Tillering of ‘Marandu’ Brachiaria Under Different Nitrogen Rates in The Brazilian Savannah

Assis, A. B. O.*; Bocchi, A. L.*; Pedrosa, T. C.*; Matos, A. O.*; Soares, A. P. B.*
* Agricultural Sciences Unit, Jataí Federal University

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Abstract: The tiller is the basic unit of grass growth and tiller density determines the horizontal ground cover, leaves production and pastures perennially. The objective in this study was to quantify the number of aerial and basal tillers and basal:aerial tillers ratio in *Urochloa brizantha* cv. Marandu, established in Brazilian savannah, submitted to nitrogen doses (0, 50, 100 and 150 kg N/ha). The experiment was carried out in the Forage and Pasture Sector of Jataí Federal University (UFJ) and after soil correction and fertilization, plots were established with Marandu palisade grass in a randomized block design, with four replications and four N doses. Tiller count was performed after the uniformity cut and at the end of each cycle, when the average height of the forage canopy reached average 30 cm. Tillers were identified with colored wires (one color/generation), in a total of six generations (cycles). The highest ratio of basal:aerial tiller was 1.36 and occurred at dose of 100 kg N/ha as an answer to the highest tiller survival and lowest tiller mortality. Highest percentage of basal tiller and the lowest percentage of aerial tiller occurs at dose of 100 kg N/ha. Nitrogen fertilization is an important strategy to obtain more production of high quality mass, highest ground cover by highest survival rate, less mortality and a better proportion between basal and aerial tillers in Marandu palisade grass, favoring their perennity when is used 100 kg N/ha.

Introduction

Brachiaria spp. are among the grassland plants that are most commonly used for cattle produced in Brazil, given their plasticity, architecture, canopy structure and a great degree of adaptability to the soil and environmental conditions (Euclides et al. 1999). Their high tillering capacity results in increased production of high quality biomass and pasture perennity.

Tillering is the process through which new grass tillers are generated, which is regulated by hormones in response to luminosity and temperature stimuli, plus defoliation frequency, hydric conditions, and N fertilization. New tillers result from the development from buds whose dormancy was broken (Auda et al. 1966; Corsi & Nascimento Jr. 1994), either from basal buds (basal tillers) or from axillary buds (aerial tillers). In grass plants, the tillering process is a very important item in the development of forage production and management, since it is known that the rates at which tillers appear, die, and survive result in changes to tiller dynamics, demography, and population density, as well as in pasture productivity during and across years and define its perennity.

Such is the reason why research and learning institutions and organizations, both public and private, are constantly working towards genetic improvement of forage plants and are constantly bringing forth new accessions and cultivars from different species, including hybrid forages, which are often better adapted for specific regions, selecting cultivars with more basal tillers, with a goal of greater biomass yield. Among forages used in Brazil, brachiaria spp. represent more than 80% of cattle pastures, and are also widely used in integrated production systems.

The objective was to quantify the number of aerial and basal tillers and basal:aerial tillers ratio in Marandu palisade grass, established in Brazilian savannah, submitted to nitrogen doses (0, 50, 100 and 150 kg N/ha).

Materials and Study Site

The experiment was set up in year 2021 in the Forage and Pasture Sector area of Jataí Federal University, State of Goiás, Brazil (51°430S, 17°530W and 670 m asl) in a latosolic red soil (Santos et al. 2018). The climate is mesothermal with dry winters, Aw according to the Köppen classification. The average annual rainfall is 1534 mm occurring from October to April, an average temperature of 23.2ºC (ranging from 25.1 to 21ºC). After dissecting, liming and fertilizing, which was based on soil analysis results and included calcitic limestone (3000 kg/ha), super triple phosphate (130 kg/ha) and potassium chloride (40 kg/ha), plots were divided in four blocks separated by half meter wide corridors to provide ground slope control, all within the 17.75 x 17.75 meter area dedicated to the experiment. The *Urochloa brizantha* cv. Marandu palisade grass was planted in 4 x 4-meter parcels and the four different concentrations of nitrogen fertilizer were randomly applied in plots on the blocks, subdivided in three applications of nitrogen (December, February and April) and repeated in each following year. The quantity of seeds initially planted was compatible with the required initial population of 2,000 plants/m^2, and at the end of each cycle, population and also tiller dynamics and demography were evaluated, based on counts of basal, aerial and dead tillers. Tilers from different generations were told apart by wire rings of different colors, allowing to identify the generation to which belonged each tiller in an area determined by polyvinyl chloride washers installed in the center of each plot with the diameter of 350 mm. Cycles were defined by the time sward took to reach about 30 cm average height and at in this moment the parcels were pruned to a height of 15 centimeters and the tillers were counted once time more. Between January to March 2021, six cycles were evaluated, and at the end of each cycle the rates of tiller generation, death and survival were computed, as well as the percentages of basal and aerial tillers and their relative proportion. Regression curves were obtained with the aid of the SISVAR statistical program, considering collections and nitrogen dose as levels.

Results and Discussion

Tiller survival rate was higher at the 100 kg N/ha rate (Figure 1) and the difference between the doses even in mortality (Figure 2) show that this fertilization recommendation can maximize the production capacity and sustainability of the production system. When Marandu palisade grass is properly fertilized, it shows a great capacity to produce basal tillers (Figures 3 and 4) with high life span which sustains an adequate ratio of tiller basal:aerial, providing good ground cover and ensures pasture perennity.

