greater number of short tillers and a higher leaf area index at the beginning of the stockpile period. This pasture condition, in turn, would result in a high pasture growth rate during the stockpiling period.

On the other hand, the lowering of pasture can also occur immediately before the beginning of the stockpiling period. In this situation, the abrupt lowering of a higher pasture would promote the removal of a large amount of leaf present in the canopy upper layer, reducing the of leaf area index. In addition, depending on the lowering level, a high percentage of tillers may have their apical meristem removed. These factors can reduce the pasture growth rate and, consequently, limit the forage production in the stockpiled pasture.

Despite the undeniable scientific relevance of previous works dealing with stockpiled pasture management (Alves *et al*., 2019; Gouveia *et al*., 2017; Nogueira *et al*., 2020; Sousa *et al*., 2019), they did not unravel whether the different ways to do the pasture lowering changed the forage production and the stockpiled canopy structure. In this context, the understanding of the effects lowering on the characteristics of stockpiled pasture serves as a basis for the idealization and recommendation of management strategies capable of optimizing the production and quality of the stockpiled canopy.

We hypothesized that (i) the abrupt lowering of a tall pasture reduces the forage production; and (ii) the maintenance of the low canopy for four months before the stockpiling period increases the pasture growth rate, but this management worsens the stockpiled canopy structure. Thus, the objective of this study was to test these hypotheses, in order to identify strategies for lowering the canopy of *Urochloa brizantha* cv. Marandu at the beginning of the stockpiling period, which results in an increase in forage production during the stockpiling period and an improvement in the structure of stockpiled canopy.

MATERIAL AND METHODS

The present study was conducted from October 2016 to June 2017 at the Experimental Farm Capim-branco, at the Faculty of Veterinary Medicine of the Federal University of Uberlândia, in Uberlândia, MG. The geographical coordinates of the site are 18°30’ south latitude and 47°50' west longitude, and its altitude is 776m. The climate of Uberlândia, according to the Köppen classification, is Aw, a tropical savanna with a dry winter season (Alvares *et al*., 2013). The average annual temperature is 22.3ºC. The average annual rainfall is 1,584mm.

During the experimental period, climatic conditions were monitored in a meteorological station about 200 m from the experimental area (Figure 1).

The relief of the experimental area is flat, and the soil was classified as Dystrophic Dark Red Latosol (Serviço, 1999). In November 2016, soil samples were taken to analyze the fertility level of the experimental area, which presented the following results: pH on H_2O: 0 5.4; P: 1.3 (Mehlich-1): and K: 123mg/dm³; Ca^{2+}: 2.6; Mg^{2+}: 0.6 and Al^{3+}: 0.0 $cmol_c/dm^3$. With these results, it was not necessary to make the liming or potassium fertilization. Phosphate (50kg/ha of P_2O_5) and nitrogen (50kg/ha of N) fertilizations were carried out in January 2017. Urea and simple superphosphate were used as fertilizer sources. Fertilizations were carried out in the evening and under cover.

The experimental area consisted of 12 experimental plots (experimental units), each with 9m². The specie *Urochloa brizantha* cv. Marandu (marandu palisade grass) was sown in 2015.

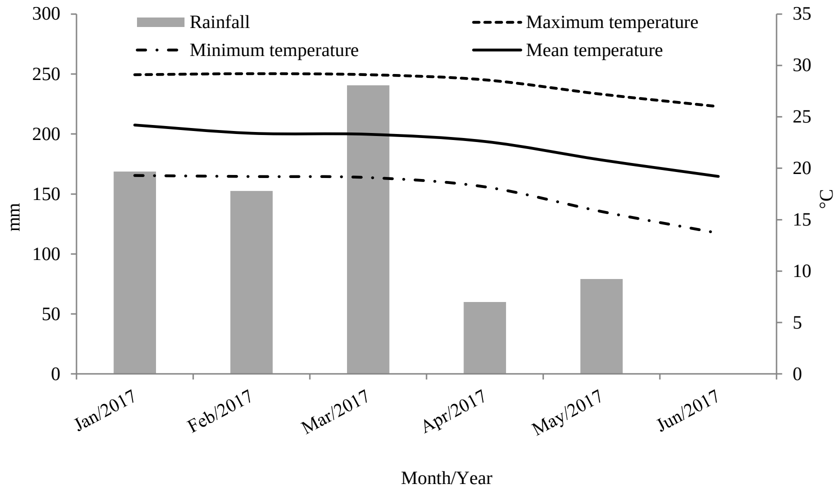


Figure 1. Values of rainfall and minimum, average and maximum temperatures during the experimental period.

