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Mini Review

Organic Production of Baby Corn in the Semi-Arid Region of Rio Grande Do Norte State Based on Genetic Material and Detasseling

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Abstract

Success in producing baby corn depends on the use of appropriate genetic materials and the adoption of cultivation techniques that promote production gains. Therefore, this study was conducted to evaluate baby corn production in an organic production system in the Potiguar semi-arid region, considering genetic material and plant de-tasseling. The experiment was carried out in Ipanguaçu – RN, using a randomized block design with four replications and a 2 × 3 factorial arrangement, where the first factor was the presence or absence of tassel removal, and the second factor was the genetic material (two local varieties and one commercial hybrid). Growth and production characteristics were evaluated. No significant effect of tassel removal was observed. There is potential for using local varieties for baby corn production; however, the commercial hybrid proved to be more productive compared to these seeds.

Introduction

Corn is one of the most important agricultural crops in Brazil, grown in all states primarily for grain production. In the Northeast region, the crop is particularly notable due to its diverse uses and its significance in the sociocultural context of the population, making corn and its derivatives a staple food for many families [1,2]. However, due to the edaphoclimatic conditions of the Northeastern semi-arid region, characterized by low precipitation and poorly distributed rainfall, grain production tends to have low yields or even becomes unfeasible when not irrigated.

A commercial option for crops adapted to the semi-arid region is the production of baby corn, which involves harvesting the ears two or three days after the emergence of the silk. Baby corn is used fresh or preserved for human consumption [3]. Provided that irrigation water is available, the cultivation of baby corn can be carried out almost year-round and can yield profitability exceeding 400% [4]. Due to its shorter growth cycle and the advantage of being harvested early in the reproductive phase, irrigated baby corn cultivation is an economic alternative for the semi-arid region, particularly for family farming. Compared to grain production, it requires less water and energy, making it a more resource-efficient option [1].

In Brazil, several corn cultivars have been evaluated for baby corn production under tropical conditions. However, there are few studies assessing the use of local varieties, especially for production under the edaphoclimatic conditions of the semi-arid region. The preservation of local varieties and the adoption of an organic production system, using natural nutrient sources, can reduce production costs and enable farmers to enter the organic market niche [5]. As baby corn production is relatively recent for Brazilian farmers, cultivation techniques have been developed to achieve higher production values. One widely used technique is detasseling, which involves removing the male inflorescence to stimulate the faster development of ears with better yield [6].

With this, the present study was conducted with the aim of evaluating the organic production of baby corn from heirloom varieties and a commercial hybrid, with and without detasseling, in the semi-arid region of the Rio Grande do Norte State in the Brazilian Northeast.

Materials and Methods

The trial was conducted at the experimental field of the Fazenda-Escola of the Federal Institute of Education, Science and Technology of Rio Grande do Norte (IFRN), Ipanguaçu campus, located in the district of Base Física, 4 km from the municipality of Ipanguaçu-RN (5º 32' 08" S; 36º 52' 13" W; 22 m altitude), from February to June 2016. The region's climate is characterized by irregular rainfall, with an annual average of 550 mm [7].

The soil in the area is classified as Fluvisol [8], Its fertility is described in Table 1.

Table 1: Chemical analysis of the soil in the experimental area, from the 0 - 10 cm layer.

pH	P	K^+	Na^+	Ca^{2+}	Mg^{2+}	BS	t	OM
H_2O	------------------------------mg dm^{-3}------------------					---$cmol_c$ dm^{-3}---		%
6.66	53.80	14.59	40.03	13.79	6.64	0.33	0.33	1.23

BS: Bases sum; t: Effective cation exchange capacity; OM: organic matter

The area was prepared with two diskings, and planting fertilization was done using organic compost (Table 2) and MB-4 rock dust, according to soil fertility and crop requirements. Additionally, cow urine was applied as a topdressing at the base of the plants at 20 and 40 days after emergence.

