STRUCTURAL CHARACTERISTICS OF MEGATHYRSUS MAXIMUS CV. MOMBAÇA AND CV. PAREDÃO SUBJECTED TO DIFFERENT LEVELS OF NITROGEN FERTILIZATION DURING DRY PERIODS

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ABSTRACT

The main source of cattle feed in Brazil is based on pastures, which, when properly managed, can be an economically viable alternative and present good productivity rates. Nitrogen fertilization can bring improvements to plants, resulting in higher yields per area. Therefore, the objective of this study was to evaluate the influence of different levels of nitrogen fertilization on the structural characteristics of Megathyrsus maximus cv. Mombasa and cv. Wall in a period of drought. The experiment was conducted in Imperatriz-MA, during the dry season of the region. The experimental area was prepared for the cultivation of Megathyrsus maximus cv. Mombasa and Paredão, focusing on the analysis of variables such as height, number of tillers and weight of samples in the field. The evaluations were carried out 28 days after each cut, using nitrogen fertilization levels (0, 100, 200, 300 and 400 Kg N ha^{-1} $year^{-1}$). The results indicated that fertilization had little influence on the variables analyzed. The height of the forage did not reach the recommendation for the beginning of grazing, which is 80 to 90 cm. Only in the sixth cut was the ideal height reached for the beginning of grazing, with an average of 107.50 cm for Paredão grass with

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300 kg of N/ha/year and for Mombaça grass with 200 and 300 kg of N/ha/year. In addition, the fertilization rates tested did not show a significant impact on the production of green matter per hectare during the dry periods.

Keywords: Nitrogen fertilizer. Pastures. Handling. Productivity.

INTRODUCTION

Agriculture in the Northeast faces great climatic variability, characterized by droughts and heavy rainfall. This climatic irregularity hinders the development of plants and contributes to the degradation of many pastures, which generally have low soil fertility. This condition is largely aggravated by nitrogen (N) deficiency, which is one of the main limiting factors in pasture productivity. This situation represents a considerable challenge for agricultural and livestock production in the region (PEEL *et al*., 2007; CASTRO, 2012; FACTORI *et al*., 2017).

In view of this, nitrogen fertilization emerges as an effective management strategy to intensify animal production in tropical pastures, as pointed out by Alvin and Botrel (2001). The application of nitrogen can increase the carrying capacity of pastures and animal production per unit area, being essential to improve the efficiency of livestock.

According to Werner (1986), nitrogen is fundamental for the development of forage plants, affecting the size of leaves and stems, in addition to influencing the emergence and growth of tillers. The author observes that when the availability of nitrogen in the soil is low, plant growth becomes slow, resulting in a reduced size and a scarce number of tillers, which leads to insufficient protein levels to meet the nutritional requirements of the animals. The main natural source of nitrogen in soil is organic matter, which is not directly absorbed by plants, but needs to be mineralized by microorganisms for nitrogen to become available.

In addition, nitrogen plays a structural role in plants, as it is an essential component of organic compound molecules, such as proteins and amino acids, and participates in vital metabolic processes, including photosynthesis, respiration, protein absorption, and synthesis (LOPES, 2005).

Due to its importance for plant species, several studies have been carried out to evaluate the effects of nitrogen fertilization on forage plants of the species *Megathyrsus maximus* (synonym of *Panicum maximum*), especially in relation to its influence on morphology, physiology, and chemical composition (LAGE FILHO *et al*., 2024; GOMIDE *et al*., 2019; GOMIDE, 2016; GALINDO *et al*., 2017). Lage Filho *et al*., (2024) and Gomide *et al*., 2019 in their work observed an increase in the number of tillers in response to nitrogen fertilization, which contributes to the improvement of forage production and quality.

The grasses of the genus (*Megathyrsus maximus* [Jacq.] B. K. Simon & S. W. L. Jacobs) have a high productivity, quality and adaptations to different edaphoclimatic conditions and resistance to pests, such as the leafhopper (JANK *et al*., 2010; (GOMIDE, 2016; LAGE FILHO *et al*., 2024). Among the cultivars *Megathyrsus maximus* that stand out in pastures in Brazil is cv. Mombasa (JANK *et al*., 2010; BATISTA *et al*., 2024) and cv.

MG12 wall (MATSUDA, 2023). According to information from Matsuda Sementes, the MG12 Paredão cultivar has a good palatability, resulting in good production of both meat and milk, it is a grass demanding in soil fertility, with characteristics of intense basal tillering, broad leaves, with excellent forage production, in addition to presenting trials with the absence of nymphs and adult leafhoppers (MATSUDA, 2022). It has recommendations for silage production and direct grazing, as it has a good leaf/stem ratio (BARBEDO, 2020). The *Megathyrsus maximus* cv. Mombasa is also an option for areas with high soil fertility, with indications mainly for pastures in intensive systems (REGO *et al*., 2003). Acceptance beyond cattle, such as for buffaloes, sheep and goats; medium tolerance to the grasshopper, and good adaptation to different edaphoclimatic conditions, with high carrying capacity, providing high animal production capacity (PEREIRA, 2016). Employed best when subjected to rotational grazing (GOMIDE, 2016).