Three lowering strategies of marandu palisade grass were evaluated prior to the stockpiling period, which occurred on March 15, 2017. These strategies were:
- 15/15cm: maintenance of canopy with 15cm from November 2016 until 03/15/2017, that is, for four months before the beginning of the stockpiling period;

- 30/15 cm: maintenance of canopy with 30cm since November 2016, however at the beginning of the stockpiling period, on 03/15/2017, the plants were lowered to 15cm;

- 45/15cm: maintenance of canopy with 45cm from November 2016 until the beginning of the stockpiling period (03/15/2017), when the forage canopy was lowered to 15cm.

The experiment was conducted in a completely randomized design, with four replications.

Before the stockpiling period, the maintenance of the plants with 15, 30 or 45cm occurred by cutting twice a week, with pruning shears. After cutting, the excess cut forage that remained on the plants was removed. On 03/15/2017, beginning of the stockpiling period, the forage 30 and 45cm canopies were cut to 15cm using pruning shears. The cut forage was removed from the plants. All canopies remained stockpiled, that is, without cuts, until 06/13/2017, totaling 90 days of the stockpiling period.

At the beginning of the stockpiling period, after cutting canopies with 30 and 45cm to 15cm, the forage mass was evaluated. For this, a forage sample contained within a 0.5m square was cut close to the soil of each plot. Each sample was placed in a plastic bag and separated into a live leaf blade, live stem plus live sheath, dead leaf blade and dead stem. Subsequently, they were dried in a forced ventilation oven at 55°C for 72 hours, when they were weighed. These same procedures were repeated at the end of the stockpiling period. Thus, with this data, it was possible to calculate the forage masses and the morphological compositions of the forage canopies, both at the beginning and at the end of the stockpiling period. Forage production during the stockpiling period was calculated by the difference between the forage mass at the beginning and the forage mass at the end of this period.

At the beginning and at the end of the stockpiling period, the tiller population density was also determined by harvesting, cutting at ground level, all tiller contained within a 0.25 x 0.5m frame, in two samples per plot. These tillers were separated and quantified in vegetative and reproductive tillers. Live tillers that had visible inflorescence were classified as reproductive and live tillers that did not have visible inflorescence as vegetative.

Seven days after the beginning of the stockpiling period, the number of live tillers without the apical meristem was also quantified, which corresponded to the tillers that had their apex cut more intensely and, therefore, did not show new leaf growth from the meristem apical. These tillers were counted at two samples per plot, using a 0.25 x 0.5m frame.

At the end of the stockpiling period, the number of aerial tillers was determined on the same samples used for counting vegetative and reproductive tillers. The aerial tillers consisted of tillers that were not directly connected to the plant's root system, but to a stem of a basal tiller.

At the beginning of the stockpiling period, the plant's horizontality index was calculated, by the ratio between the extended plant height and the canopy height of the, according to the recommendations described by Medica *et al*. (2017). The canopy height was measured with a graduated ruler, considering the distance from the soil to the apex of the highest leaf of the plant, without causing disturbance in the canopy. Then, the tillers were extended, and the height was measured again according to the same previous criterion. These measurements occurred at 10 points per plot.

At the beginning of the stockpiling period, 50 live leaf blades were harvested randomly from each plot. A small part of the ends of these leaf blades (apex and base) was cut and discarded, in order to obtain an approximately rectangular leaf blade segment. The width and length of each segment were measured and, using the product of these dimensions, the leaf area of the leaf blade segments was obtained. These were placed in a forced ventilation oven, at 55°C, for 72 hours and then weighed. With these data, the specific leaf area (cm^2/g of leaf blade) was calculated. The leaf area index of marandu palisade grass was calculated by the product of the specific leaf area by the respective live leaf mass existing in the canopy at the beginning of the stockpiling period.

At the end of the stockpiling period, the canopy height was measured at 10 points per plot, considering the distance from the soil surface to the live leaf located high in the canopy. On this occasion, the numbers of vegetative and reproductive tillers were also quantified.

