Mass production and morphology of Brauna brachiaria under different nitrogen rates in the Brazilian savannah

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Abstract: Nitrogen is the nutrient that most contributes to increase forage productivity and quality. The objective was to evaluate Brauna brachiaria (*Urochloa brizantha* cv. Brauna) submitted to nitrogen doses in the Brazilian savannah through the total and green mass production, leaf:stem and brachiaria:weed ratio. Plots were established in a randomized block design, with four replications and four N doses 0, 50, 100 and 150 kg N/ha). After the uniformization cut, the data collect cycles occurred when the canopy reached 30 cm average height. Samples were taken until 15 cm from the ground in an area of 0.25 m^2. Fractions were separated according botanical (brachiaria and weeds) and morphological (leaf, stem, dead material and inflorescence) components. The maximum and minimum response points were calculated by derivative. Samples were weighed and dried and values were used to calculate components mass production and ratios. The highest value of dry matter production occurred at 100 kg N/ha dose (2,606 kg DM/ha). Below or above this value the mass production decreased. The highest value of relation green mass:dead material was 4.24 at 131 kg N/ha dose. Brauna was able to control the weeds, and the best performance (4.68) was observed at 86 kg N/ha dose. The highest accumulation rate occurred at 87.5 kg N/ha dose. Brauna had higher leaf:stem ratio with higher nitrogen doses but above 131 kg N/ha the dead mass can result in energy loss per respiration. Above 86 kg/N the mass accumulation rate decreases which means that the fertilization cost is not favorable over this dose.

Introduction

The most pasture areas in Brazil are cultivated with the species *Urochloa brizantha* and *Megathyrsus maximum* which represent more than 90% of Brazilian tropical pastures (Vilela 2019). Despite of this, new forage cultivars have been introduced or even improved by research and/or education institutions and private companies in order to obtain the most suitable germplasm for each region.

In order to forage species express their maximum productive potential, fertilization becomes one of the most important abiotic factors within the production system. Fertilizers provide the necessary nutrients to the metabolic demand of plants and so interferes in forage quality. Among the macronutrients, nitrogen is in insufficient quantity to attend grasses demand with high production potential due to the degradation of soil organic matter in Brazilian savanna, because its high cycling or unavailable as a function of low soil pH (Fagundes et al. 2006).

Bonfim da Silva & Monteiro (2006) observed that nitrogen rates were decisive for leaf and stem dry mass production. Higher values of leaf:stem ratio result in higher forage protein value, digestibility and consumption. Besides that, to favoring the grass after defoliated, the nitrogen apport guarantee greater remaining leaf area and, consequently, greater regrowth speed (Rodrigues et al. 2008).

The objective was to evaluate *Urochloa brizantha* cv. Brauna submitted to different doses of nitrogen fertilization in the Brazilian savannah through the production of total and green mass, leaf:stem ratio and brachiaria:weed ratio.

Methods and Study Site

The experiment was set up in 2021 in the Forage and Pasture Sector area of Jatai Federal University, State of Goias, Brazil (51°430S, 17°530W and 670 m asl) in a latosol red soil (Santos et al. 2018). The climate is mesothermal with dry winters, Aw according to the Köppen classification. The average annual rainfall is 1,534 mm occurring from October to April, 23.2ºC of average temperature, ranging from 21,0 to 25,1ºC.

After desiccation the area was liming and fertilized, which was based on soil analysis results with calcitic limestone (3,000 kg/ha), super triple phosphate (STP - 130 kg/ha) and potassium chloride (KCl - 40 kg/ha), the plots were distributed in four blocks separated by half meter wide corridors to provide ground slope control, within a 17.75 x 17.75 area. The *Urochloa brizantha* cv. Braúna (MG13) was planted in 4 x 4 meter parcels and the four nitrogen doses were randomly applied in the plots along four blocks, subdivided in three nitrogen applications (December, February and April). The quantity of seeds planted looked for the waited initial population of 2,000 plants/m^2.

