Chapter 174

Cultivation systems, corn variety and *Azospirillum* - alternatives for small rural properties

Crossref doi **10.56238/tfisdwv1-174**

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ABSTRACT
In the Western region of Goiás, the agricultural activity carried out by small producers predominates, many of which are dissatisfied with the production of corn for silage, due to its high production cost. Thus, it was evaluated the response of genetic materials of corn (variety SCS 154, SCS 156e hybrid Dow 2A620PW), grown in a solitary way and intercropped with pumpkin, with and *without Azospirillum brasilense as inoculant* for phytotechnical and productive aspects, seeking viable alternatives for family agriculture. The experiment was carried out in strips, sowing 1 hectare of corn and 1 hectare of pumpkin in monoculture; and, 1 hectare of corn + pumpkin in consortium. The sowing was performedon 11/15/2018, being for mechanized corn, and for pumpkin, manually. For pumpkin, higher productivity (13.11 t.ha-1) was obtained in the single system. For corn, there was no influence of cultivation systems on grain yield. The use of *Azospirillum* was efficient, providing better development in corn plants, however, there was a differentiated response of the genéticmaterials to the inoculant. The hybrid showed higher grain yield (5,536 kg.ha-1),, while the tested varieties showed higher dry mass production by shoots, making it promising in the production of bulky foods.

Keywords: Family farming, diazotrophic bacteria, intercropping.

1 INTRODUCTION

In the Western region of Goiás, the predominant agricultural activity is livestock (dairy and beef), considered as the main income generator in rural establishments. Allied to this activity, there is the cultivation of cereals, especially corn, since 70% of what is produced, is used for feeding poultry, cattle and pigs, especially in the dry season (DIAS, et al. 2015). According to these authors, there is a predominance of small rural properties, which have modules that do not exceed 100 hectares and act predominantly as family farming.

In these establishments, the use of hybrid seeds with high productive potential has generated dissatisfaction on the part of farmers, especially regarding the economic profitability of the crop, since to express their productive potential, hybrid materials also need to use modern technological packages, associated with the high demand for insum, often nonexistent in these agricultural properties.

In this sense, the use of seeds of creole corn varieties or open pollination (VPA), considered as more rustic genetic materials with good productive potential (Bianchetto et al., 2017, Batista et al., 2020), adapted to various climate and soil conditions, tolerant to low levels of investment in insumos (Fonseca et al., 2015) and which enable the farmer himself to produce his own seed for subsequent crops, become practical and applicable alternatives to reduce the production costs of cultivated areas.

Associated with the use of these more rustic genetic materials, in family farming, another potentiating factor for food production to the herd (mainly dairy) is the cultivation associated with other species. This form of cultivation consists of using two or more species, with different cycles and vegetative architectures, cultivated simultaneously in the same area and in the same period of time, allowing the small producer to diversify production and explore the soil intensively (BLANCO et al., 2011).

According to Veiga Silva et al. (2013), this form of cultivation provides greater stability of production in adverse environmental conditions, efficient use of resources, biological diversity and favors the control of pests and diseases. In this sense, little is known about the use of pumpkin; that due to its rusticity and low nutritional demand, presents high production even in crops with low technological level (characteristic of the region), making it, together with variety corn, an alternative of great potential for use by producers in the region.

The cultivation of this species in consortium results in a lower incidence of pest attack (Phillips & Gardiner, 2016), thus reducing the use of insecticides. In addition, the leaves of this species, when falling to the ground, release substances that instill weed germination, contributing to a lower need for herbicides or mechanical practices for their control.

As for nutrition, one of the elements required in greater quantity by corn is nitrogen (N). To meet its demand, nitrogen fertilizers are used, however, the utilization rate by plants is low, rarely exceeding 50% of what was applied (HUNGRIA et al., 2010). Thus, to reduce the use of nitrogen fertilizers and assist in plant development, the use of inoculants with nitrogen-fixing microorganisms has been an alternative to reduce production costs (RAFFI & CHARYULU, 2020).

For Szilagyi-Zecchin et al. (2015) and Spaepen & Vanderleyden (2015), inoculation with *Azospirillum* induces the production of phytohormones, which stimulate plant root growth, triggering several other beneficial effects, such as increased water and nutrient absorption, greater tolerance to stresses (salinity and dryness). It also provides improvement in photosynthetic parameters (Quadros et al., 2014), such as an increase in chlorophyll and stomatic conductance content, improvement in water potential, greater elasticity of the cell wall, resulting in increased biomass production (Rockenbach et al., 2017), Peres et al., 2020), plant height and productivity (SKONIESKI et al., 2017).

