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Research Article

Productivity of Mombaça Grass Subjected To Different Nitrogen Doses

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Abstract

For plant nutrition and as an essential constituent of proteins, nitrogen is of fundamental importance for the good development and growth of pastures. In this way, the present work aimed to evaluate the effect of different doses of nitrogen fertilization on the productivity and crude protein of Mombaça grass in the conditions of Palmeiras de Goiás. The experiment was conducted in the municipality of Palmeiras de Goiás - GO in a randomized block design (RBD) with four doses of N and five replications, totaling 20 experimental plots. With dosages of 0, 90, 220 and 330 kg ha^{-1}. The urea was used as a N Source. The evaluations included plant height, stem diameter, fresh mass, and crude protein content. The Mombaça grass showed a significant response to each level increase in nitrogen dosage, with an increase mainly in forage production (height, weight and width of stem) at a nitrogen dose of 330 kg ha^{-1}, reaching 60 t ha^{-1} of production. As for the crude protein index in the grass, the best result was at the dosage of 90 kg ha^{-1}.

Keywords: Forage Plants; Pastures; Nitrogen Fertilization; Crude Protein

Introduction

Most grass species of African descent arrived in Colonial Brazil through slave ships. Among these is Mombaça grass, which was used as a mattress for slaves and, upon arrival in Brazilian lands, was discarded on the soil. Due to its favorable conditions similar to those of Africa, Mombaça grass managed to adapt and spread throughout Brazil [1].

According to [2] among forage species in Brazil, the Panicum genus ranks second in demand by producers. The main interest in the genus is justified by Mombaça grass, which was introduced by Embrapa - Gado de Corte in 1993. It exhibits vigorous plant growth with rapid stand closure and high productivity but it requires greater soil preparation and planting care due to its small seed size compared to other forages with larger seed size.

According to [3], mombaça grass has generated interest not only in Brazil due to its high production, quality, adaptation to various climates and soils, good palatability, and animal conversion efficiency, which has increased interest and led to its substitution for other countries.

In subtropical and tropical environments, Mombaça grass is one of the grass species that performs best and yields a high dry matter index, with the possibility of reaching a production of 33 tons ha $year^{-1}$ [4]. Mombaça grass can provide excellent returns to the producer but it requires more nitrogen [5]. It has thick stems and contains a lot of water, making it mainly recommended for grazing, resulting in a 25% more efficient outcome compared to Tanzanian grass, and for silage production, resulting in increased milk production, but not being well utilized in hay production [6].

Nitrogen is essential for the healthy and efficient development of any crop. Insufficient amounts of nitrogen are detrimental to the synthesis of amino acids and proteins, nucleic acids, hormones, chlorophyll, and other organic compounds essential to plant life [7]. Among all nutrients, nitrogen is one of the major limiting

factors for overall progression, especially in plant dry matter production. The main nitrogen sources for plants are ammonia-based fertilizers, such as urea, ammonium sulfate, and ammonium nitrate [8]. Another detail highlighting the importance of studying nutrient behavior in forages is that nitrogen deficiency is the main cause of Brazilian pasture degradation. Therefore, the objective of this study was to evaluate the effect of different doses of nitrogen on the productivity and crude protein of Mombaça grass under cerrado conditions.

Materials and Methods

The experiment was conducted from January to March 2023, in the municipality of Palmeiras de Goiás. Initially, the area was weeded and plowed, followed by full-area basal fertilization using 100 kg ha^{-1} of N-P-K (10-10-10). Subsequently, seeds were uniformly sown in all plots and lightly covered with soil. Supplemental irrigation was not necessary throughout the experiment, as it was conducted during the peak of the rainy season, when precipitation is frequent. Fifteen days after grass emergence, a single topdressing nitrogen fertilization was applied. Urea with 45% Nitrogen was used as the fertilizer. The treatments included no nitrogen (0 kg ha^{-1}), 90 kg ha^{-1} of N, 220 kg ha^{-1} of N, and 330 kg ha^{-1} of N. The experimental design used was randomized complete block with a 4x5 scheme; four nitrogen doses and five replications each, totaling 20 experimental units. The experimental plots were sized at 2 x 2.4 meters, totaling 4.8 m^2. During the experiment, manual removal of weeds using a hoe was necessary. Final grass samples were collected at 95 days after planting to obtain the data.

At 95 days after sowing (DAS), the grass at different N doses was evaluated as follows

- **Plant height:** Measured using a tape measure from the base of the forage to the tip of the leaf (m).
- **Stem diameter:** Measured using a digital caliper, with results expressed in (cm).
- **Fresh mass:** Cutted close to the ground and weighed in kilograms using a precision balance.

The crude protein content (%) was determined by a leaf analysis at laboratory by following the methodology proposed by [9].

