Estimation of Pasture Carrying Capacity using the Square Method, Cacaria, RJ

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ABSTRACT
The difficulty in determining the carrying capacity of a pasture is a reality in most rural properties, this determination has become increasingly necessary due to Global Climate Change, which makes the amplitude of climatic events more extreme, with susceptibility to periods of prolonged drought and drought, as well as large-volume precipitation events. These events have become more frequent and have direct impacts on Livestock. During the dry period, which occurs from June to September, the scarcity of forage significantly impairs cattle performance, leading to weight loss, a sharp reduction in milk production, decreased fertility and a general weakening of the herd. In this sense, the study aimed to evaluate the support capacity of a Brachiaria decumbens pasture for dairy cattle farming using the square methodology. The study was carried out at the Veterinary Medicine Course School Farm at the Iguaçu University, in a Brachiaria decumbens pasture, Municipality of Piraí, in Rio de Janeiro, in April. Support capacity was assessed using the Square Method, recommended by EMBRAPA (2010). Considering the result of approximately 3 AU/ha through rotation every 3-4 days, a low result, continuous monitoring of the pasture is recommended, with seasonal assessment according to the seasons. It is also recommended to carry out a soil analysis and possible fertilization and liming.

Keywords: Animal Production, Brachiaria decumbens, Fodder.

1 INTRODUCTION

The difficulty in determining the carrying capacity of a pasture is a reality in most rural properties, this determination has become increasingly necessary due to Global Climate Change.

Livestock is an economic activity totally dependent on edapho-climatic factors, such as temperature, rainfall, air and soil fertility and humidity, and solar radiation (Cunha et al., 2023). The main effects of changes in these factors affect crop productivity and management, as well as social and economic systems (Lima, 2002).

As a result of Global Climate Change, Brazil is more susceptible to periods of prolonged drought and drought, which are more frequent and have direct consequences for animal production (Silva et al., 2009; Silva et al., 2010). Considering the higher incidence of extreme events and the increase in the average temperature expected for the coming decades, of at least 2º C, these variations can have a very negative impact on livestock (Cardoso et al., 2020), culminating in a drastic reduction in pasture quality and adaptive physiological changes such as a decrease in protein content and an increase in fiber content, making digestion slower and food less nutritious (Leal, et al., 2021).

Several studies have addressed the relationship between edaphoclimatic factors and forage production, highlighting the importance of agroclimatic zoning to assess the risks and potentials of livestock in the face of climate change (Lima. 2022; Echeverria et al., 2016; Silva et al., 2010). Among the commercial crops, forage species represent the most cultivated plants of economic interest in Brazil and in the world (Vitória et al., 2012). Among the forage plants used by the animals, grasses of the genus Brachiaria and Panicum are the main options to feed the Brazilian cattle herd (Silva et al., 2016; Silva et al., 2017). Due to its desirable characteristics, such as resistance, dry matter production, and nutritional value (Lisbôa et al., 2016; Mendonça et al., 2014).

In the region where the UNIG School Farm is located, located in Piraí, Rio de Janeiro, the cattle ranching activity is mainly based on the use of native or cultivated pastures. However, there is an irregular availability of forage throughout the year, with greater supply during the rainy season and a significant reduction in the dry season. This variation affects carrying capacity, reducing the nutritional quality of forage, resulting in negative impacts on the zootechnical indices of herds (Cavalcante, 2015; Milhorance et al., 2019).

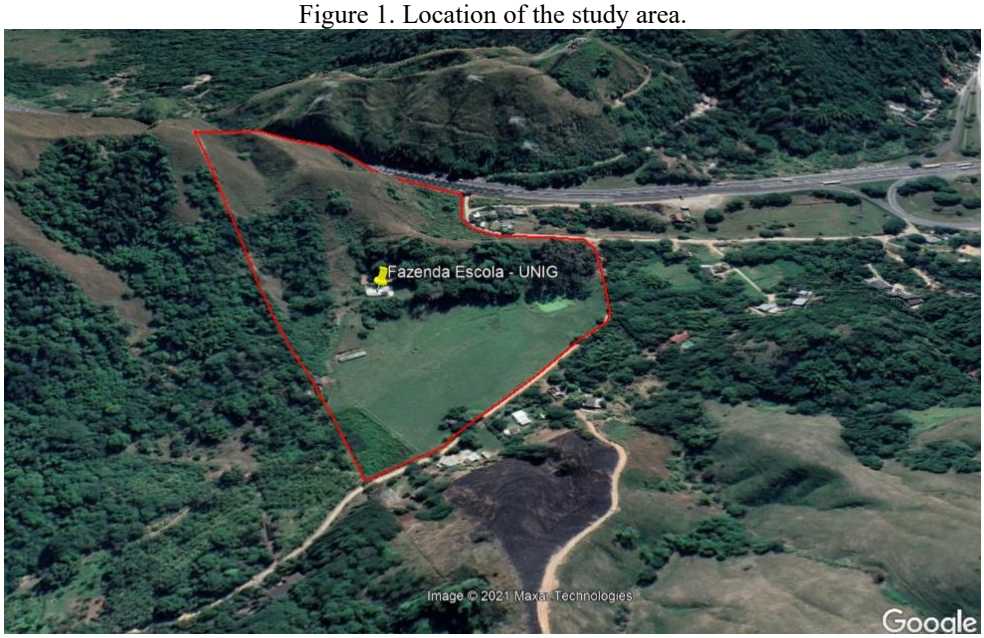
Studies carried out in semi-arial regions, as highlighted by Monção et al. (2019) and Santana et al. (2019), report low carrying capacity, reflecting in low zootechnical indices due to the nutritional deficit caused by long periods of drought. In this context, it is important to understand the correlations between the productive and nutritional characteristics of forage, in order to optimize animal performance and longevity of pasture use (Leal et al., 2020; Reis et al., 2020).