In this sense, in the search for technologies that will contribute to the increase of food production for the cattle herd of the region, this study aimed to evaluate the response of genetic materials of corn grown in a single way and in association with pumpkin, with and *without Azospirillum brasilense*, regarding the phytotechnical and productive aspects of the plants, looking for viable alternatives for family farmers in the region.

2 MATERIAL AND METHODS

This work was carried out in the Community of Taquari, Iporá-Goiás, in an agricultural area of 3 hectares. Two cultivation systems (monoculture - 01 hectare of corn and 1 hectare of pumpkin - *C. mochata strain* dry burst cultivated in a single way were tested; intercropping - 1 hectare of corn and pumpkin in intercropping), 3 genetic materials of corn (variety SCS 154, variety SCS 156 and hybrid Dow 2A620PW) with and without *Azospirillum brasilense*.

The experiment was mounted in tracks, with four replications. Prior to its implementation, with the purpose of producing phytomass for soil cover, in every experimental area, millet sowing was carried out on 10/01/2018, using 35.0 $^{kg.ha-1}$ of seeds. The desiccation of this cover plant was performed on 11/05/2018, with herbicide based on glyphosate and dosage of 3.5 L.ha-1.

Fertilization was determined based on the chemical analysis of soil in a sample collected in the 0.0-0.20 m depth layer. Laboratory analysis revealed pH (CaCl) of 5.5; Ca, Mg and Al contents of 3.4 respectively; 1.4 and 0.0 cmolc.dm^3; Available P and exchangeable K of 15 and 98 mg.dm^3, organic matter of 23.0 $^{g.kg-1}$ and base saturation of 69%. As for the granulometric composition, the soil has 430 $^{g.kg-1}$ clay, 230 $^{g.kg-1}$ silt and 340 $^{g.kg-1}$ sand, being classified by the textural triangle as clayey texture.

The experiment was implemented on 11/15/2018 (Figure 1A). At the time of planting, in 50% of the cultivated area of each cultivation system, inoculation with *Azospirillum brasilense was inoculated* in the sowing groove (concentration of 2x10^8 variable cells/mL) and a dose of 200 mL $^{ha-1}$ of commercial inoculant. Based on the contents of soil chemical analysis and following the recommendations of Souza & Lobato (2004), the necessary fertilization was determined considering the crop with the highest demand. For phosphate fertilizer, 280 kg.ha-1 of STF (Super Triple Phosphate) was applied to the sowing groove 280 kg.ha-1. Potassium and nitrogen fertilizers were applied to the pitch. KCl (potassium chloride) was used as a source of potassium, applying 80 kg.ha-1 of K at the time of millet desiccation. As a source of N, urea was used, applying 90 kg.ha-1 of N, being 50% of the dose distributed when the corn plants were in the V5 stage and 50% of the dose when in V8.

For distribution of fertilizer and inoculant in the sowing groove, a Jumil - Model 3090PD seedwas used, with 12 lines spaced 0.5 m between them. In all lines, the base phosphate fertilizer was distribution. However, the distribution of corn seeds in the single and intercroppered system was made interspersed, one line with seed and another without, forming the crop with spacing of 1.0 m between rows. The inoculant was distributed by spraying in the sowing groove (Micron kit) in all lines, but interspersed considering the seeding strides, in which in one the system was connected (with inoculation) and in another disconnected (without inoculation).

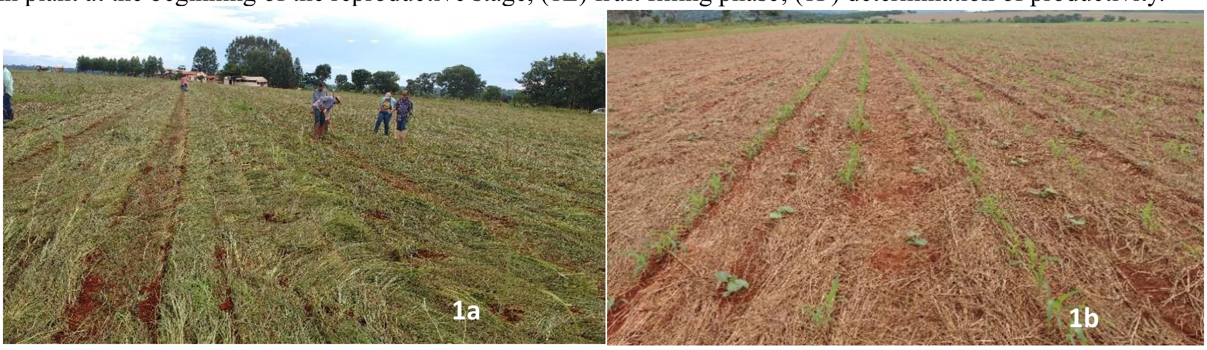
Thus,after this process, corn, both in the monoculture system and in the concrop, was implanted in the spacing of 1.0 m between lines and with the distribution of 50,000 seeds per hectare, and in the plots with pumpkin, all lines were fertilized, being in all treatments tested, 50% ofthe lines inoculated with *A. brasilense*. The pumpkin was then manually sowing, maintaining the spacing of 1.0 m between lines x 1.5 m between pits, distributing approximately 7,000 seeds.ha-1 for both monoculture and intercropping. At 26 days after sowing, pumpkin plants were thuded in both cultivation systems (Figure 1C) for 4,000 plants.ha-1.

