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GEOMETRIC ARRANGEMENT OF CORN+PALISADE GRASS IN CROP-LIVESTOCK INTEGRATION SYSTEM

Raimundo Filho Freire de BRITO [1]; Antonio Clementino dos SANTOS [2]; Rodrigo Estevam Munhoz de ALMEIDA [3]; Raphael Pavesi ARAUJO [4]; Esdras Henrique SILVA [5]; Luciano Fernandes SOUSA [2]; José Geraldo Donizetti dos SANTOS [2]; Tiago Barbalho ANDRÉ [1]; Paulo Humberto Gomes FILHO [6]; Warley Silva LINO [7]

[1] Agronomist. Doctoral student in tropical animal science. Universidade Federal do Tocantins; [2] Agronomist. Researcher. Universidade Federal do Tocantins; [3] Agronomist. Researcher. EMBRAPA Pesca e Aquicultura; [4] Zootechnist. Researcher. Instituto Federal do Tocantins; [5] Agronomist. Researcher. Instituto Federal do Tocantins; [6] Zootecnhist. Master Student in tropical animal science. Universidade Federal do Tocantins; [7] Agronomy student. Student. Instituto Federal do Tocantins

ABSTRACT
The production systems have been modified due to greater sustainability. The intercropped corn crops with *Urochloa ruziziensis* provide biomass that can be used as straw in sequential crops, favoring the intensification of productive areas. Investigating and proposing a phytotechnical arrangement between corn and brachiaria is important to favor the production of forage / grain, and consequently animal production, by minimizing the negative effects of forage shading and maximizing grain productivity. This study was conducted in Colinas do Tocantins, Brazil. The experimental design was in complete randomized blocks in a factorial scheme (2x2x2). The treatments consisted of three factors: 1- corn seeding spacing (0.45m and 0.90m); 2- planting orientation (north-south and east-west); 3- forage planting method (corn planting line and in between corn planting line). Corn grain yield, forage dry matter yield and grass height were evaluated on the day of the corn harvest. The yield of corn grains and dry mass of forage, does not depend on the spacing and orientation of the planting of corn. The height of the grass at the time of the corn harvest shows significant differences.
Key words: productivity; planting orientation; spacing

INTRODUCTION

Livestock farming is considered one of the main causes of environmental conflicts related to deforestation, compaction, soil erosion and the loss of biodiversity (IBRAHIM et al., 2003). Areas destined to agricultural monocultures are also criticized for the environmental impacts caused and the loss of biodiversity. However, from an environmental point of view, several studies show that it is possible to work with livestock and agriculture while conserving the environment with the use of multipurpose components in integrated systems (MURGUEITIO, 2003; ALONSO et al., 2007). The use of intercropped crops using grain cultivation with tropical forages favors the rural producer a financial compensation to cover the costs of recovering pastures (RODRIGUES, et al., 2015), in addition, the intercropped crops favor an increase in food production without the need to expand cultivation areas (BORGUI et al., 2008). According to EMBRAPA (2003), the behavior of intercropped crops needs to be known, as the competition for resources determines grain productivity and forage yield, in addition, nitrogen and potassium cycling is benefited in production systems of the corn with palisade grass (OLIVEIRA et al., 2019). Therefore, it is necessary to understand the relationships between components of the intercropped crops, in which the corn with the brachiaria in function of the spacing, orientation of the corn planting and the way of planting the forage, maximizes corn productivity and forage yield, as well as reduce the unfavorable effects of organizing these arrangements. The objective of this study was to evaluate different geometric arrangements of the components of intercropped corn cultivation with brachiaria for greater grain and forage productivity.

MATERIAL AND METHODS

The experiment was conducted, from February to June 2020, in the experimental area of the Federal Institute of Education, Science and Technology of Tocantins - IFTO, located at Latitude 8°05'24"S and Longitude 48°28'58" W, at an altitude of 221 meters, in the municipality of Colinas do Tocantins, TO. The climatic data of the place, during the period of the experiment, are presented in Figure 1.

