

DOI: <https://doi.org/10.24297/jaa.v13i.9192>**Agronomic Performance of Corn Silage Intercropped with *Urochloa Ruziziensis***Wellington Ferrari da Silva <sup>1\*</sup>, Reginaldo Ferreira Junior <sup>2</sup>, Evamaria Perreira da Cunha Marques <sup>2</sup>, Renata Priscila de Oliveira Paula <sup>3</sup>, Dayse Menezes Dayrell <sup>4</sup><sup>1</sup>Dr. Nuclear Sciences and Techniques (Researcher at Faculdade Cidade de Coromandel - FCC, Coromandel – Minas Gerais, Brazil)<sup>2</sup>Agronomist (Faculty Cidade de Coromandel – FCC, Coromandel – Minas Gerais, Brazil)<sup>3</sup>Master's Student in Agricultural Microbiology (Researcher at Faculdade Cidade de Coromandel - FCC, Coromandel – Minas Gerais, Brazil)<sup>4</sup>Master's Student in Plant Production (Researcher at Faculdade Cidade de Coromandel - FCC, Coromandel – Minas Gerais, Brazil)**Abstract**

The integrated cultivation of corn with forages leads to competition for production factors such as water, light and nutrients however, currently, it is being practiced to improve the chemical, physical and biological characteristics of the soil, in addition to increasing grain and straw production for the next crop. In this sense, the objective of this work was to evaluate the agronomic performance of corn silage intercropped with the species *Urochloa ruziziensis*. The experiment was carried out on a rural property located in the municipality Abadia dos Dourados - Minas Gerais, Brazil. A randomized block design was used with two treatments (corn cultivated with and without intercropping with *U. ruziziensis*) and ten replications. The evaluations in the corn crop were carried out at 100 days after planting. The variables analyzed were: plant height, corn cob insertion height, corn cob weight and corn cob size. Data were selected for analysis of variance and level means of Tukey test models at 5% probability test. *Urochloa ruziziensis* when intercropped with a corn hybrid increased the height of the corn cob insertion, the size and weight of the corn cob reaching satisfactory levels.

**Keywords:** *Trochlea*, Corn, Consortium.**Introduction**

The Corn (*Zea mays* L.) is a species that belongs to the *Poaceae* (Sin. *Gramineae*) family, originating in teosinte for over 8000 years and cultivated in many parts of the world (Barros and Calado, 2014). Corn is produced on almost all continents, and its economic importance is characterized by the different forms of its use, as a source of food, fiber, fuel and feed (Nardino *et al.*, 2017).

Brazil occupies the third position among world producers, behind the United States and China. The estimate for grain production for the 2020/21 harvest is 7.4 million tons, with a reduction of 28% (Conab, 2021).

The succession of crops, with the production of corn, causes difficulties in the formation and maintenance of straw in the soil, which is one of the requirements for the success of the system (Aratani *et al.*, 2018). One of the alternatives for the sustainability of the succession system is the consortium, which consists of a system in which, in the same area, two or more species are implanted, living together, in part or in their entire cycle, allowing an increase in productivity (Almeida *et al.*, 2019).

The cultivation of corn with *Urochloa* in an intercropped system has already been practiced in several regions of Brazil, providing at the same time grain and straw production for the next crop. In addition to improving soil quality and better weed control, offering the next planting on the straw a high quality and precision plantability, providing more nutrients and moisture retention in the soil (Seibert and Borsoi, 2020).

The genus *Urochloa* is of African origin, from tropical regions such as Zaire and Kenya. It was introduced in Brazil in the 1960s through the Amazon region and then expanded to all tropical and subtropical regions of Brazil (Caldas, 2018).

From the year 2000, the intercropping of corn with forage grasses had great prominence in rural properties, and was the object of research (Oliveira *et al.*, 2011). In this system, *Urochloa* species are intercropped with



corn, without negative interference in the annual crop, providing forage production in the off-season, diversifying production in the area, also enabling the production of high quality straw, suitable for conducting the no-tillage system. under tropical conditions (Gorgen *et al.*, 2010; Carvalho *et al.* 2005).

The intercropping, when practiced in a technically correct way, provides an increase in the amount of straw, aiming at better soil cover for the realization of direct sowing and often increasing productivity in the subsequent crop, or the anticipation of pasture formation (Chioderoli *et al.*, 2010). Intercropped cropping systems make it possible to harvest grains during the period necessary for the establishment of the forage, reducing the cost of establishment without impairing the efficiency of forage implantation and the cost of establishing the pasture is limited to the cost of the seed (Cabezas, 2011).