Table 2: Composition of the class A BIO-ORGAN compound fertilizer used in the trial.

pH	N	P	K^+	Ca^{2+}	Mg^{2+}	S	OM	C/N	CEC
	---%----------------------------								$mmol_c/kg$
6.5	1.0	10.0	1.5	12.0	1.0	1.0	25.0	18/1	300

OM: Organic matter; CEC: Cation exchange capacity

The experimental design was a randomized block design in a 2 × 3 factorial scheme with four replications, totaling 24 experimental plots. The first factor involved maintaining or removing the tassel of the plants (with and without detasseling), and the second factor involved three genotypes, two heirloom varieties (Tard*ão* and Z*é* Moreno) and one commercial hybrid. Sowing was done with a spacing of 0.8 m between rows and 0.40 m between plants, with two plants per hill, resulting in a density of 62,500 plants per hectare. Weed management was conducted through hoeing between 20 and 40 days after sowing.

Each experimental plot consisted of three rows of plants, each 4.0 m in length. The central row was considered the useful area, while the lateral rows and the plants at the ends of the central row were regarded as borders. Monitoring of the fall armyworm *(Spodoptera frugiperda)*, the main pest of corn in the region, was conducted. Its management involved four weekly applications of neem extract *(Azadirachta indica)*, starting 15 days after emergence.

Due to the instability of the rainy season, supplemental irrigation was applied using the sprinkler method, based on the crop's needs and the regional rainfall during the study period (Table 3).

Table 3: Observed rainfall during the experimental period.

Monthly precipitation (mm)					
JAN	FEB	MAR	APR	MAY	Total
95.7	63.8	75.4	109.1	14.7	358.7

Growth and production characteristics were evaluated, as well as chlorophyll content (SPAD) at 45 days (beginning of flowering) and at 70 days (end of baby corn production) after sowing. For growth, plant height and the height of the first ear insertion were assessed. The yields of baby corn ears were evaluated through seven harvests after the start of female flowering, with the first harvest conducted at 54 days after sowing, and subsequent harvests every two days. The number and yield of total and marketable ears, including husked and dehusked, were recorded. Marketable husked ears were those free from damage caused by pests or diseases, while marketable dehusked ears were those with good health and a color ranging from pearl-white to light yellow, cylindrical shape, diameter ranging from 0.8 to 1.8 cm, and length ranging from 4 to 12 cm (Figure 1). The data were subjected to analysis of variance and regression using SISVAR software version 5.6. [9].

Figure 1: Standard for marketable baby corn ears.

Results and Discussion

No effect of detasseling was observed; however, significant effects were noted for the genotypes on ear height and chlorophyll content at 70 days after sowing (DAS). No effect was observed for plant height and chlorophyll content at 45 DAS. No interaction effect between the factors detasseling and genotypes was observed for these characteristics. No effect of detasseling was observed for the production variables. However, a significant effect of the genotypes was noted for all the evaluated production variables (Table 4).

Table 4: Summary of analysis of variance for growth and yield variables, containing degree of freedom, mean square (MS), significance of F value and coefficient of variation (CV).

MS Anova							
Variables	Block (3)	Detasseling (1)	Genotype (2)	Interaction (2)	Error	Mean	CV (%)
Growth variables							
Plant height	354.43	3.53 ^{ns}	428.16 ^{ns}	105.25 ^{ns}	202.39	196.36	7.24
Ear height	334.55	126.96 ^{ns}	574.88*	136.55 ^{ns}	125.77	111.97	10.02
SPAD 45 days	68.26	3.92 ^{ns}	6.04 ^{ns}	14.48 ^{ns}	41.83	42.97	15.05
SPAD 70 days	83.26	0.33 ^{ns}	121.80*	0.64 ^{ns}	32.78	45.63	12.55
Yeld variables							
Number of baby corn ears	149.13	260.04 ^{ns}	9,634.63**	430.79 ^{ns}	595.96	119.37	20.45
Yield of baby corn ears[1]	5,445.89	8,305.62 ^{ns}	34,111.03*	12,704.44 ^{ns}	6,593.97	6,811.41	37.7
Number of husked ears	160.95	3.38 ^{ns}	8,138.67**	36.50 ^{ns}	302.09	76.46	22.73
Marketable ears[1]	7.05	0.25 ^{ns}	463.99**	9.21 ^{ns}	41.66	763.27	26.74

^{ns}; **; *: Not significant, significant at 1% and 5%, respectively, by the F test of the analysis of variance. 1: mean square *1,000.