In view of the above, understanding whether nitrogen fertilization can improve pasture productivity in a context of climate variability is crucial to optimize pasture management and improve productivity. Therefore, the objective was to evaluate the influence of different levels of nitrogen fertilization on the structural characteristics of *Megathyrsus maximus* cv. Mombasa and cv. Wall in a period of drought.

METHODOLOGY

This study was carried out at the Lourenço Vieira da Silva Exhibition Park – SINRURAL, located in the city of Imperatriz/MA, located at the geographic coordinates 5°33'41.18"S 47°27'25.15"W and altitude of 118 m. The cultivars Mombaça and Paredão of the grass *Megathyrsus maximus* (syn. *Panicum maximum*).

The climate of the region is classified according to Köppen-Geiger as Aw, characterized by having two predominant seasons, one dry and the other rainy, with an average temperature of 27.1°C and an average annual rainfall of 1221 mm.

The soil of the experimental area was classified as Fluvic Neosol. The area was prepared to receive the experimental units, including soil analysis to determine the chemical and granulometric characteristics of the soil (Figure 1). From the results of the soil analysis, it was found the need for soil correction, 1t/ha of dolomitic limestone was applied in an area of 5000m² totaling 500kg/ha, which was distributed by haul. This application aimed to improve soil pH, increasing nutrient availability and favoring forage establishment. Subsequently, soil plowing and harrowing were carried out.

Figure 1 - Chemical analysis of the soil sampled in the 0-20 cm layer.

			Complexo Sortivo							Saturação do Complexo Sortivo				
pH $CaCl_2$	M.O g/Kg	P mg/dm³	K	Ca	Mg	Al	H + Al	SB	CTC	V	m	Ca	Mg	K
			cmol /dm³							%				
Nro: 199872			Gleba: Area 01 0-20cm											
4,6	13,8	3,8	0,08	1,94	0,59	0,00	3,24	2,61	5,85	44,6	0,0	33,2	10,1	1,3

Legend: M.O. = soil organic matter; SB = sum of bases; V = base saturation, m = aluminum saturation.

For planting, phosphate fertilization was carried out using 330 kg/ha of fertilizer foundation of the formula 04-30-10, which was incorporated into the treatment area to assist in the initial development of the plants and correct the low levels found in the soil sample.

The sowing of the forage *Megathyrsus maximus* (syn. *Panicum maximum*) cv. Mombasa and Paredão were made by casting using a total of 16 Kg/ha in each experimental unit 20 g of encrusted seed was placed.

The evaluation and sample collection period took place from June to November 2021. The variables analyzed included height, number of tillers, and weight of the sample in the field. The nitrogen doses tested were: : 1°= 0 kg N $ha^{-1}year^{-1}$ (witness); 2° = 100 kg N $ha^{-1}year^{-1}$; 3° = 200 kg N $ha^{-1}year^{-1}$; 4° = 300 kg N ha^{-1} $year^{-1}$; 5° = 400 kg N $ha^{-1}year^{-1}$. Nitrogen application was performed every 28 days. During this period, the evaluations of the forages were carried out using a 50 cm x 50 cm square, randomly thrown in the experimental area.

A two-block Randomized Block Design (DBC) was used, with each experimental unit occupying an area of 12 m^2. In all, 40 experimental units were created, which included five treatments with different levels of nitrogen fertilization (0, 100, 200, 300, 400 Kg/ha/year) and two replications, using two varieties of forage: *Megathyrsus maximus* (syn. *Panicum maximum*) cv. Mombasa and Paredão.

The data were analyzed and submitted to analysis of variance with the aid of the statistical program Analysis of Variance System - SISVAR, and the mean test using the Tukey test at 5% probability.

RESULTS AND DISCUSSION

The results of the variables of height, number of tillers and green matter production per hectare are shown in tables 1 to 6, and are represented by the averages of the evaluations of each cut of *Megathyrsus maximus* cv. Mombasa and Paredão.

Table 1: Grass averages *Megathyrsus maximus* cv. Paredão and cv. Mombasa and in relation to the levels of nitrogen fertilization in the first cut.

