AGRONOMIC STUDY OF TWO CORN VARIETIES (ZEA MAYS, L.) UNDER EDAFOCLIMATIC CONDITIONS

ESTUDIO AGRONÓMICO DE DOS VARIEDADES DE MAÍZ (*ZEA MAYS, L.)* EN CONDICIONES EDAFOCLIMÁTICAS

Yuraisy García Naún. ynaun@uho.edu.cu. University of Holguin, Cuba
ORCID: https://orcid.org/0000-0001-9580-2708
José Salas Montero. Joseangelsala4@gmail.com. University of Holguin, Cuba
ORCID: https://orcid.org/0009-0001-4133-028X

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ABSTRACT

The present work was carried out at «El Purial» farm, located in Urbanos Noris municipality. The purpose of this study is to evaluate two varieties of maize (zea mays, L.) agronomically under climatic conditions of the area. A randomized complete block (RCB) design with four replications was used and plots with 20 m^2 in area on a vertisol soil. Growth, development and yield indicators were also evaluated for Tayuyo Gigante Holguinero (TGH) and Canilla varieties. When evaluating indicators of growth and development of the crop, it was observed that there are no differences between the two varieties under study.

KEYWORDS: agroecology; meteorological events; family farming

RESUMEN

El presente trabajo se llevó a cabo en la finca «El Purial», del municipio Urbanos Noris. El objetivo del presente estudio consistió en evaluar agronómicamente dos variedades de maíz *(zea mays, L.)* en las condiciones edafoclimáticas existentes en la zona. Se utilizó un diseño de Bloques Completos al Azar (BCA) con 4 réplicas; las parcelas tuvieron un área de 20 m^2 sobre un suelo vertisoles. Se evaluaron

indicadores de crecimiento, desarrollo y rendimiento en las variedades Tayuyo Gigante Holguinero (TGH) y Canilla. Al evaluar los indicadores del crecimiento y desarrollo del cultivo, los resultados muestran que estos no difieren para las dos variedades objeto de estudio, sin embargo, la variedad Canilla muestra el mejor rendimiento con 5.3 $t \cdot ha^{-1}$.

PALABRAS CLAVE: agroecología; sucesos meteorológicos; agricultura familiar

INTRODUCTION

Throughout history, the agriculture importance for society development has been demonstrated, and our country has been no exception. Over time, the agricultural sector has set its own goals in search of alternatives to achieve sustained development in agricultural production.

In the economic and social tasks, the country is immersed in during this stage of economic development, the constant increase in productive efficiency within this crucial sector is a primary interest for all branches of the national economy, as it is considered a matter of national security, especially in the current context where the Cuban economy is undergoing a process of change.

Although corn production *(zea mays, L.)* is far from satisfying our population needs, its production and the use of high-quality seeds are key to the success of this crop (Aranguren et al., 2023).

Furthermore, it has become not only a means of obtaining economic income but also a way to improve the diet of inhabitants in urban and rural areas, thereby diversifying the area's production and generating profitable employment opportunities in the rural sector young people, helping to retain peasant families. It is grown under the most diverse soil and ecological conditions due to its high plasticity, and its global production and consumption reach the highest figures compared to other crops (FAO, 2022).

However, agriculture currently faces environmental modifications due to climate change, which particularly varies temperature, radiation, and rainfall, negatively affecting production (Arce-Romero et al., 2018). Therefore, it is vitally important to have different types of crops in their various varieties that allow for high yields under stable soil and climatic conditions throughout the year; this is a primary task for grain producers (Damián-Huato, 2013).

In Holguín Province, according to studies conducted at «El Purial» Farm, in Urbano Noris municipality, most of its population is dedicated to productive activities highly dependent on climate, which exposes them to its hard-to-control impacts.

Furthermore, the area has single characteristics that influence its agricultural use and soil management, making it suitable for certain types of crops, but also presenting challenges related to corn biodiversity *(zea mays, L.)*, demonstrated for the edaphoclimatic conditions that allow for establishing an adequate strategy in the local production system to increase efficiency and production.

To address this production deficiency in the municipality, it is necessary to introduce varieties that are adaptable to the local field conditions to increase agri-food production under the prevailing edaphoclimatic conditions. Therefore, this work aims to: Agronomically evaluate two varieties of corn *(zea mays, L.)*, under the edaphoclimatic conditions of the «El Purial» Farm in Urbano Noris municipality.