However, there is still resistance from farmers in adopting this model, due to the fear of losing corn productivity due to this competition (Rosa, 2021).

Some studies (Cecon *et al.*, 2014; Lobo and Marques, 2020) report a reduction in corn grain yield in intercropping with *Urochloa*, which can be attributed to the forage population density.

Different results were found by Chioderoli *et al.*, (2012), the authors concluded that intercropping of corn with *Urochloa* species did not reduce corn productivity and increased the dry mass input in the production system under no-tillage.

According to Fiorentin *et al.*, (2012), when evaluating the influence of intercropping with *Urochloa* in corn, they found that there was an increase in the speed of leaf senescence and a reduction in the crude protein content in grains, however, the agronomic attributes (plant population, stem diameter, etc.) and grain yield were not affected. Secretti *et al.*, (2013) evaluated corn productivity with *U. ruzizensis* and single corn and found that there were no differences between single corn and intercropped corn, making it possible to use intercropping to improve the production system.

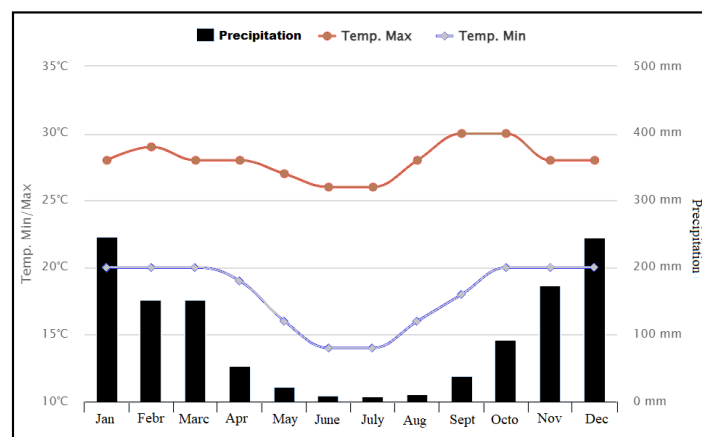
Therefore, this research aimed to evaluate the agronomic characteristics of corn silage intercropped with the species *U. ruzizensis*.

## Materials and Methods

This part should contain sufficient detail that would enable all procedures to be repeated. It can be divided into subsections if several methods are described.

The study was conducted on a rural property in the municipality Abadia dos Dourados (18° 22' 41.05" S and 47° 30' 01.87" W, altitude of 735 m), in the state of Minas Gerais, Brazil.

The climate, according to the Köppen classification, is Aw, defined as humid tropical, with high temperatures, rain in summer and dry winter. The average annual rainfall is 1,200 mm, with an average annual temperature of approximately 25°C (Climatempo, 2021). In Figure 1 are the temperature data, rainfall in the period of the experiment.



**Figure 1.** Maximum, average and minimum temperature (°C); precipitation (mm).

The design used was randomized blocks, with two treatments (corn cultivated with and without intercropping with *U. ruziziensis*) in ten replications. The seed of the *Urochloa* species was cultivated in 4 plants/m<sup>2</sup>, which corresponds to the planting of 5 kg ha<sup>-1</sup> of seeds. Each treatment consisted of 10 rows of corn, 6 m long, spaced 0.50 m apart, and the useful area consisted of the six central rows, excluding 1.5 m of border, totaling 12m<sup>2</sup> (3x4m). The chemical characteristics of the soil were determined, and their values are presented in Table 1.

**Table 1.** Soil attributes of the experimental area, municipality Abadia dos Dourados - MG, 2021.

| Depth   | pH                   | Ca                    | Mg    | Al    | H+Al  | CTC   | K     | K     | P <sub>Meh</sub>    | M.O.                 | V     |
|---------|----------------------|-----------------------|-------|-------|-------|-------|-------|-------|---------------------|----------------------|-------|
| (cm)    | (CaCl <sub>2</sub> ) | -----                 | ----- | ----- | ----- | ----- | ----- | ----- | -----               | -----                | ----- |
|         |                      | cmolcdm <sup>-3</sup> |       |       |       |       |       |       | mg dm <sup>-3</sup> | dag kg <sup>-1</sup> | %     |
| 00 - 20 | 5.6                  | 4.2                   | 1.1   | 0.0   | 2.3   | 7.9   | 0.25  | 98    | 2.3                 | 3.3                  | 71    |

The corn used in the experiment is the hybrid B2688 PWU having dual grain/silage aptitude. It presents early cycle, average height of 2.1 meters, being considered a hybrid of high productivity.