During the vegetative development of corn, the chemical control for the cartridge caterpillar was performed, performing two insecticide applications. The first was made when theplants were and st. in V4, using insecticide based on thiamethoxam and lambda-cyalothrin (250 mL.ha-1). In the second application, acetamipride + bifentrin was applied at the dosage of 250 g.ha-1. As for weed control, a selective manual weeding was performed 34 days after sowing, removing only the most developed invasive plants.

During the vegetative development of the plants, two evaluations of biometric attributes were performed, the first being performed at 22 days after sowing, evaluating for pumpkin in both cultivation systems the height of plants, leaf area, SPAD index and number of leaves. For corn, in addition to these variables, the stem diameter was also determined. After 49 days after planting, when the pumpkin plants were at the beginning of the reproductive stage (Figure 1D), the second evaluation was performed, determining for this species the number of male, female flowers, flower buds and reproductive structures (developing fruits), and for corn, plant height, leaf number and stem diameter.

As for productivity; for pumpkin, it was determined at 82 days after planting, considering all existing fruits in a sample area of 60^{m2} (Figure 1F). For corn, it was determined at 115 days after sowing, when the plants were harvested, determining also the length and diameter of the ears, number of grains per ear, number of ears per plant, dry mass per plant (shoot, grains and total), harvest index, grain moisture, weight of 1,000 seeds.

Figure 1 – (1A) implementation of an experiment, (1B) initial phase of plant development, (1C) thawed pumpkin plants; (1D) pumpkin plant at the beginning of the reproductive stage, (1E) fruit filling phase, (1F) determination of productivity.



After tabulation of the data, each variable was submitted to variance analysis (Anova) using the SASM-Agri program (Canteri et al., 2001), and when a significant effect of the treatments was detected, the means were compared by the Tukey test at 5% probability of error.

3 RESULTS AND DISCUSSION

For pumpkin, the initial phase of plant development (evaluated at 22 days after sowing) was not influenced by the form of cultivation or by the use *of Azospirillum* as an inoculant (Table 1). For the variables related to reproductive components (performed 49 days after planting), there was a significant effect of the form of cultivation for the number of female flowers (FFN) and number of reproductive structures (NER), and highly significant effect ($P<0.01$), for productivity (evaluated at 82 days after planting).

In relation to corn, the forms of cultivation also did not influence its initial development, evaluated at 22 days after sowing. However, there was significant influence of genetic materials for number of leaves per plant (NF) and the use of *Azospirillum* for stem diameter (DC) and leaf area of plants (PA). In the second evaluation made at 49 days after sowing, there was no significant effect of the factors tested.

Table 1 - F values and significance level for the variables evaluated in maize and dried pumpkin plants burst as a function of the cultivation system, genetic material of corn and the use or not of *Azospirillum brasilense* as inoculant. Iporá, GO, 2019.

----------PUMPKIN----------								
FV	ALP[1]	AF[1]	SPAD[1]	NFF[2]	NFM[2]	NFR[2]	NER[2]	PRD[3]
Block	1.75 ns	1.53 ns	0.87 ns	0.43 ns	0.63 ns	1.11 ns	1.02ns	2.09 ns
C	0.012 ns	0.15 ns	0.29 ns	**6,01***	0.81 ns	3.52 ns	**5,18***	**93,71***
I	0.01 ns	2.90 ns	2.27 ns	0.02 ns	1.13 ns	0.14 ns	1.51ns	0.15 ns
C*I	0.69 ns	2.25 ns	1.14 ns	0.02 ns	0.01 ns	1.27 ns	0.03ns	0.11 ns
C.V.(%)	16,5	23,1	7,5	230,1	87,6	215,0	65,9	37,1
----------CORN----------								
FV	ALP[1]	NF[1]	Dc[1]	AF[1]	SPAD[1]	ALP[2]	NF[2]	Dc[2]
Block	3.65 ns	0.59 ns	1.63 ns	2.98 ns	0.72 ns	0.89 ns	3.07 ns	1.51 ns
C	1.67 ns	0.12 ns	0.41ns	3.29ns	0.08 ns	3.64 ns	2.58 ns	0.05 ns
MG	0.78 ns	**6.08** **	0.78 ns	0.06ns	3.23 ns	0.88 ns	1.34 ns	1.32 ns
I	0.12 ns	0.89 ns	**6.72** **	**8,44****	4.79 ns	0.54 ns	0.93 ns	0.71 ns
C*MG	1.48 ns	0.17 ns	0.92 ns	0.152ns	0.93 ns	1.87 ns	1.34 ns	1.14 ns
C*I	1.31 ns	0.89 ns	0.58 ns	0.05ns	1.41 ns	1.24 ns	3.06 ns	3.39 ns
MG*I	1.32 ns	0.39 ns	1.22 ns	0.72ns	1.91 ns	0.93 ns	1.24 ns	1.74 ns
C*MG*I	0.11 ns	2.74 ns	0.24 ns	2.71ns	0.59 ns	0.55 ns	1.65 ns	0.88 ns
C.V.(%)	11,8	12,6	11,1	14,8	7,4	6,9	9,01	13,4