GRASS	**DOSES OF N (kg.ha^{-1})**	**HEIGHT (cm)**	**NO. TILLERS**	**P.M.V. ha (kg.ha^{-1})**
Cv. Paredão	0	40,0	58.8from	3250,0
	100	47,5	47,0b	1850,0
	200	47,5	58.5from	3750,0
	300	45,0	56,8from	3600,0
	400	50,0	51.3from	2500,0
Cv. Mombasa	0	42,5	56.0from	1900,0
	100	45,0	69,5from	2650,0
	200	47,5	65,0from	2500,0
	300	50,0	80,5a	4000,0
	400	55,00	76.0from	3300,0
CV %		13,83	20,60	48,58

Source: Prepared by the authors.
Legend: Values by Tukey's test ($p < 0.05$). P.M.V. / ha: Green Matter Production per Hectare.

The data in Table 1 demonstrate positive effects of nitrogen fertilization on the variables analyzed. It is observed, in general, that with the increase in the dose of nitrogen, both the height and the number of tillers tend to grow, especially in the Mombasa field. In addition, at the dose of 300kg of N/ha, the Mombaça grassland achieved the highest number of tillers (80.5) and the highest production of green matter (4000kg/ha), indicating that this grass can be more efficient under this dose of nitrogen fertilization. In addition to indicating that this dose of nitrogen fertilization is effective in stimulating the growth and branching of the Mombaça grassland, which results in a higher density of plants.

On the other hand, in Table 6, Paredão grass showed efficiency in number of tillers at a dose of 200 kg of N/ha/year. This suggests that the Paredão can respond effectively to a lower dose of nitrogen fertilization compared to the Mombasa, which can be advantageous in terms of cost and management.

These results corroborate the observations of Fagundes *et al*., (2006) and Morais *et al*., (2006), who highlight the positive effect of nitrogen fertilization on grass tillering.

However, the other data related to the number of tillers in sections 2, 3, 4 and 5 (Tables 2, 3, 4 and 5) were not affected by fertilization levels, possibly due to unfavorable conditions of growth factors, such as light, temperature and, mainly, water availability, during the months of the experiment. According to Corsi and Nascimento Jr. (1994), the tillering of forage plants is a response to soil fertility, which is associated with the season, frequency and interval between cuts. The lack of water imposes limitations on the rate of leaf expansion, the number of leaves per tiller and the total number of tillers (CORSI *et al*., 1998).

Water availability is a determining factor for forage production, because in dry periods, plants tend to mature, which results in a decrease in forage quality, reduced crude protein levels and lower efficiency in forage digestibility (MOREIRA *et al*., 2003).

Table 2: Grass averages *Megathyrsus maximus* cv. Mombaça and Paredão in relation to nitrogen fertilization levels in the second cut.

GRASS	DOSES OF N ($kg.ha^{-1}$)	HEIGHT (cm)	NO. TILLERS	P.M.V. ha ($kg.ha^{-1}$)
Cv. Paredão	0	42,5	43,25	2600,0
	100	45,0	58,0	2850,0
	200	47,5	59,0	3250,0
	300	50,0	64,75	3300,0
	400	45,0	57,75	3250,0
Cv. Mombasa	0	47,5	52,75	2150,0
	100	45,0	60,75	1800,0
	200	42,5	63,50	2150,0
	300	45,0	60,75	2350,0
	400	50,0	70,50	2550,0
CV %		13,49	21,32	33,56

Source: Prepared by the authors.
Legend: Values by Tukey's test ($p < 0.05$). P.M.V. / ha: Green Matter Production per Hectare.

Table 3: Averages of Megathyrsus maximus cv. Mombaça and Paredão in relation to the levels of nitrogen fertilization in the third cut.

GRASS	DOSES DE N ($kg.ha^{-1}$)	HEIGHT (cm)	NO. TILLERS	P.M.V. ha ($kg.ha^{-1}$)
Cv. Paredão	0	36,25	54,50	1050,0
	100	46,25	63,25	1400,0
	200	50,00	86,50	1250,0
	300	52,50	84,25	1900,0
	400	47,50	73,25	1750,0
Cv. Mombasa	0	43,75	57,00	1000,0
	100	43,75	57,50	1350,0
	200	50,00	60,75	1600,0
	300	46,25	65,25	1750,0
	400	41,25	61,50	1500,0
CV %		14,63	23,05	48,81

Source: Prepared by the authors.
Legend: Values by Tukey's test ($p < 0.05$). P.M.V. / ha: Green Matter Production per Hectare.

Table 4: Averages of Megathyrsus maximus cv. Mombaça and Paredão in relation to nitrogen fertilization levels in the fourth cut.

GRASS	DOSES OF N (kg.ha^{-1})	HEIGHT (cm)	NO. TILLERS	P.M.V. ha (kg.ha^{-1})
Cv. Paredão	0	37,14	70,14	1228,6
	100	40,00	70,25	1100,0
	200	38,75	60,75	1200,0
	300	45,00	77,25	1700,0
	400	45,00	66,25	1100,0
Cv. Mombasa	0	40,00	61,00	1800,0
	100	38,75	66,50	1350,0
	200	42,50	64,50	1450,0
	300	40,00	56,25	1450,0
	400	41,25	78,25	1700,0
CV %		14,85	19,88	35,58

Source: Prepared by the authors.
Legend: Values by Tukey's test (p < 0.05). P.M.V. / ha: Green Matter Production per Hectare.