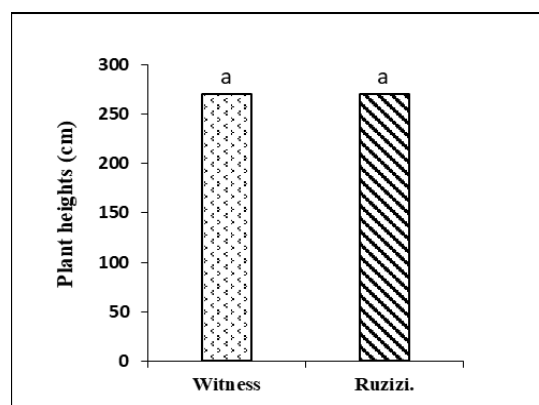
The sowing of the corn hybrid (B2688) was carried out on October 29, 2020, with a density of 66.6 thousand plants ha<sup>-1</sup>, with a Planti Center PC-5/4 penta 2 multiple seeder. Sowing fertilization was carried out with 350 kg ha<sup>-1</sup> of 08-28-16 in furrow. The topdressing fertilization was carried out with 300 kg ha<sup>-1</sup> of 30-00-20 with maize in V5 stage. To control dicotyledonous weeds in post-emergence, the herbicide Atrazine was applied at 3 L ha<sup>-1</sup> at 20 DAP of corn.

At 100 DAE, maize was harvested at the point of physiological maturity, manually, collecting all the ears present in the useful area of the plots. The variables evaluated in the corn crop were: Plant height: determined by the distance between the neck of the plant and the insertion of the flag leaf, with a wooden ruler graduated in meters; Height of Insertion of the First Ear: it was determined by the distance between the neck of the plant and the insertion of the first ear, with a wooden ruler graduated in meters; Ear Length: it was determined by measuring from the base to the apex of the ear, with the aid of a ruler graduated in centimeters; Cob weight was used on a 0.0001 g precision scale.

Data were submitted to analysis of variance (ANOVA) using the F test (5% probability) and when a significant difference was observed, the means were compared using Tukey's test (P < 0.05) using the SISVAR software (Ferreira, 2014).

## Results and Discussion

The analysis of variance did not find significant differences at 5% probability for the variable plant height (m) (Fig. 2), indicating that the treatments did not interfere in the morphological characteristics of the hybrid.

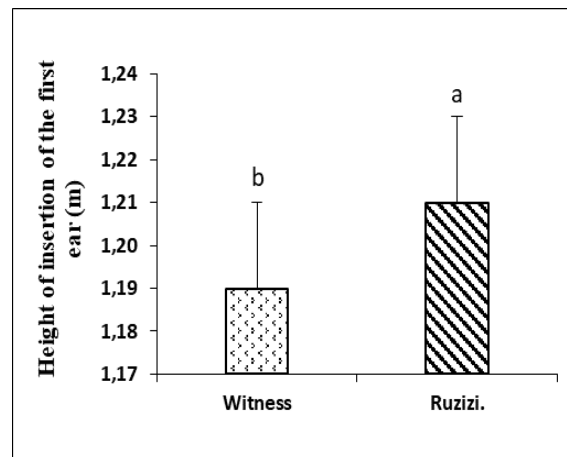


**Figure 2.** Plant height (cm) of corn silage intercropped with *U. ruziziensis*. Abadia dos Dourados-MG, 2021.

Means followed by the same letter do not differ by Tukey's test, at 5% probability.

This morphological characteristic is more linked to abiotic and biotic factors, such as water deficit, related to management and also to the genetics (genotype) of the hybrid. According to Jakelaitis *et al.*, (2006), when evaluating the effects of population density and emergence time of *Urochloa* species, in competition with maize plants, noticed that, when the forage establishes before the maize, the greater the interference of the forage on the height of seedlings. plants.

The height of insertion of the first ear showed a statistically significant difference for the species of *U. ruziziensis* (Fig. 3).



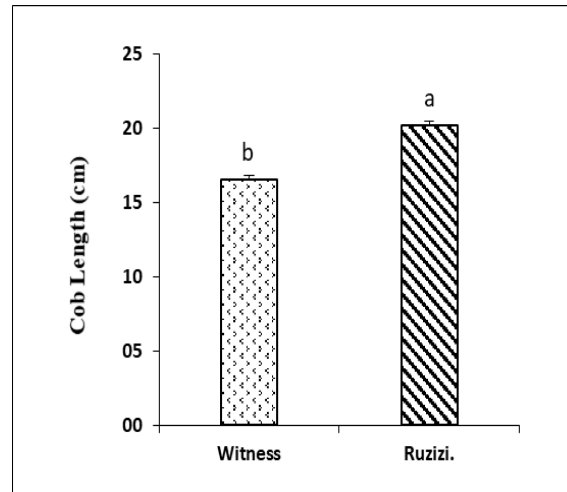
**Figure 3.** Height of insertion of the first ear (m) of corn silage intercropped with the species *U. ruziziensis*. Abadia dos Dourados-MG, 2021. Means followed by the same letter do not differ by Tukey's test, at 5% probability.