[1] - evaluation performed 22 days after planting. [2] - evaluation performed 49 days after planting, [3]- evaluation made at 82 days after sowing; FV - Source of variation; C - form of cultivation; MG - corn genetic material; I - inoculation; ALP - plant height, PA - leaf area of plants, SPAD - SPAD index, NFF - number of female flowers, NFM - number of male flowers, NFR - number of fruits, NRP - number of reproductive structures per plant, PRD - productivity, NF - number of leaves, DC - stem diameter, C.V.= Coefficient of Variation; *=significant to 5%; **=significant to 1%; ns=not significant.

As for the productive components of corn evaluated at the time of harvest (Table 2),it was observed a significant effect ($P<0.05$) of the cultivation systems for the diameter of the ear (ED), and the *use of Azospirillum* for weight of one thousand seeds (PMS). As for corn genetic materials, there was a significant effect on ear length (EC), total shoot dry mass per plant (MSTP), weight of one thousand seeds (PMS), harvest index (CI), and highly significant effect ($P<0.01$) for productivity (PRD). In relation to interactions, there was a significant effect for genetic material of corn x inoculant in the variables ear length (EC), ear diameter (ED) and total dry mass of the aerial part of the plant (MSPA).

Table 2 – F values and significance level for ear length (EC), ear diameter (DE), number of grains per ear (NGE), plant shoot dry mass (MSPA), grain mass per plant (MGP), total dry mass per plant (MSTP), harvest index (CI) and yield (PRD) for corn as a function of the cultivation system, genetic material of corn and the use or not of *Azospirillum brasilense*. Iporá, GO, 2019.

FV	EC	FROM	NGE	MSPA	MGP	MSTP	PMS	IC	PRD
Block	0.12ns	0.61ns	0.17ns	1.01ns	0.24ns	0.86ns	1.11ns	0.43ns	2.14ns
C	0.56ns	**13,17****	0.43ns	0.09 ns	1.69ns	0.03 ns	0.01ns	0.13 ns	0.71ns
MG	**5,79***	0.45ns	2.74ns	1.40 ns	0.76ns	**5.77** *	**5,76****	**3.91***	**8,15****
I	1.89ns	0.27ns	2.64ns	0.40 ns	1.15ns	0.01 ns	**5,59****	0.30ns	0.79ns
C*MG	0.45ns	0.86ns	0.49ns	0.037ns	0.00ns	0.42 ns	1.06ns	0.11ns	0.24ns
C*I	0.00ns	0.08ns	0.00ns	0.52 ns	1.16ns	0.31 ns	1.47ns	2.14ns	1.67ns
MG*I	**14,34****	**21,45****	2.39ns	**5,10***	1.59ns	0.56 ns	1.53ns	1.44ns	0.43ns
C*MG*I	3.98ns	0.36ns	1.35ns	0.92 ns	0.53ns	0.49 ns	2.03ns	1.27ns	1.55ns
C.V.(%)	8,27	4,22	21,6	25,2	24,8	21,6	39,0	27,3	25,6

FV= Source of variation; C = form of cultivation; I = inoculation; C.V.= Coefficient of Variation; *=significant to 5%; **=significant to 1%; ns=not significant.

The effect of the form of cultivation on the development of plants and formation of reproductive structures (fruits in formation) of the dried pumpkin burst can be seen in Table 3, where the plantas in single cultivation produced 4 times more female flowers, and 1.7 times more reproductive structures than those cultivatedin the same way as with the corn. This fact indicates that the type of cultivationexerts a marked influence on the reproductive components of the pumpkin, which consequently affected the fruit production, obtaining for the pumpkin grown in a single way, a productivity approximately 18 times higher than that obtained for pumpkin concropheroried with corn. Even with low productivity the contracted system is interesting for small farmers, since it did not influence corn yield and made it possible to produce in the same area and cultivation period 0.711 t.ha-1 of pumpkin fruits, which can be used in the feeding of animals in the period of scarcity of fodder.