All statistical analyzes were performed using SAS®, version 9.0. For all characteristics, analysis of variance was performed, in a completely randomized design. Subsequently, the effects of the factor levels were compared by the Student Newman Keuls test at the level of significance of up to 5% of probability of occurrence of type I error.

RESULTS

At the beginning of the stockpiling period, the canopy managed with 45/15cm showed a lower number of vegetative tillers than those under 15/15cm and 30/15cm (Table 1). There were no reproductive tillers in the canopies at the beginning of the stockpiling period.

The number of tillers without apical meristem was higher in the canopy managed with 45/15cm, intermediate in that under 30/15cm and lower in the canopy submitted to 15/15cm (Table 1).

The horizontality index, the leaf area index and the percentage of live leaf in the forage mass showed the same response pattern at the beginning of the stockpiling period, being higher in the canopies managed with 15/15cm, when compared to the others. An opposite response pattern occurred for the percentage of live stem in the forage mass (Table 1).

Table 1. Structural characteristics of *Urochloa brizantha* cv. Marandu submitted to lowering strategies at the beginning of the stockpiling period

Characteristic	Lowering Strategies*			P-valor	SEM[1]
	15/15	30/15	45/15		
Vegetative tiller/m²	757a	715a	543b	0.0158	56.7
Tiller without apical meristem/m²	16c	62b	132a	0.0037	29.2
Horizontality index	1.3a	1.0b	1.1b	0.0077	0.1
Leaf area index	2.6a	0.4b	0.3b	0.0029	0.7
Forage mass (kg/ha of DM)	4233a	3811a	3852a	0.6195	116.4
Live leaf (%)	33.6a	6.7b	5.0b	0.0443	9.5
Live stem (%)	28.4b	39.2a	36.7a	0.0083	2.8
Dead leaf (%)	25.9a	27.0a	27.0a	0.8454	0.3
Dead stem (%)	12.1b	27.1ab	31.3a	0.0214	5.0

* 15/15: grass with 15cm from November 2016 until the beginning of the stockpiling period; 30/15: grass with 30cm since November 2016 and lowered to 15cm beginning of the stockpiling period; 45/15: 45cm grass since November 2016 and lowered to 15cm beginning of the stockpiling period; [1]Standard error of the mean; For each characteristic, means followed by the same letter do not differ by the Student Newman Keuls test (P>0.05).

At the beginning of stockpiling, the following structural characteristics were not influenced by the lowering strategies: forage mass and its percentage of dead stem, whose average values were 3965kg/ha of DM and 23.5%, respectively.

At the end of the stockpiling period, the height (30.7cm) and the percentage of live stem in the forage mass (21.8%) did not differ between the canopies. On the other hand, the number of vegetative tillers at the end of the stockpiling period was higher in the canopy managed with 45/15cm, compared to those under 15/15 and 30/15cm (Table 2).

At the end of the stockpiling period, the number of reproductive tillers, the forage mass and the percentage of dead leaf in the forage mass were higher in the canopy managed with 15/15cm than in those submitted to 30/15 and 45/15cm. An opposite response pattern occurred for the number of aerial tillers and percentage of dead stem in the forage mass (Table 2).

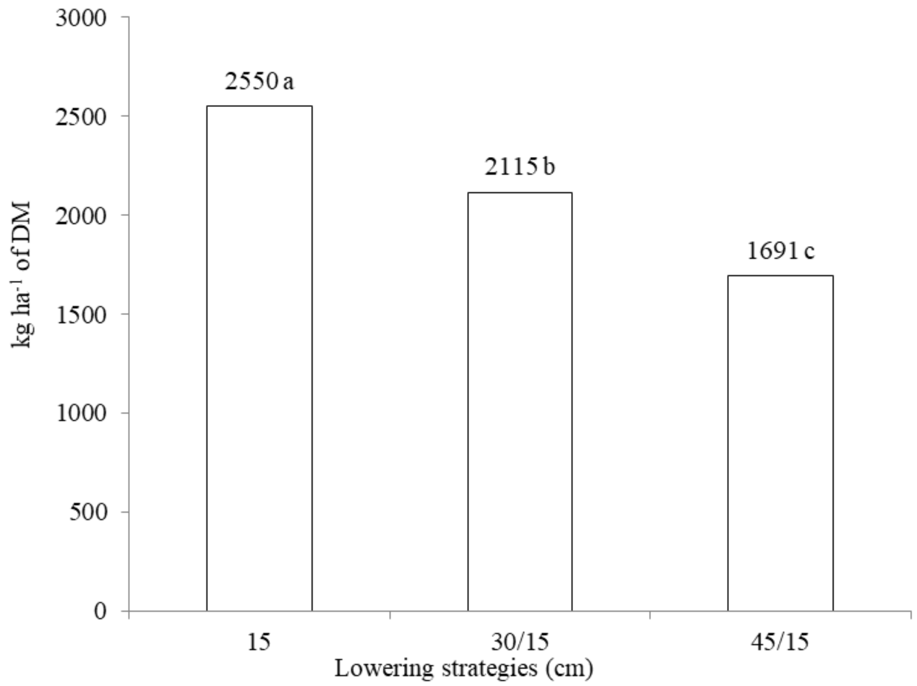
Table 2. Structural characteristics of the *Urochloa brizantha* cv. Marandu submitted to lowering strategies at the end of the stockpiling period