Results and Discussion

A significant effect was observed for all variables studied in this experiment. All variables were affected by the increasing doses of N applied to Mombaça grass. In pasture management, nitrogen plays a crucial role, especially in intensive production systems, such as rotational grazing, where forages need to recover within a short period to receive the animals rotating in a new cycle. Understanding the behavior of forages in response to mineral nutrition, especially nitrogen fertilization, provides field technicians with information for recommending management practices and species to be cultivated. This is particularly important considering that ruminant feeding in Brazil is based on pastures, primarily grasses [10]. Figure 1 shows the height of Mombaça grass at the four tested N doses under Palmeiras de Goiás conditions. The forage exhibited growth directly proportional to the N doses, with the 330 kg ha^{-1} dose reaching a height of 2.3m at 95 (DAS), approximately 29.6% higher than the plants in the treatment receiving 0 kg ha^{-1}.

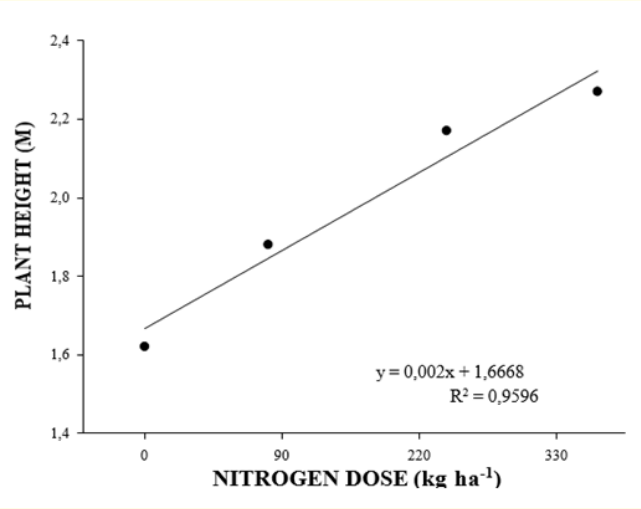

Figure 1: Height of Mombaça Grass cultivated under different doses of nitrogen fertilization. Palmeiras de Goiás, 2023.

[11] Assert that studies conducted with different doses of nitrogen fertilization also resulted in better plant height development, causing a difference of up to 26% in height for each nitrogen dose difference in their work. The stem diameter variable, as shown in Figure 2, also exhibited a direct effect on production with the studied N doses. Stem diameter directly influences grass quality; a larger stem volume is a negative point for animal nutrition, as the stem has a lower nutritional value compared to the leaf area. Thus, grass with a larger leaf area is of better quality. As expected, stem diameter also improved with increasing nitrogen doses, reaching an average of 0.33 cm at the highest dose, which is a slightly significant increase compared to leaf growth in the leaf/stem ratio.

The production of fresh mass (Figure 3) is one of the most important agronomic characteristics to consider in pasture management. It is based on the production of fresh matter that more te-

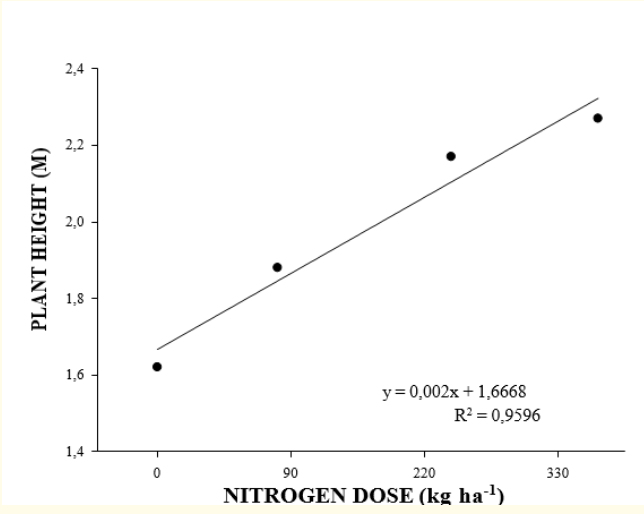

Figure 2: Stem diameter of Mombaça Grass cultivated under different doses of nitrogen fertilization.

chnical analyses of zootechnical interest can be conducted, which will define the specific number of animals that can remain in the area based on these agronomic characteristics.

The highest dose applied, 330 kg ha^{-1}, showed the highest fresh mass among the N doses studied in Mombaça Grass. Accumulating about 7.51 kg more when compared to the dose that received the lowest N dose (0 kg ha^{-1}). Effective responses of mass production with nitrogen applied as topdressing in Mombaça Grass were also confirmed in the experiments of [12].

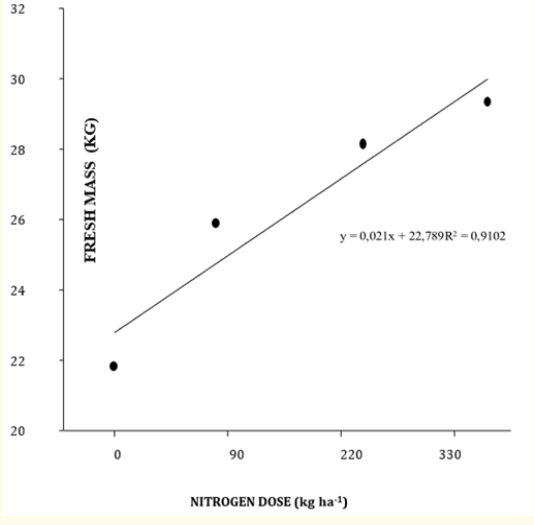

Figure 3: Fresh mass of Mombaça Grass cultivated under different nitrogen fertilization doses in Palmeiras de Goiás, 2023.