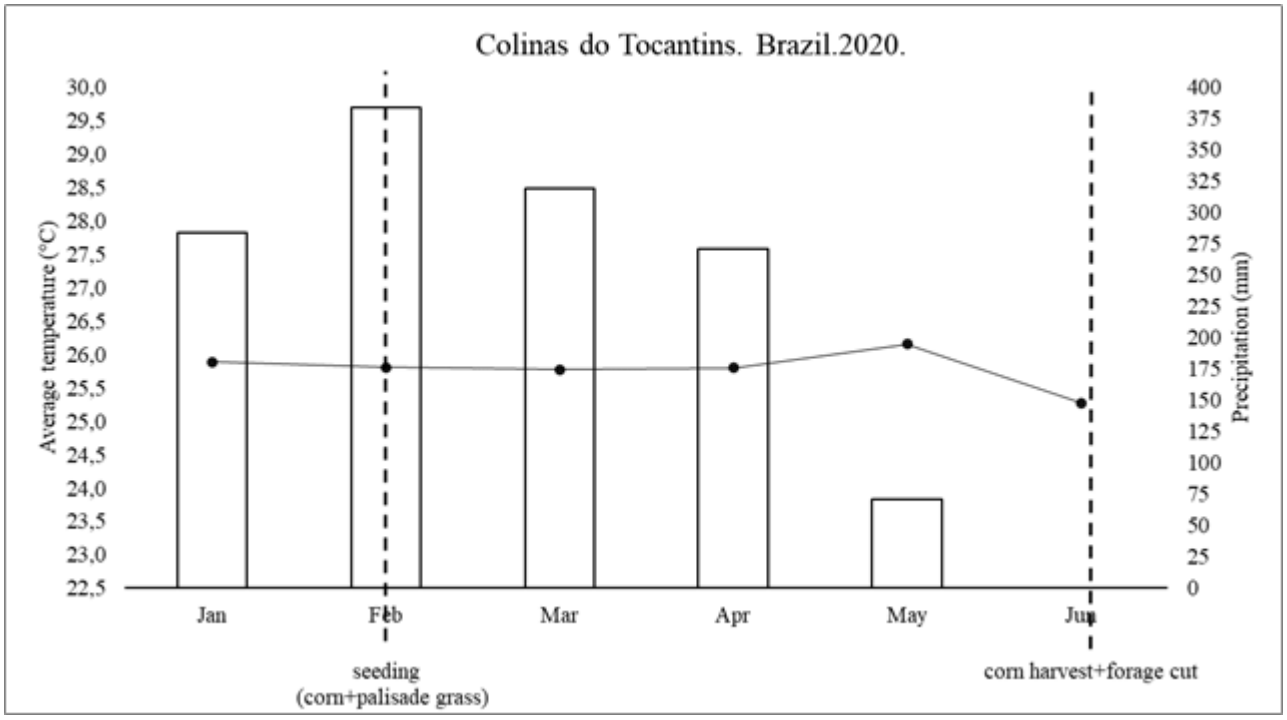

Figure 1. Climatic data of the study area.

The soil of the area is characterized as a Typic Quartzipisamment (USDA, 2014). Fertilization was carried out with 201 kg ha^{-1} of N, 153 kg ha^{-1} of P_2O_5 and 60 kg ha^{-1} of K_2O. The experimental design used was in complete randomized blocks in a factorial scheme (2x2x2). The treatments consisted of three factors: 1- corn seeding spacing (0.45m and 0.90m); 2- planting orientation (north-south and east-west); 3- forage planting method (corn planting line and in between corn planting line). The plots had dimensions of 20.25 m² (4.5 m x 4.5 m). The maize used was the early hybrid 2B512PW® at a density of 66,600 plants ha^{-1}. The forage *Urochloa ruziziensis* (Syn. *Brachiaria ruziziensis*) was sown with 7.5 kg ha^{-1} (viable seeds 60%) with inlaid seeds in all treatments, planted simultaneously. At 25 days after sowing, 1000 g a.i. ha^{-1} of 6-chloro-N2-ethyl-N4-isopropyl-1,3,5-triazine-2,4-diamine (atrazine) 500 g l^{-1} was applied. It was evaluated (i) the corn yield by manual harvesting of ears on the central lines of each plot, weighing the grains, moisture correction to 13% moisture and extrapolation to kg ha^{-1}; (ii) forage dry matter yield by manually cutting the forage flush with the soil in a 1.2 m² frame, drying in a forced ventilation oven at 65ºC for 72 h, and weighing the dry material and extrapolating it to kg ha^{-1}; (iii) height of the forage canopy measured with a ruler graduated in centimeters at six central points of each plot.

