

Sugarcane Varieties for Animal Feeding in the Pre-Amazon Region of Brazil

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Abstract

The expansion of agricultural frontiers in Brazil has resulted in the growth of ruminant production in the Pre-Amazon Region. However, this production is favored mainly in the rainy season, due to the greater supply of pasture for the animals. This fact limits the maintenance of production due to the lack of quality forage for the animals throughout the year. This work aimed to evaluate the nutritional value of the different sugarcane varieties for animal feeding during four crop cycles. In this experiment, the varieties RB 92579, RB 867515 and RB 863129 were studied for cane plant, first, second and third ratoons. The experiment was divided in four stages according to each cycle, and each cycle lasted approximately 10 to 11 months. For the productivity analysis and other parameters samples were collected at the end of each experimental cycle, when the dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), Brix, NDF/Brix and productivity were determined. The RB 92579 variety showed higher productivity ($P < 0.05$) in all the studied cycles, and remained above the national productivity average in all the cycles ($\pm 75 \text{ ton ha}^{-1}$). This same variety, presented the best results for all nutritional parameters (DM, CP, NDF, ADF and FDN/Brix) when compared to the other varieties. The productivity/nutritional relation value must be taken into account when choosing a variety for animal feeding, being the RB 92579 variety the most expressive, during four cycles, which lasted 4 years.

Keywords: nutritional value, productivity, *Saccharum* spp.

1. Introduction

With the expansion of agricultural frontiers in Brazil, the Pre-Amazon Region is in full growth with regard to the production of ruminants, mainly goats, sheep, and dairy cattle. However, this growth is considered seasonal, once the production is only accentuated in the rainy season when there is a greater supply of pasture for the animals. This fact is a limiting factor for the constant maintenance of production due to the lack of quality forage for the animals throughout the year, specially in the Pre-amazon region, where research is needed to improve ruminant production.

The Brazilian Legal Amazon Region extends over an area of approximately 5,200,000 km² and represents 59% of Brazil's land mass. Its population of twenty four million people are distributed over 775 municipalities and the region is home to a very high ecological and socio-economic diversity. The livestock activity in these region has its importance in the socioeconomic-spatial context. Thus, agriculture studies in the Pre-Amazon region represent an important role, since results found can be expected to expand to other parts of Amazon, where it is important to maintain sustainability (Silva et al., 2009).

Used in the rest of the country as an excellent forage resource in the dry season due to its innumerable attributes, such as the easy implantation, the need for few crop treatments, as well as its high productivity (ranging from 100 to 120 ha⁻¹ or even more), sugarcane has increased its expressiveness in the agricultural scenario in Brazil's Pre-Amazonian Region, currently with 840 ha⁻¹ planted, and average productivity of 51.64 ton ha⁻¹ in this region (Vidal, 2018). In addition, their harvest season coincides with the period of pasture shortage. Regarding animal feeding, the nutritional value of sugarcane should not be considered as an isolated factor, but as a complex formed by chemical composition, and secondary constituents that, together, may interfere with the ingestion and

use of the forage consumed by the ruminants, as well as other factors, such as age, parts of the plant and mainly the variety.

In view of the diversity of the available varieties in the industry, the varieties selection for forage purposes is of great importance and is directly linked to the success of the nutritional management of the animals, where the adequate choice is the guarantee to have good bulky quality throughout the period of forage shortage (Silva et al., 2018). However, one point to be observed is that this forage also has other characteristics that may limit its use by animals of great genetic potential, among which, highlights the low crude protein, sulfur, phosphorus, manganese, and slow ruminal degradation fiber that limits the intake of dry matter (Goes et al., 2018), there is thus, the need to select varieties that have the highest crude protein, low fiber content, combined with high productivity.

In addition to increasing productivity, the use of best-adapted cultivars is a low-cost input in the production system and, therefore, easily adopted by farmers. Thus, new cultivars resulting from the identification of parameters of high yield and acceptable quality in different regions must be constantly assessed, while considering, in particular, the existence of genotype \times environment interactions to determine the agronomic behavior of the genotypes and their adaptation to different local conditions.

In this context, for the success of animal production in this region while maintaining environmental sustainability, it is evident the need for studies on the nutritional value of sugarcane varieties for a better choice in the implantation of this crop, in order to meet the needs of animal feeding. Thus, this study aimed to evaluate the nutritional value of different sugarcane varieties for animal feeding, with higher potential for the Pre-amazon region of Brazil.

2. Method

This study was conducted in an experimental area at the Federal University of Maranhão, located at latitude 3°44'26" and longitude 43°21'33", along with four crop cycles (cane plant, 1st, 2nd, and 3rd ratoons). The climate of the region corresponds in the Koppen classification to type Aw, and it is characterized by rains in summer and dry in winter. The soil in the region is classified as Oxisol-Latossolo Amarelo (Embrapa, 2013), and presented the following characteristics: pH 4.82 in water, 0.81 cmolc dm⁻³ Ca, 1.54 cmolc dm⁻³ Mg, 0.01 cmolc dm⁻³ Na, 0.01 cmolc dm⁻³ K; 0.48 cmolc dm⁻³ Al, 4.83 cmolc dm⁻³ H + Al and 0.54 mg kg⁻¹ P.