The crude protein in relation to the different doses of nitrogen fertilization can be observed in Figure 4. In the crude protein result, a significant difference is noticeable between the control group, where no nitrogen topdressing was applied, and the other samples with nitrogen topdressing. The highest levels were observed with doses of 90 kg ha^{-1} and 330 kg ha $^{-1}$, averaging 19.5%. [13] did not observe the effect of nitrogen fertilization on crude protein content in the first cut of the forage. [14] Obtained similar results in their experiments working with varied doses of nitrogen in Mombaça grass and Brachiaria agrass, using 70, 140, 210, and 280 kg ha^{-1} and 0, 100, 200, and 300 kg ha^{-1}, resulting in an increase in CP with the use of nitrogen. According to the authors, this is explained by the high amount of free amino acids, which fix nitrogen in their structure, and peptides in the grass tissue in response to the amount of nitrogen in the soil.

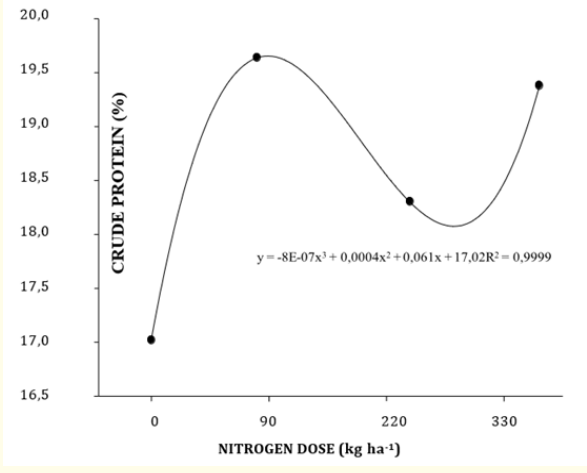

Figure 4: Crude protein content (%) of Mombaça Grass cultivated under different nitrogen fertilization doses in Palmeiras de Goiás, 2023.

Conclusion

- Mombaça grass showed a significant response to each increase in nitrogen dosage, particularly in forage production (height, weight, and stem width) at the nitrogen dosage of 330 kg ha^{-1}, reaching a production of 60 t ha^{-1}.
- Regarding the crude protein index in the grass, the best result was obtained at the dosage of 90 kg ha^{-1}.

Bibliography

1. ALEXANDRINO E., *et al*. "Rest period, canopy structural characteristics and live weight gain of steers in Mombaça grass pasture under intermittent stocking". *Revista Brasileira de Zootecnia, Viçosa* 34.6 (2005).
2. COLLOZA MT. "Yield and leaf diagnosis of aruana and Mombaça grasses grown in red-yellow latosol fertilized with nitrogen doses". Piracicaba. Thesis (PhD) - Escola Superior de Agricultura "Luiz de Queiro", University of São Paulo (1998): 126.
3. DEUNER S., *et al*. "Foliar and soil nitrogen fertilization in corn plants in the initial development phase". *Ciência e Agrotecnologia, Lavras-MG* 32.5 (2008): 1359-1365.
4. EUCLIDES VPB. "Mombaça grass management for wet and dry periods. Embrapa Beef Cattle; Campo Grande, MS (2014).
5. FACTORI MA., *et al*. "Forage mass productivity and crude protein of irrigated Mombaça grass as a function of nitrogen fertilization". *Colloquium Agrariae* (2017): 49-57.
6. FONSECA DM., *et al*. "Absorption, use and internal critical levels of phosphorus and tillering in Andropogon gayanus and Panicum maximum". *Revista da Sociedade Brasileira de Zootecnia de Viçosa* (2010).
7. FREITAS KR., *et al*. "Evaluation of Mombaça grass (Panicum maximum Jacq.) subjected to different nitrogen doses". *Acta Scientiarum Agronomy* 27.1 (): 83-89.
8. GALINDO FS., *et al*. "Nitrogen fertilization management in Mombaça grass as a function of nitrogen sources and doses (2017).
9. MAÇÃS JES. "Nitric and Ammoniacal Nitrogen in the Development of the Aerial Part of Corn Cultivated in Argissol.
10. MANARIM CA and MONTEIRO FA. "Nitrogen in the production and leaf diagnosis of Mombaça grass". *Boletim de Indústria Animal* 59.2 (2002): 115-123.
11. NASCIMENTO HLB. "Cultivars of Panicum maximum fertilized and managed with defoliation frequency corresponding to 95% light interception". *Viçosa MG* (2014).
12. SILVA DJ and QUEIROZ AC. "Food Analysis: Chemical and Biological Methods. 3rd edition. Minas Gerais: UFV Publisher (2005): 57-75.
13. VIANA MCM., *et al*. "Nitrogen fertilization in the production and chemical composition of Brachiaria grass under rotational grazing". *Revista Brasileira de Zootecnia* 40.7 (): 1497-1503.
14. VIEIRA RF. "Nitrogen Cycle in Agricultural Systems. Brasília, DF. Embrapa (2017).