The lower number of femininflowers and reproductive structures observed in pumpkin, when cultivated in a consorciated manner may be associated with the shading of corn plants on pumpkins, thus resulting in an inhibiting effect on the emission of flowers and reproductive structures, and consequently, resulting in lower productivity (Table 3). Another factor that may have contributed to this result is a possible greater difficulty of pollinating insects locating female flowers in the middle of corn plants, thus leading to a lower rate of fertilization of them, and consequently, lower fruit formation.

Table 3 **-** Female flower number (FFN), number of reproductive structures (NER) and productivity (PRD.) of the dried pumpkin burst according to the cultivation system. Iporá, GO, 2019.

	NFF	**NER**	**PRD.**
Type of Cultivation	---------------------------un.m^2---------------------------		----------t.ha-1----------
Single	1st A	7.75 A	13,114 A
Consortium	0.25 B	4.5 B	0.711 B

Means followed by different letters in the column indicate statistical difference by tukey test at 5% probability.

In this sense, in a study developed by Mélo et al. (2010), in which 1 to 3 bees per female flower were tested, there was a low fruiting index for *the culture of C. moschata*. On the other hand, for the condition of free pollination, 90% of fruiting was obtained. Thus, when interspecific competition occurs, the balance between the two species will provide a reduction in insect populations (Veiga Silva et al., 2013), with less pollination of flowers as one of the consequences.

According to Rezende et al. (2009), although consortia systems of cultivation are economically viable, competition between species may or may not occur, depending on which they make up the production system. According to these authors, in a study developed growing lettuce, pepper, cabbage and radish in intercropping, it was observed in this cultivation system increased lettuce yield and reduction in cabbage when compared to monoculture.

Regarding the initial development of corn (1st evaluation), for variable number of leaves per plant, the variety SCS 156 presented 5.2 $^{leaves.plant-1}$, a value statistically higher than that observed for the hybrid corn Dow 2A620PW (4.4 leaves.plant-1), which did not differ from the variety SCS 154 (with 4.9 $^{leaves.plant-1}$). The higher number of leaves observed in the variety SCS 156 suggests that this genetic material of corn, although still little tested in the region, has good adaptation, demonstrating initial development compatible and/or superior to that of hybrid corn. The adaptation of a corn genetic material can be variable according to the climate of the region and the cultivation system adopted. In this sense, Giunti et al. (2017) evaluated the agronomic performance of commercial cultivars and corn creole in organic system, noting that more rustic genetic materials (varieties) presented a higher number of leaves above the ear (6.2 leaf.plant-1), when compared to commercial cultivars (5.82 leaf.plant-1).