The average temperature during the experimental period was 29 °C, and the average rainfall was 120 mm in the summer, and 27.5 mm in the winter, according to the data obtained by the Northeast Region Real-Time Climatic Monitoring Program (PROCLIMA) in the INPE CPTEC site (Figures 1A and 1B). The experiment was implemented in May 2013, with conventional soil preparation, and the varieties used were: RB 867515, RB 863129 and RB 92579.

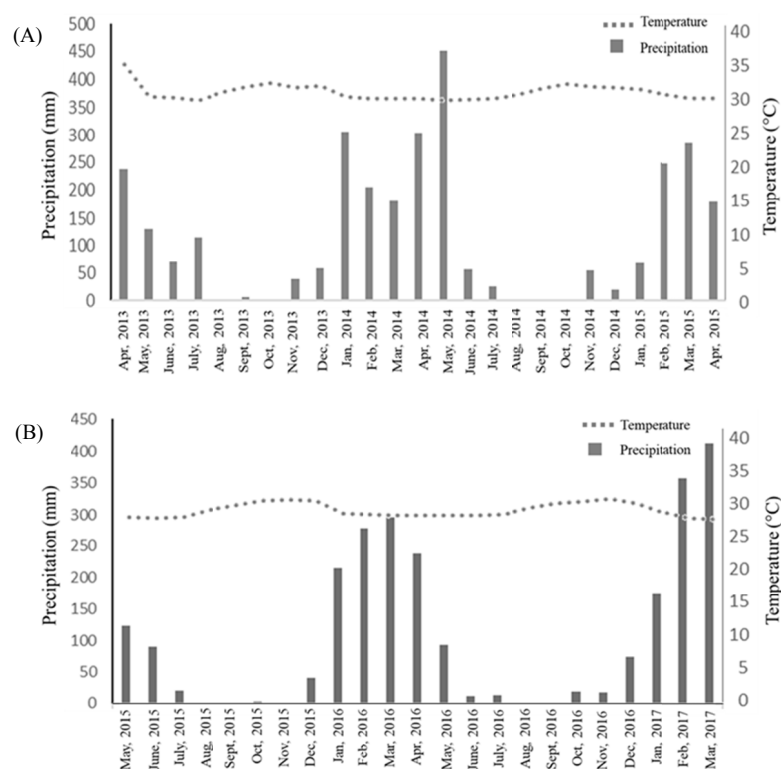


Figure 1. Temperature and precipitation during the experiment period

The RB 92579 variety presents a high sprout, high tillering for both cane plant and ratoons, providing a good closing between the lines. Classified as medium ripeness, this variety expresses high productivity with high sucrose and average fiber contents. The RB 867515 variety, by being fast growing, presents high sprouting for both cane plant and for regrowth, average tillering and good closure between rows. The production and sucrose contents are high, but their maturation is late. The RB 863129 variety, presents excellent sprouting for cane plant and great regrowth for the ratoons, combined with a good closing between the lines. It presents high productivity and high sucrose contents, with an average fiber content (Singh et al., 2017)

The fertilization of the cane plant occurred after the rooting of the seedlings, using the super-triple phosphate and potassium chloride in the doses of 120 kg P_2O_5 ha⁻¹ and 140 kg K_2O ha⁻¹. In the consecutive cycles (1st, 2nd, and 3rd ratoons), urea was used as a source of nitrogen and potassium chloride as a source of potassium in the doses of 120 kg N ha⁻¹ and 140 kg K_2O ha⁻¹. For all the evaluated cycles, approximately 300 days after the fertilizer application, which occurred one month after each harvest of each cycle, the manual harvesting and despoiling of the sugarcane was performed to evaluate the productivity.

The yield of stalks was obtained by taking the fresh weight of stalks collected in a useful area of 3 m² in each plot to estimate productivity. After that, three plants of each plot were randomly collected. Subsequently, the material was ground in a Willey mill to obtain 1.0 mm particles to determine the dry matter (DM) content and, based on DM, the crude protein (CP) content, according to methodologies described by Silva and Queiroz (2002); neutral detergent fiber (NDF), acid detergent fiber (ADF) by the Van Soest method, described and simplified by Souza et al. (1999). The soluble solids content (%) of sugarcane was measured with the aid of a field refractometer, according to the methodology proposed by Costa et al., (2017). The NDF/Brix ratio was calculated according to the method proposed by Magalhães et al. (2018), taking into account the fiber content in relation to the soluble solids content in sugarcane.

The experimental design was completely randomized, with the arrangement in 3 × 4 split plots (three varieties x four years). The data were submitted to the Shapiro Wilk normality test and Cochran homoscedasticity and obtained a normal distribution and a homoscedastic population, in which case there was no need to transform them. All data were submitted to the variance analysis and had the average compared by the Turkey test at 5% (p < 0.05) of probability by the Infostat 2016 program.