The statistical model was adjusted using the PROC MIXED procedure of the SAS® (version SAS Studio; Copyright© 2012-2018, SAS Institute Inc., Cary, NC, USA), using the maximum likelihood (REML) as an estimation method. The treatments were compared using the Tukey test at 5% probability.

RESULTS AND DISCUSSIONS

For the variables corn yield and dry matter of forage there was no effect of treatments. Corn produced, on average, 5,212 kg ha^{-1} and grass 1,241.9 kg ha^{-1} (Figure 2). Demonstrating that the corn yield is not reduced by corn spacing and forage planting method. The orientation of the planting of corn and the spacing of the planting of corn influenced the height of the grass, however there was no effect of significant interaction between the factors. The grass showed greater growth when the system was implanted in the north-south orientation (32.8cm) in relation to the east-west orientation (29.5cm), such behavior can be explained due to the plant's stiolation, since the corn planting oriented in north-south direction, it promotes greater shading by reducing the amount of light that enters the canopy. The grass presented greater height in the spacing of 90cm (32.6cm), in relation to the spacing of 45cm (29.7cm), this is due to the decumbent behavior of this forage, this characteristic being intensified under spacing of 45 cm.

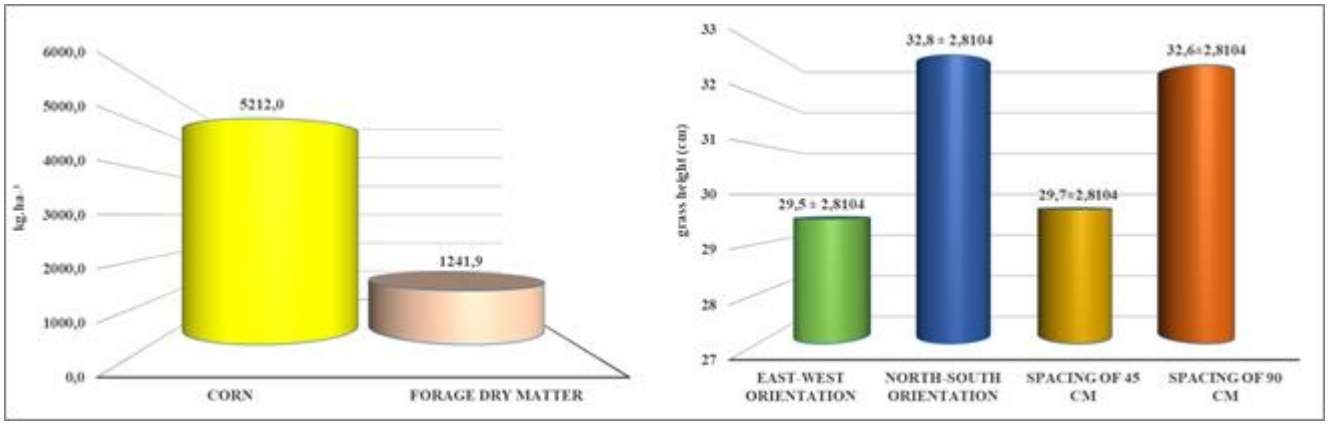

Figure 2. Maize yield, forage dry mass and grass height at corn harvest.

CONCLUSIONS

This study demonstrates that the geometry of organization of the intercropped components does not alter the corn yield and the dry mass of the forage. The height of the forage canopy is influenced by the planting orientation and spacing between lines.

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