For plant height, the average value was 195.98 cm when the tassels were maintained, and 196.75 cm when detasseling was performed, with no significant difference between them (Table 5). For the height of the first ear insertion, there was also no significant difference due to detasseling, with average values ranging from 109.67 cm to 114.27 cm for plants with and without tassels, respectively. For the same characteristic, considering the variety, the highest values were observed in the heirloom variety *Zé* Moreno, with 121.03 cm, not significantly different from the values observed in Tard*ão* (110.65 cm), but significantly different from those observed in the commercial hybrid (104.23 cm). For chlorophyll content at 45 and 70 days after sowing (DAS), no significant differences were observed due to the tasseling factor. However, an effect was observed at 70 DAS for the varieties, with the hybrid cultivar showing the highest values (49.74 SPAD), followed by the varieties *Zé* Moreno and Tard*ão*, with 45.16 and 41.98 SPAD, respectively.

Table 5: Observed means for growth variables and chlorophyll content (SPAD) in corn plants for baby corn production, as a function of detasseling and genotypes.

Treatments[1]	Plant height (cm)	Ear height (cm)	SPAD 45 days	SPAD 70 days
Detasseling				
With tassels	195.98 a	109.67 a	42.57 a	45.51 a
Without tassels	196.75 a	114.27 a	43.38 a	45.74 a
Genotypes				
Commercial hybrid	189.45 a	104.23 b	42.80 a	49.74 a
Tard*ão*	195.62 a	110.65 ab	43.91 a	41.98 b
Zé moreno	204.03 a	121.03 a	42.20 a	45.16 b

[1].Means followed by the same letter in the column do not differ significantly by the Student's t-test for detasseling and the Tukey test for genotypes at the 5% probability level.

The highest values for the production variables were observed in the commercial hybrid, which differed significantly from the averages observed in the heirloom varieties, which did not differ statistically from each other (Table 6).

Table 6: Observed means for production variables as a function of detasseling and genotype.

Treatments[1]	Total baby corn ears		Marketable husked baby corn	
	Number ha^{-1} * 1,000	Yeld (kg.ha^{-1})	Number ha^{-1} *1,000	Yeld (kg.ha^{-1})
Detasseling				
With tassels	123.0 a	6,223.14 a	76.0 a	766.48 a
Without tassels	116.0 a	7,399.69 a	77.0 a	760.08 a
Genotypes				
Commercial hybrid	159.0 a	9,194.31 a	113.13 a	1,039.40 a
Tardão	96.0 b	5,547.61 b	55.13 b	586.66 b
Zé moreno	103.0 b	5,692.33 b	61.13 b	653.76 b

[1]: Means followed by the same letter in the column do not differ significantly by the Student's t-test for detasseling and the Tukey test for genotypes at the 5% probability level.

Earlier studies demonstrated beneficial effects of detasseling on production. Results obtained by Grongan [10] showed that detasseling allows for greater production and translocation of photoassimilates from the leaves to the ear, due to the reduced shading of the leaves caused by the tassel, thus enabling greater light interception and leading to increased ear productivity. Other research reports that the beneficial effect of this practice is due to reduced competition for photoassimilates and nutrients between the developing male and female inflorescences, which positively influences ear formation [11]. However, more recent research indicates that detasseling did not result in gains in the number and yield of marketable ears compared to plants with tassels [12].

Conclusion

The practice of detasseling plants to increase the yield of baby corn ears proved to be ineffective for this purpose. Regarding genotypes, baby corn production from heirloom seeds proved viable, offering an option for organic production for smallholder farmers. However, the use of commercial hybrid seeds resulted in more than a 50% increase in the number and yield of marketable ears per area compared to heirloom seeds.

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