Cycles were defined by the canopy height and samples were collect when sward reaches 30 cm average height. Between January to May 2021, six cycles were evaluated. The sample graze mass strata (up to 15 cm from the ground) was collected from an area of 0.25 m^2 with a scissors. After sampling, plots were uniformed using a manually. Samples were manually separated according botanical (Brachiaria and weeds) and morphological (leaf, stem, dead material and inflorescence) components. After this they were weighed and dried in a forced ventilation oven at 60ºC until reaching constant weight. The weight values was used to calculate Brachiaria:weeds ratio, leaf:stem ratio, green:dead mass and mass accumulation rate. The maximum and minimum response points were calculated by derivative. Data were analyzed using logistic regressions, using the GLM procedure of SAS considering collects and nitrogen doses. Quadratic regressions were used after a testing lack of fit for a simple linear regression model.

Results and Discussion

The total mass production (stems, leaves, inflorescence and dead material) and green mass production (leaf and stem) was altered by the nitrogen fertilization. The highest value of dry matter production occurred at 100 kg N/ha dose (2,606 kg DM/ha). Above and below this value the mass production decreased (Fig. 1 and 2).

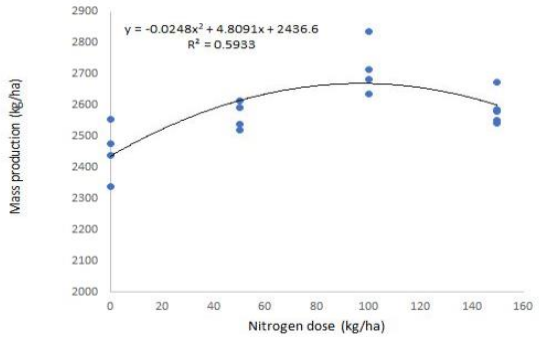

Figure 1. Total dry mass of Brauna submitted to different nitrogen doses

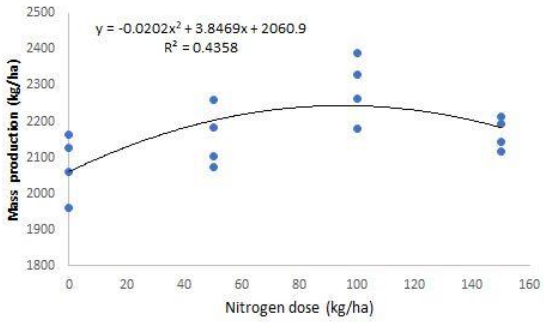

Figure 2. Green dry mass (leaf and stem) of Brauna submitted to different nitrogen doses

When evaluated the green mass:dead material ratio, Brauna grass showed a positive linear response to nitrogen fertilization levels. The highest relation green mass:dead material ratio was 4.24 at 131 kg N/ha dose. The highest green mass:dry ratio is desirable in the grazing system because the animal harvests the green part of the pasture, but it is also important to remember that the dead mass favors nutrient cycling and the sustainability of production systems.

We should avoid the elongation of the internode and stem, which results in a lower leaf:stem ratio, quality and pasture perennity due to the loss of mass digestibility and sward structure. In this aspect, Brauna grass showed a favorable as response to nitrogen doses presenting increasing leaf:stem ratio (2.09) as response to the increasing nitrogen dose until 150 kg N/ha dose. The grass structure is constituted by the leaf:stem ratio (Da Silva & Nascimento Jr. 2006) which changes in the pasture quality and in the grazing ingestive behavior, increasing the bite volume and, consequently, the leaf ingestion.

Leaves have higher nutritional value and promote better animal performance as a function of consumption and mass digestibility, factors that determine mass quality. Every time the stem elongate, the tiller exposes its growing point (apical meristem) to decapitation, which results in high tillers mortality and, consequently, in a small stand and in the pasture perenniality loss.

When evaluating the mass of Brachiaria and weeds ratio it is observed that the Brauna was able to control the weeds, and the best performance (4.68) was observed at 86 kg N/ha dose. Forage accumulation rate is the mass production/day and the highest accumulation rate occurred at 87.5 kg N/ha dose.

Conclusion

The highest dry mass and green mass production of Brauna grass occurred at 100 kg N/ha dose. Brauna had higher leaf:stem ratio with higher nitrogen doses but above 131 kg N/ha the dead mass can result in energy loss per respiration. Above 86 kg/N the mass accumulation rate decrease which means that the fertilization cost is not favorable over this dose.

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