Characteristic	Lowering Strategies*			P-valor	SEM[1]
	15/15	30/15	45/15		
Canopy height (cm)	30.1a	29.6a	32.5a	0.1102	0.8
Vegetative tiller/m²	552b	574b	632a	0.0391	20.7
Reproductive tiller/m²	75a	4b	8b	0.0057	19.9
Aerial tiller/m²	16b	62a	42a	0.0045	11.5
Forage mass (kg/ha of DM)	6783a	5109b	5176b	0.0812	473.9
Live leaf (%)	29.6b	33.8ab	34.3a	0.0443	1.3
Live stem (%)	24.1a	19.6a	21.6a	0.0905	1.1
Dead leaf (%)	6.0a	4.1b	4,1b	0.0004	0.6
Dead stem (%)	9.6b	29.7a	26.9a	0.0003	5.5

* 15/15: grass with 15cm from November 2016 until the beginning of the stockpiling period; 30/15: grass with 30cm since November 2016 and lowered to 15cm at the beginning of the stockpiling period; 45/15: 45cm grass since November 2016 and lowered to 15cm at the beginning of the stockpiling period; [1]Standard error of mean; For each characteristic, means followed by the same letter do not differ by the Student Newman Keuls test (P>0.05).

At the end of the stockpiling period, the percentage of live leaf in the forage mass was greater in the canopy under 45/15 cm than in that under 15/15cm; and the canopy managed with 30/15cm showed similar values to the others (Table 2).

The forage production during the stockpiling period was higher in the canopy managed with 15/15cm, intermediate in that under 30/15cm and lower in the canopy submitted to 45/15cm (Figure 2).



15/15: marandu palisade grass with 15cm from November 2016 until the beginning of the stockpiling period; 30/15: marandu palisade grass with 30 cm since November 2016 and lowered to 15cm beginning of the stockpiling period; 45/15: 45cm marandu palisade grass since November 2016 and lowered to 15cm at the beginning of the stockpiling period. Averages followed by the same letter do not differ by the Student Newman Keuls test (P> 0.05).

Figure 2. Forage production during the stockpiling period of *Urochloa brizantha* cv. Marandu submitted to lowering strategies.

DISCUSSION

The maintenance of the low marandu palisade grass canopy (15cm) for four months before the beginning of the stockpiling period allowed the adaptation of forage plant to more intense defoliation. Among the adaptive responses, the largest number of small tillers in the canopy under 15/15cm stands out (Table 1), which is due to the higher light incidence at the plant base, which stimulates the development of basal buds in tillers (Matthew *et al*., 1995). This response pattern was also observed by Sbrissia and Da Silva (2008) in marandu palisade grass pastures under continuous stocking and variable heights.

Another morphological adaptation before the stockpiling period, which characterized the phenotypic plasticity of marandu palisade grass under 15/15cm, was its high horizontality index (Table 1), which indicates that the tillers presented a growth orientation more prostrate or close from soil surface. This adaptive mechanism also occurred in the work of Medica *et al*. (2017), when marandu palisade grass was defoliated more frequently. Furthermore, Santos *et al*. (2011) also observed this same response in overgrazed sites of *Urochloa decumbens* cv. Basilisk pasture.