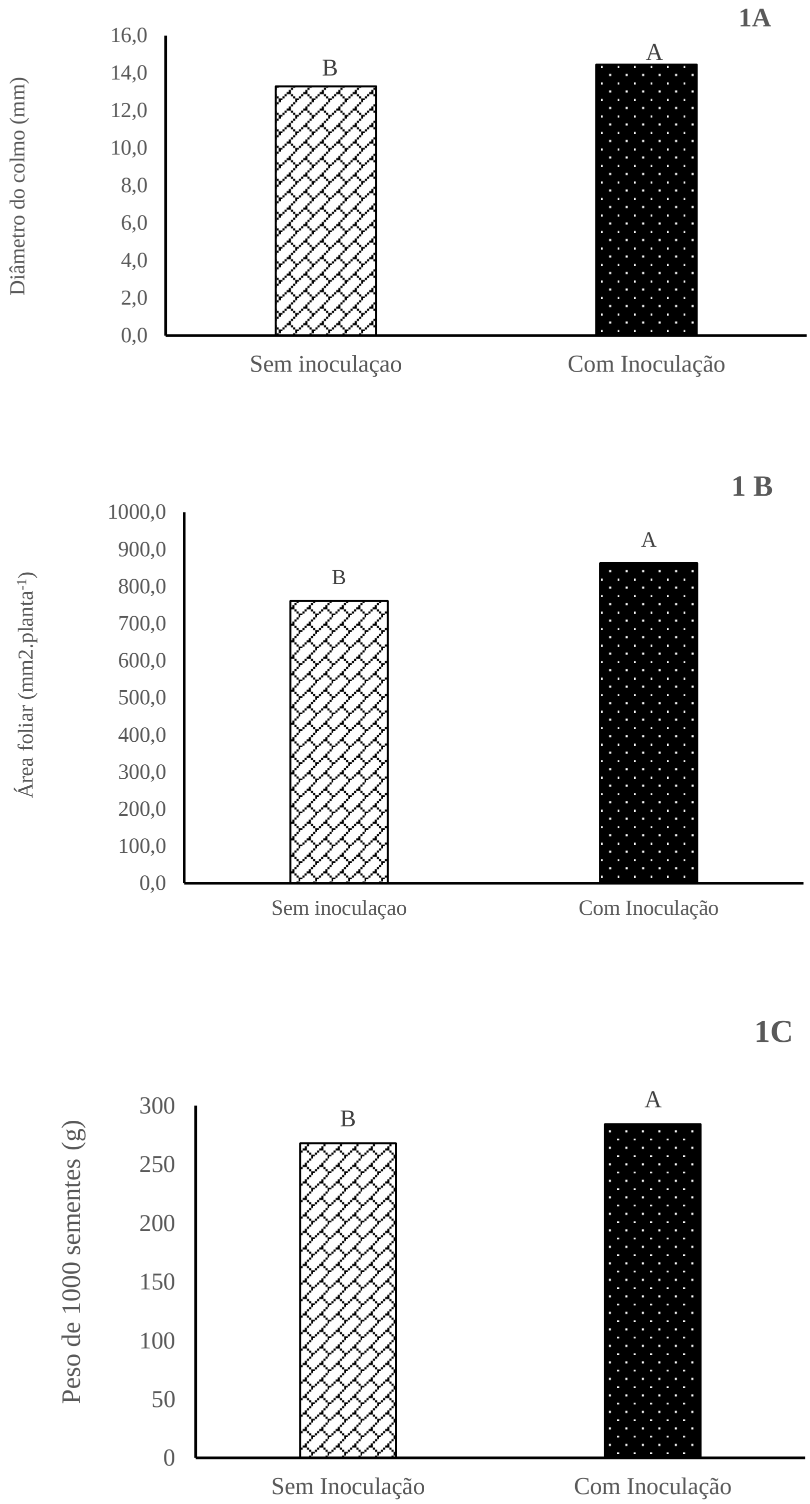
Regarding the effect of *the use of Azospirillum brasilense* on the initial development of corn, it is observed that the use of this bacterium provided an increase of 9.1% in the diameter of the stem (Figure 1A) and 13.3% in the leaf area of the plants (Figure 1B), when compared to the plants without inoculation. The response of corn to *A. brasilense* as an inoculant is quite variable, depending on several factors related to plant, bacteria and environment.

Rockenbach et al. (2017), testing the *efficiency of Azospirillum brasiliense* associated with nitrogen fertilization in corn, observed a linear increase in the diameter of the ear with the increase of the inoculant dose used, but there was no response to the length and mass of the ear. Costa et al. (2015), testing different forms of inoculation (via seed, spraying and control) in corn at 60 days after sowing, observed an increase of 10% in plant height and 8.0% in stem diameter when inoculated via seeds. They also report that this form of inoculation, when compared to the control (without *Azospirillum*), provided an increase of 49.0% in the dry mass of the shoots and 123% in that of the root system.

Positive results are also reported by Quadros et al. (2014), for three corn hybrids (AS 1575, P 32R48 and SH 5050) using inoculant formed by the *mixture four strains of Azospirillum* (*A. brasilense*, *A. lipoferum*, *A. oryzae* and *A. lipoferum*), where inoculation when compared with control, provided significant increments for the hybrid AS 1575 when inoculated in the variables SPAD (from 31.94 in control to 34.32); N content in shoot dry matter (from 32.0 $^{g.Kg-1}$ in control to 44.0 $^{g.Kg-1}$) and plant height in R1 (from 224.0 cm to 236.0 cm).

In this work, both the increase in the stem diameter and leaf area found may be associated with morphophysiological alterations that *the use of A. brasilense* in corn plants. Thus, the further development of inoculated plants may be associated with the production of phytohormones (Spaepen and Vanderleyden, 2015), mainly indole-acetic acid (AIA), excreted *by Azospirillum*, fundamental in promoting plant growth, as well as auxins, giberelines and cytokinins, which provide greater root growth and consequently greater absorption of water and nutrients (Pondoolf et al., 2015), resulting in a more vigorous and productive plant.

Figure 1 - Isolated effect of *the use of Azospirillum brasilense* with inoculant in stem diameter (1A), leaf area of corn plants at 22 days after sowing (1B) and weight of 1000 seeds after harvest (1C). Iporá, GO, 2019.