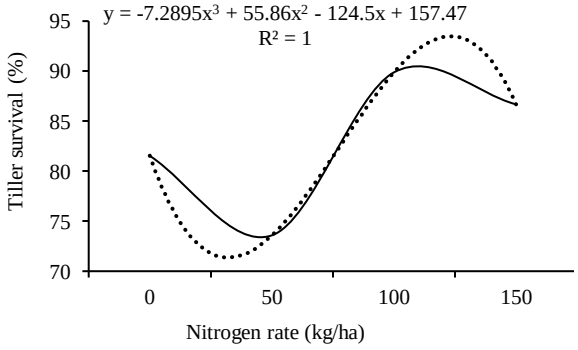

Figure 1. Tiller survival rates of Marandu palisade grass submitted to different nitrogen rates.

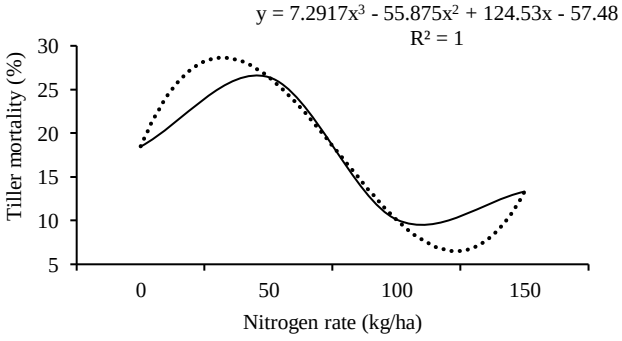

Figure 2. Tiller mortality rates of Marandu palisade grass submitted to different nitrogen rates.

The highest ratio of basal:aerial tiller was 1.36 and occurred at the 100 kg N/ha rate (Figure 3) because of the high tiller survival and low tiller mortality. The 100 kg N/ha rate similarly provided the highest percentage of basal tillers and the lowest percentage of aerial tillers. This result may be somewhat cultivar-dependent because Marandu palisade grass has short rhizomes and erect to slightly decumbent stems which allow the light to reach the lower strata of the canopy, thereby stimulating basal tillering and improving ground cover.

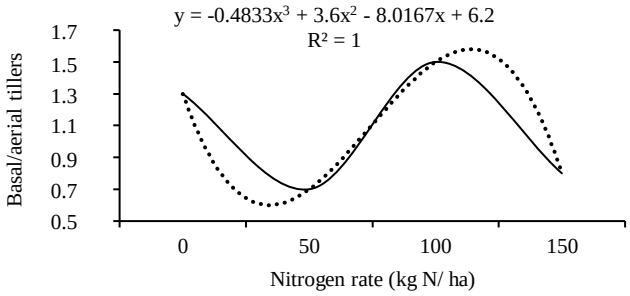

Figure 3. Proportion of basal to aerial tillers of Marandu palisade grass submitted to different nitrogen rates.

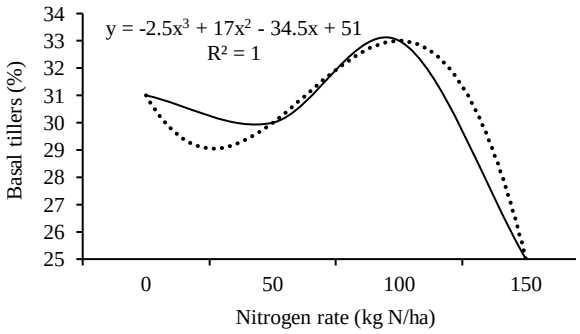

Figure 4. Basal tiller percentage of Marandu palisade grass submitted to different nitrogen rates.

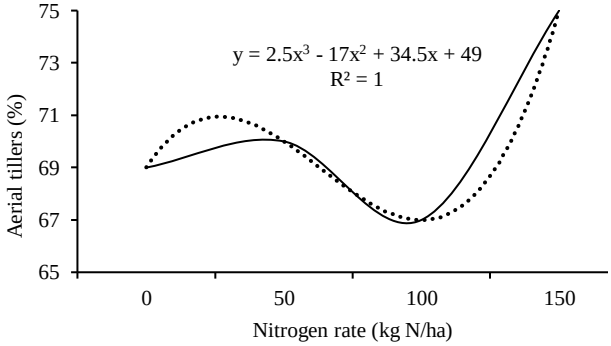

Figure 5. Aerial tiller percentage of Marandu palisade grass submitted to different nitrogen rates.

A greater proportion of basal tillers is a primary factor in ensuring ground cover in perennial pastures. According to derivate calculated, theses tillers reached a maximum of 333 tillers/m^2 at 74 kg N/ha and represents 32% of all tillers. The maximum aerial tillers was 754 tillers/m^2 and occurred at the 150 kg N/ha rate, where it represented 73% of all tillers. Higher aerial tiller percentages are associated with stem and internode elongation, which can compromise the forage quality and canopy structure.

Conclusion

Nitrogen fertilization is an important strategy to obtain more production of high quality mass, highest ground cover by highest survival rate, less mortality and a better proportion between basal and aerial tillers in Marandu palisade grass. These results suggest these characteristics and the pasture's perennity is optimized at the 100 kg N/ha rate.

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