It is observed that the height of ear insertion differed from the species *U. ruziziensis*, compared to the control. The results do not corroborate those of Rosa, (2021), where the author observed that there were no significant differences between corn intercropping and *Urochloa ruziziensis* for the height of insertion of the first ear.

These results of plant height and height of insertion of the first ear are important, since plant height is the easiest variable to assess competition between crops in the intercropping (Skora Neto, 2003; Tsumanuma, 2004). According to Cobucci (2001), the absence of differences for these variables, in the intercropping of corn with *Urochloa* spp., in simultaneous sowing, can be explained by the fact that *Brachiaria* present slow initial growth, not interfering with the development of corn.

According to Crusciol *et al.*, (2012), plants with higher ear insertion height, as long as they do not provide lodging for the plants, favor mechanized harvesting, reducing the percentage of ears not harvested by the harvester platform. In addition, increasing ear insertion in the intercropped system can be beneficial, as long as it does not lead to a reduction in grain yield, as it leads to an increase in the height of the cutting platform, with a higher harvest and, consequently, a lower amount of harvest. forage and, therefore, with less time of sealing the area, for the introduction of animals to the first grazing.

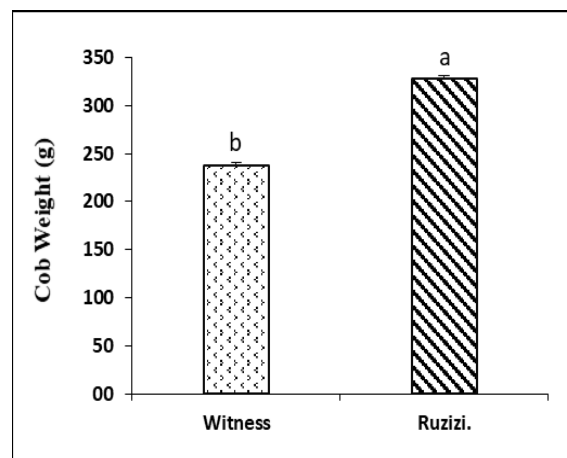
For the analysis of variance of ear length, it was found that there were significant differences at 5% probability (Fig. 4). It is observed that maize had the largest ear size being cultivated in consortium with the species *U. ruziziensis* with 20.2 g and the control with 16.5 g.



**Figure 4.** Ear length (cm) of corn silage intercropped with *U. ruziziensis* species. Abadia dos Dourados-MG, 2021. Means followed by the same letter do not differ by Tukey's test, at 5% probability.

The results obtained corroborate those found by Pariz *et al.*, (2011) who evaluated the intercropping of corn with *U. ruziziensis* species in simultaneous cultivation in the broadcast and in the corn sowing line, and observed greater ear lengths in relation to the control.

For ear weight, it was found that there were significant differences at 5% probability (Fig. 5). It is observed that maize presented higher ear weight being cultivated in consortium with the species *U. ruziziensis* with 328.6 g, differing from the control with 237.3 g.



**Figure 5.** Weight of the ear (g) of corn silage intercropped with the species *U. ruziziensis*. Abadia dos Dourados-MG, 2021. Means followed by the same letter do not differ by Tukey's test, at 5% probability.

Severino *et al.*, (2005) with the objective of evaluating interferences of the adoption of intercropping with forages on corn productivity, concluded that despite the negative effect on the growth curves of the corn crop caused by forage plants, this growth reduction does not make it unfeasible. the agriculture-livestock production system, as the productivity of both forage crops and corn was acceptable.

The values expressed in Figures 3 and 4 show that the *Urochloa ruziziensis* species obtained gains compared to the control. Boer *et al.* (2008) state that the species *Urochloa ruziziensis*, in addition to contributing to the maintenance of soil cover, increasing the content of organic matter, in addition to acting as a physical barrier against the infestation of invasive plants, also favors germination and development. of subsequent cultures.

## Conclusions

The experiment carried out showed that the intercropping of corn with a species of *Urochloa ruziziensis* did not affect the height of plants of the corn hybrid.

*Urochloa ruziziensis* when intercropped with a corn hybrid increased the height of ear insertion, ear size and weight, reaching satisfactory levels.

### Conflicts of Interest

The authors have no conflict of interest to declare

### Acknowledgments

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