The further development in the initial phase of inoculated plants possibly contributed to them being better able to express their productive potential, resulting in seeds with higher density, and consequently, a higher weight of 1000 seeds (Figure 1C). In this condition, when compared to non-inoculated plants, *the use of Azospirillum* provided an increase of 6.1% in grain mass. These results disagree with those found by Sangoi et al. (2015), who did not observe significant differences in grain yield of inoculated and non-inoculated plots. However, the inoculated plots produced grains with higher mass than the non-inoculated ones, considering mean values for N doses and management levels.

As for the isolated effect of corn genetic materials on biometric attributes evaluated at harvest (Table 4),Dow 2A620PW hybrid corn was higher than scs 156 and SCS 154 in the colheite index and productivity. For the harvest index, when compared to the varieties, hybrid corn was 25.0% higher than the strain SCS 156, and 15.4% higher than the variety SCS 154. For productivity, this hybrid superiority was 23.2 and 28.4%, respectively. The best performance of hybrid corn in these variables is possibly associated with the fact that it has already undergone a marked genetic improvement process, aiming to maximize its grain production, thus resulting in higher productivity and harvest index.

Table 4 **-** Isolated effect of corn genetic materials for ear comprimento (EC), total shoot dry mass (MSTP), harvest index (CI), weight of 1000 seeds (PMS) and productivity (PRD). Iporá, GO, 2019.

Variable	**Hib. Dow 2A620PW**	**Var. SCS 156**	**Var. SCS 154**
EC (cm)	20.13 B	21.13 AB	22.24 A
MSTP (g)	282.4 B	380.5 A	363.0 A
IC	0.52 A	0.39 B	0.44 AB
PMS (g)	250.56 B	283.32 AB	357.16 A
PRD (kg)	5,526.7 A	4,241.8 B	3,953.6 B

Means followed by different letters on the line indicate a significant difference between treatments by the Tukey Test at 5.0%.

On the other hand, the maize variety SCS 154 was superior to hybrid corn in the variables ear length, total dry mass of shoots and weight of one thousand seeds. For these variables, except for the Variable MSTP, the variety SCS 156 presented intermediate behavior, not differing statistically from the other corn genetic materials used.

The greater development of maize plants is an expected characteristic when compared to hybrid corn, as reported by Silveira et al. (2015), for sixteen varieties of Creole corn in Rio Grande do Sul. Despite the lower grain yield when compared to hybrid corn (Batista, et al. 2020), the highest total dry mass production of shoots (average 31.5 % higher than hybrid), is an indication that these materials may be an interesting alternative when aiming at the production of bulky food such as silage (PERES et al., 2020).

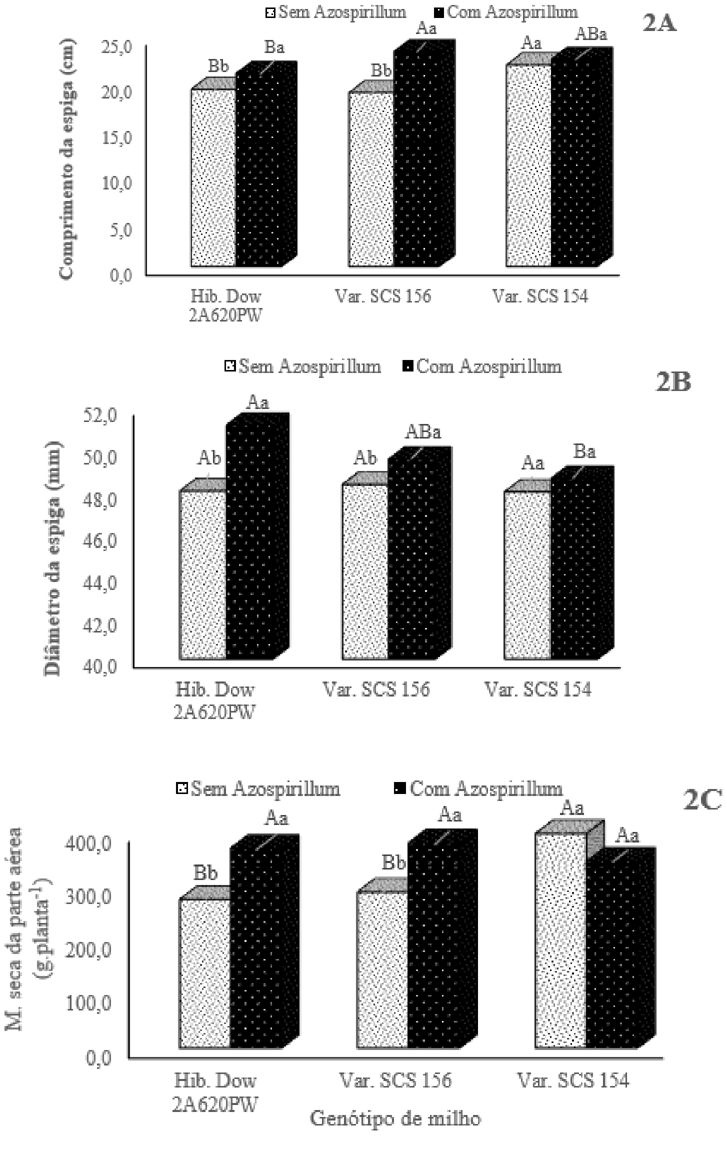
Costa et al. (2017), in a study developed in Chapada do Araripe, rural area of Crato (CE), found that variety corn obtained the best results for plant height, height of insertion of the first ear and number of ears per plant, with emphasis on productivity, in which they obtained productivity levels statistically equal to those of cultivars 20A55, Feroz Viptera, BRS 2022 and BR 206.