The greater number of small tillers and the more prostrate growth of marandu palisade grass under 15cm before the stockpiling period reduced the probability of the plant being defoliated, characterizing an escape strategy. As a result, a smaller number of tillers had their apical meristem removed and the canopy had a higher leaf area index and live leaf percentage at the beginning of the stockpiling period (Table 1). As a consequence, this greater amount of live leaf at the beginning of the stockpiling period probably contributed to the greater light interception and photosynthesis of the canopy under 15/15cm (Sousa *et al*., 2012; Vilela *et al*., 2012), factors which may have been responsible for the largest forage production in this canopy during the stockpiling period (Figure 2).

The preservation of the apical meristem of the tillers was also responsible for the smaller number of aerial tillers in the canopy under 15/15cm (Table 2). The apical meristem produces auxin, which maintains apical dominance, by stimulating the production of strigolactone in the axillary buds. Strigolactone, in turn, is responsible for the transcription of the axillary yolk growth suppressing factor (Taiz *et al*., 2015).

The greater development during the stockpiling period of marandu palisade grass under 15/15cm also resulted in greater forage mass (Table 2); and it also justifies the greater number of reproductive tillers in this canopy at the end of that period. The presence of tillers in the reproductive stage in stockpiled pastures is indicative that canopy structure can limit the consumption and performance of the grazing animals, as the reproductive tillers have high live stem and dead leaf percentages, but low live leaf percentage, when compared to vegetative tillers (Santos *et al*., 2010).

The greater development of marandu palisade grass under 15/15cm during the stockpiling period may also have increased the shading inside the canopy, causing the increment of leaf senescence. This, then, may have been the cause of high dead leaf percentage and low live leaf percentage at the end of the stockpiling period in the canopy under 15/15 cm (Table 2).

On the other hand, and in general, the canopy managed with 45/15cm showed a pattern of responses contrary to that under 15/15cm. Indeed, marandu palisade grass submitted to 45/15cm had a lower number of tillers at the beginning of the stockpiling period, due to the greater shading at the base of taller plants, a factor that inhibits tillering (Matthew *et al*., 1995). This greater self-shading in the canopy maintained at 45cm before the stockpiling period also increased competition for light between the tillers. These, in fact, started to grow more upright, in order to arrange the younger leaves in the upper layer of the canopy, where the quantity and quality of light is greater. Therefore, the canopy horizontality index under 45/15cm was low at the beginning of the stockpiling period (Table 2), indicating that the tillers grew in the vertical direction. This vertical growth of the canopy under 45/15cm caused many tillers to lose their apical meristem during the lowering to 15cm at the beginning of the stockpiling period (Table 1). After having their apical meristem removed, many tillers die (Langer, 1979), which explains the high dead stem percentage in the forage mass at the end of the stockpiling period in 45/15cm canopy (Table 2). It is worth mentioning that this dead stem mass was probably limited to the basal stratum of forage canopy, below 15cm, which could limit the animals' access to this morphological component, in grazing situations.

Another part of the tillers that had their apical meristem removed may have grown up through the development of aerial tillers (Langer, 1979), which also justifies the high number of aerial tillers in the canopy under 45/15cm at the end of the stockpiling period (Table 2). The greater number of aerial tillers, at the expense of basal tiller, compromised the forage production (Figure 2), because the former has greater growth capacity than the latter (Pereira *et al*., 2014; Santos *et al*., 2014). However, aerial tiller has a high proportion of leaves and is in pasture strata with higher incidence of light (Santos *et al*., 2014). Therefore, these tillers can have the function of helping the reestablishment of the leaf area after intense defoliation.

The vertical growth of the canopy under 45/15 cm also caused the largest portion of the live leaves to be in the upper portion of the canopy. Thus, after cutting to 15cm, many live leaves were removed and the remaining canopy was characterized by low LAI and live leaf percentage, but high live stem and dead stem percentages (Table 2). The greater presence of non-photosynthetic tissues (stem) in the canopy managed with 45/15cm at the beginning of the stockpiling period probably limited the plants growth, causing less forage production throughout the stockpiling period (Figure 2), as well as lower forage mass at the end of this period (Table 2).