Table 5: Averages of Megathyrsus maximus cv. Mombaça and Paredão in relation to nitrogen fertilization levels in the fifth cut.

GRASS	DOSES OF N (kg.ha^{-1})	HEIGHT (cm)	NO. TILLERS	P.M.V. ha (kg.ha^{-1})
Cv. Paredão	0	57,50	75,25	8200,0
	100	72,50	61,25	7800,0
	200	67,50	82,50	8050,0
	300	72,50	106,25	11100,0
	400	67,50	82,75	7900,0
Cv. Mombasa	0	53,75	66,50	7650,0
	100	66,25	90,50	8500,0
	200	75,00	84,00	11400,0
	300	75,00	87,25	11650,0
	400	71,25	107,75	13000,0
CV %		13,93	31,21	27,23

Source: Prepared by the authors.
Legend: Values by Tukey's test (p < 0.05). P.M.V. / ha: Green Matter Production per Hectare.

During the experiment period, the height of the Paredão forage did not reach the recommended measurement for the beginning of grazing, which varies between 80 and 90 cm, as mentioned by Matsuda (2021). The analysis of variance indicated a significant effect of grass height only in the sixth cut. This is shown in Table 6, where Paredão grass responded to the application of 300 kg of N/ha/year, while Mombaça grass showed favorable responses at doses of 200 and 300 kg of N/ha/year.

Table 6: Averages of Megathyrsus maximus cv. Mombaça and Paredão in relation to nitrogen fertilization levels in the sixth cut.

GRASS	DOSES OF N (kg.ha^{-1})	HEIGHT (cm)	NO. TILLERS	P.M.V. ha (kg.ha^{-1})
Cv. Paredão	0	80,00c	57,50abc	14550,0
	100	102,50from	70,25from	18950,0
	200	97,50abc	73,25a	12800,0
	300	107,50a	55,50abc	12600,0
	400	105,00from	51,00abc	16600,0
Cv. Mombasa	0	82,50bc	43,50bc	8150,0
	100	95,00abc	37,00c	8250,0
	200	107,50a	38,25c	10450,0

	300	107,50a	44,75bc	10350,0
	400	105,00from	47,75bc	10150,0
CV %		10,02	21,69	37,31

Source: Prepared by the authors.
Legend: Values by Tukey's test ($p < 0.05$). P.M.V. / ha: Green Matter Production per Hectare.

According to the data in Table 6, Paredão grass showed efficiency in number of tillers at a dose of 200 kg of N/ha/year. This suggests that the Paredão can respond effectively to a lower dose of nitrogen fertilization compared to the Mombasa, which can be advantageous in terms of cost and management.

The impact of nitrogen fertilization observed in this study did not present positive results in relation to the increase in green matter production, which contrasts with the results of MOREIRA *et al*., (2011), who showed a significant effect of nitrogen fertilization on the increase in forage production in the pasture of *Brachiaria decumbens* cv. Basilisk. In addition, a literature review by Mariani *et al*., (2018) indicates that higher doses of nitrogen have a beneficial effect on the dry matter production of MG12 Paredão grass, which responds satisfactorily to nitrogen fertilization. The low production and, in part, the reduction in quality during the dry season can, according to Ferreira (1998), be attributed to a deficit in the water balance.

The characteristics of *Megathyrsus maximus* cv. Mombasa and cv. Walls that include the recommendation of soil with high fertility and the ability to produce quality forage, suggest that these forages have a good potential response to nitrogen fertilization. However, the edaphoclimatic conditions during the months of evaluation of the experiment were unfavorable, especially due to the dry period, which led to an unsatisfactory performance of the pasture under these conditions.

CONCLUSION

Nitrogen fertilization showed a positive effect on grass tillering only in the first and sixth cuts, with results observed for Paredão grass with 200 kg of N/ha/year and for Mombaça grass with 300 kg of N/ha/year.

During the implementation of this study, only the sixth cut reached the height recommended for the beginning of grazing, which was 107.50 cm for Paredão grass with 300 kg of N/ha/year and for Mombaça grass with 200 and 300 kg of N/ha/year. This information is essential for the proper management of pastures, allowing producers to adjust fertilization doses according to the grass species and specific cultivation conditions, with the objective of maximizing forage production and the efficiency of the pasture system.

The doses tested had no impact during the dry periods in relation to the potential for green matter production per hectare, and there was no significant difference between the grasses studied.

Therefore, the results suggest that nitrogen fertilization in the dry period does not provide satisfactory yield results.

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