In this sense, the objective of this study was to estimate the carrying capacity of a Brachiaria decumbens pasture for dairy cattle using the square method.

2 METHODOLOGY

The study was carried out on a property in the municipality of Piraí, Rio de Janeiro, where the School Farm of the Veterinary Medicine course of the Iguaçu University, Nova Iguaçu Campus, is located (Figure 1).

Figure 1. Location of the study area.



Fonte: GoogleEarth, 2022

The pasture area was selected based on the observation of some characteristics, such as: proximity to the place where the animals are fed (stable, corral, etc.), proximity to roads to facilitate transport and maintenance operations.

To evaluate the carrying capacity, it was carried out according to the Square Method, according to a technical document from EMBRAPA (Salmam, 2006), which informs on how to proceed with the template, which consists of cutting the forage present within a known area delimited by a wooden or metal frame (figure 2), thrown at random at different points of the area to be evaluated.

Figure 2. Wooden template with an area of 0.25m2 (50x50 cm)

The evaluation of the pasture was carried out with a template, a wooden frame with an area of 50cm X 50cm for the collection of plant material. This method consists of cutting the forage present inside the template up to a height of 10cm above the ground, the template is thrown at random at ten points of the area to be evaluated. The collected plant material was packed in paper bags (figure 3) and sent to the Multidisciplinary Laboratory, Block B, of the University of Iguaçu for drying and then processed in the Soil Laboratory of FACET, Block M.

The pasture evaluated was Brachiaria decumbens (genus Brachiaria), which are the most used in Brazil among the cultivated forages. B. decumbens is commonly called brachiarinha or signalgrass, it was introduced in Brazil in the early 1960s. It spread rapidly due to its favorable characteristics for cultivation, especially in conditions of low fertility soils, normally found in the cattle growing regions of the country (Paciullo et al., 2016).

Brachiaria decumbens has some outstanding characteristics. Such as: good adaptability to acidic and poor soils; high seed production during the rainy season; easy multiplication by seeds; hardiness, high ability to compete with invasive plants and good forage production. However, it also has some associated restrictions, such as: susceptibility to grassland leafhoppers and photosensitization (Paciullo et al., 2016).

Figure 3. Collection of plant material and packaging in paper bags

3 RESULT AND DISCUSSION

A total of 20 simple samples were collected by sampling with a 50X50 cm (25m2) gauge at random locations, and then quantified as a whole, extrapolating to 1 ha. The forage was dried in an oven to determine the moisture content (U%) and then the DM (dry matter) calculation.

$$MS\% = \frac{Dry\ weight\ (g)}{Sample\ weight\ (g)} . 100$$

After drying, the sample showed 74% moisture, 26% of which was dry mass (DM) and the average value of the samples/template was 240g/DM per template, totaling 960g/m2. To determine the carrying capacity, the following equation was used:

$$Production = Grass\ weight\ (kg) x\%MS$$

It was found 2496kg/ha.

Considering that DM intake is equal to 2% of live weight (LW) and the average herd weight is 500 kg, DM/animal intake would be 10 kg/DM/day. With a pasture occupation period of 3 days, each animal will be 30 kg/DM (As cattle select the diet during grazing, it is recommended that the forage available in the pasture be twice the animal's consumption capacity).

So, in this case, 60 kg/DM would be needed for each animal. Dividing the yield by the value per animal, we have approximately 3 AU/ha by rotation every 3-4 days, according to the forage height (median value, interval of 1.5 AU winter – 3.5 AU summer), it is indicated to carry out adequate management (fertilization and liming).

It was observed that there was a relationship between the height of the grass and the higher the mass values, and the higher the grass, the greater the mass of the sample.

4 FINAL THOUGHTS

The square methodology was successfully performed and is easy to reproduce. The carrying capacity found was approximately 3 AU/ha by rotation every 3-4 days, according to the forage height (median value, considering the interval of 1.5 AU winter – 3.5 AU summer), indicating that adequate pasture management should be carried out. Considering the time of sampling, April, the value was lower than expected, of 3.5 AU for summer, it is recommended to continue monitoring the carrying capacity throughout the year. It is suggested that a correlation analysis between forage height and mass should be performed.

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