With the removal of approximately 67% of the vertical and upper layer of the canopy managed with 45/15cm, there was a high incidence of light at the base of the canopy during the initial stockpiling period. This condition may have stimulated the appearance of young tillers in the initial half of the stockpiling period, a time when climatic conditions, such as temperature and rainfall (Figure 1) are not yet completely limiting plant growth. This fact may be the reason for the greater number of vegetative tillers in this stockpiled canopy (Table 2). Considering that younger tillers are less predisposing to flowering and have a better morphological composition (Paiva *et al*., 2012), the presence of a greater number of young tillers in the canopy under 45/15cm would also justify the lower number of reproductive tillers, as well as the best morphological composition (more live leaf and less dead leaf) in this canopy at the end of the stockpiling period (Table 2).

The higher live leaf percentage in the canopy under 45/15cm (Table 2) has relevant zootechnical implications, as the live leaf has better nutritional value (Santos *et al*., 2010), is physically less resistant to breakage (Nave *et al*., 2010) and is preferred by animals (Santos *et al*., 2020). Thus, stockpiled pasture with a higher live leaf percentage can optimize pasture consumption and animal performance. In this context, Afonso *et al*. (2018) evaluated the effects of four heights (15, 25, 35 and 45cm) of marandu palisade grass at the beginning of the stockpiling period and found that the 15cm stockpiled pasture had higher leaf percentage and lower of live and dead stems percentages compared to other pastures. This fact was related to the greater sheep performance in the 15cm stockpiled pasture compared to the others.

Regarding the canopy managed with 35/15cm, its productive response was intermediate to the other evaluated canopies (Figure 2). It is worth noting that the values of forage production obtained during the 90 days of the stockpiling period were equivalent to forage production rates of 28.3; 23.5 and 18.8kg/ha day of DM for canopies under 15/15, 30/15 and 45/1cm, respectively. These values are lower than those obtained by Paula *et al*. (2012), who registered 56.7kg ha/day of DM for marandu palisade grass under continuous stocking during the fall, in Campo Grande, MS, Brazil.

The structural characteristics of the canopy managed with 30/15 cm, on average, were more similar to the canopy submitted to 45/30cm. In fact, at the beginning of the stockpiling period, of the nine structural characteristics evaluated (Table 1), four (44.4%) were similar between canopies under 30/15cm and 45/30cm, while only one (11.1 %) was similar between canopies under 15/15cm and 30/15cm. At the end of the stockpiling period, nine variables were also evaluated, of which five (55.6%) were similar between canopies under 30/15cm and 45/15cm, whereas only one response variable was similar between canopies under 15/15cm and 30/15cm.

In view of the results presented (Tables 1 and 2 and Figure 2), we found that the hypotheses raised before conducting our work were confirmed, namely: i) the lowering of the canopy a few months before the stockpiling period allows the morphological adaptation of the plant at a lower height, which determines a greater number of tillers and IAF at the beginning of the stockpiling period, factors responsible for the greater forage production during that period; and ii) the abrupt lowering of the canopy reduces the IAF and increases the elimination of the apical meristem of tillers at the beginning of the stockpiling period, which is why forage production is compromised during this period.

The strategy of lowering the marandu palisade grass to stockpile the pasture can be recommended according to the farmer's goals. If the objective is to work with a higher stocking rate during the winter, the pasture can be managed with 15/15cm, since this defoliation strategy results in greater forage mass at the end of the stockpiling period (Table 2). In this context, considering a grazing efficiency of 50%, a period of utilization of the stockpiled pasture of 90 days and a daily consumption of 10 kg/AU (animal unit) of DM, one could work with 1.4; 1.2 and 0.9 AU/ha, respectively, if the stockpiled pastures had the same forage mass values obtained at the end of the stockpiling period of canopies under 15/15, 30/15 and 45/15cm. Otherwise, if the farmer's goal is to obtain greater performance from the animals kept in the stockpiled pasture during the winter, it is recommended to manage 45/15cm, as this resulted in a stockpiled canopy with better structure (less reproductive tillers, higher live leaf percentage and lower dead leaf percentage, Table 2).

It is also recommended that, before presenting definitive recommendations about strategies for pasture lowering for the stockpiling, it is important that other research work be carried out under grazing conditions, in order to verify the animals' responses.

CONCLUSION

The maintenance of *Urochloa brizantha* cv. Marandu with 15cm for four months before the stockpiling period results in higher forage production in this period. The lowering of *Urochloa brizantha* cv. Marandu from 45 to 15cm at the beginning of the stockpiling period results in a stockpiled canopy with adequate structure in winter.

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