In this sense, creole varieties, because they are genotypes with a broad genetic basis, are able to respond better to abiotic and biotic stresses (Bianchetto et al., 2017), a fact that under conditions less favorable for plant development, they may have similar or even higher productive potential than that observed for hybrid cultivars, making their use a relevant alternative when seeking sustainable production, reducing production costs with insums and minimizing the use of technology packages.

In general, the use *of Azospirillum brasilense* contributed positively to the development of corn plants (Figure 2), however, there was a differentiated response of genetic materials to inoculation. In the length of the ear (Figure 2 A), when compared with the non-inoculated plants, for the Dow 2A620PW hybrid the inoculation resulted in an increase of 8.8% in this variable. For the variety SCS 156, this increase was more expressive, being 26.4%, while for the variety SCS 154, there was no significant response to inoculation. Similar behavior was observed for the diameter of the ear (Figure 2B) and dry mass of the plant area part (Figure 2C), where for these variables, for the dow hybrid 2A620PW, inoculation resulted in increments of 6.5% and 34.3% and for the SCS 156 variety in increments of 2.5% and 31.4%, respectively. For the variety SCS 154, the absence of response to inoculation with *Azospirillum brasilense is again observed*.

This differentiated response of corn genetic materials inoculation with *A. brasilense* is quite complex, since it is dependent on a series of environmental factors, the plant and the bacterium itself, which can cause positive response to inoculation in one crop and in the other not (SKONIESKI *et al*., 2017).

Figure 2. Ear length (2A), ear diameter (2B) and total dry mass of the aerial part of the plant (2C) as a function of the interaction of the genetic material factors of corn x *inoculation with Azospirillum brasilense* with inoculant.



Thus, for the hybrid Dow 2A620PW and the variety SCS 156, the increase in dry mass accumulation by the aerial part of the plant, greater length and diameter of the ears may be associated with several factors, among them, the better interaction of *A. brasilense* with these genetic materials when compared with the variety SCS 154, the ability of this bacterium to fix atmospheric nitrogen (Hungary et al., 2010, Schaefer et al., 2019), as well as to stimulate the production of phytomoniums such as auxins, giberelins and cytokinins (Szilagyi-Zecchin et al., 2015), which may have contributed to a greater formation of root hair and secondary roots, resulting in greater root surface and absorption of water and nutrients. Considering this possible better interaction of this bacterium with the variety SCS 156 and the hybrid, it resulted in the greater development of the plants.

This differentiated response of corn genetic materials to inoculation refers to the need to develop further studies in this sense, seeking to identify which cultivars are more promising regarding inoculation, as well as their response when associated with nitrogen fertilization in cover, reducing the use of nitrogen fertilizers and optimizing their efficiency.

Skonieski et al. (2017), evaluated the effect of *Azosopirillum inoculation* on different hybrid maize materials, observed that for the hybrid Defender, this practice resulted in a 4.8% increase in shoot dry mass production, while for hybrid AS 1572 there was a reduction of 3.4%. Despite this variability in inoculation response, the treatment of seeds with diazotrophic bacteria brings an important contribution to plant vegetative growth, and that inoculation associated with mineral nitrogen supply is efficient in most cases, providing better plant development and productivity (SKONIESKI et al., 2017; SZILAGYI-ZECCHIN et al., 2017; SCHAEFER et al., 2019; PERES, et al., 2020).

4 CONCLUSION

The cultivation systems affected the productive performance of the dried pumpkin burst, however, itdid not affect corn yield. Thus, the cultivation of these species when concropmys made it possible to expand the production of food (fruits + grains), which can be a promising alternative for small farmers.

The use of Azospirillum brasilense was efficient for corn, providing greater stem diameter, leaf area and weight of 1000 seeds, and the genetic materials of Dow 2A620PW corn and variety SCS 156 were more responsive to inoculation.

The corn variety SCS 156 and SCS 154 despite the lower grain yield, become interesting when aiming at the production of bulky food, presenting mays production of phytomass by the aerial part.

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