DEVELOPMENT

The experiment was conducted on a vertisol soil, characterized by its high capacity for expansion and contraction due to the presence of clays that swell with moisture and shrink upon drying. These soils have a blocky or prismatic structure that can easily disintegrate when wet but harden considerably when dry, according to the Cuban genetic soil classification version.

These soils are suitable for crops requiring good moisture retention, such as rice, sugarcane, and some vegetable crops, but they also present challenges related to

water management and the presence of cracks. A sustainable approach is crucial to maximize its agricultural potential and preserve its quality in the long term.

The research was carried out in the period between September 2024 and February 2025, at «El Purial» Farm in Urbano Noris municipality. The area is dedicated to various crops, such as vegetables, root crops, grains, as well as livestock and forestry activities. This study evaluated the corn varieties: Tayuyo Gigante Holguinero (TGH) and Canilla variety.

It was used a Randomized Complete Block (RCB) design with 4 replications. The treatments consisted of the two corn varieties in plots of 20 m², each formed by five rows. A sample of 10 plants per treatment was taken. A 2m gap was left between plots to facilitate observations.

It was structured the research methodological design in phases that chronologically and systematically addressed the specific objectives of the study, using the following research methods:

Observation: It was carried out direct observation using a measuring tape and a caliper, taking these measurements 40 days after sowing. After harvest, weighing was performed using an analytical balance; yield was estimated at the end of the vegetative cycle based on the dry weight of grains per plot.

Measurement: There were measured indicators of the varieties´ growth and productivity. There were carried out cultural practices according to the technical manual for corn cultivation (Cuba. Tropical Viands Research Institute, 2017).

Experimentation: Experimental data for all characters evaluated during the vegetative development phase in the field and at harvest time were subjected to an analysis of variance (ANOVA) to determine if there is variability between the tested varieties and to assess that variation, i.e., to determine if there are significant differences between one variety and another. A Duncan's test was applied to determine the significance of these differences, if there is one.

These indices indicate the reliability of the trials and allow for a more accurate assessment of the differences between the varieties. Through this analysis, it was studied and quantified the genetic variability value of each and every character and its statistical significance, expressed at the 0.05 level.

RESULTS

Plant height is an important parameter indicating its growth rate, determined by stem elongation as it accumulates nutrients produced during photosynthesis, which are in turn transferred to the cob during grain filling. This variable is influenced by environmental conditions such as temperature, humidity, and light quality.

Table 1 shows the average plant height values for the evaluated varieties. Significant differences were observed between the Tayuyo Gigante Holguinero variety (TGH), which reached a mean of 266.90 cm, and Canilla variety, which presented the lowest height at 246.00 cm.

	Treatments	**Average (cm)**
1	Tayuyo Gigante Holguinero Variety (TGH)	266. 90 a
2	Canilla variety	246.00 b
	Standard Error (SE)	10.46

Table 1. Plant height (cm)

Equal letters for p = 0.05 do not differ statistically.

These results coincide with those reported by Arellano et al. (2010), who indicate height ranges between 240 cm and 280 cm for various corn varieties and hybrids during the dry period, and up to 300 cm under rainy conditions.

Thus, Cubas, Córdova & Jara (2009) report that corn plants can reach heights between 2.00 and 3.00 m, except for some early varieties that barely reach 90 cm.

At 40 days, the evaluated varieties had not yet completed their vegetative development but they already showed considerable heights, attributed to favorable

environmental conditions during the trial. This trait has high agronomic and economic importance, as susceptibility to lodging or breaking depends largely on the height of cob insertion on the stem (Caviedes et al., 2020).

Number of leaves (NOL)

The number of leaves is a key morphophysiological characteristic in corn, as it is closely linked to photosynthetic capacity, plant architecture, and reproductive development. According to Heredia (1987), corn can develop between 8 and 48 leaves, although the average ranges from 12 to 18 leaves, depending on the variety. This number usually remains relatively constant within a given grain and it is influenced by genetics, environment, and agronomic management.

Table 2 shows the averages of the number of active leaves at harvest time. Both evaluated varieties presented an average of 18 leaves, with no statistically significant differences ($p > 0.05$), suggesting that this character is not a discriminating criterion between the Tayuyo Gigante Holguinero (TGH) and Canilla genotypes.

No.	Treatments	Average cm)
1	Tayuyo Gigante Holguinero Variety (TGH)	18 a
2	Canilla Variety	18 a
	Standard Error (SE)	0.0

Table 2. Number of leaves (NHO)

Equal letters for $p = 0.05$ do not differ statistically.

However, it was evident an important qualitative difference: the TGH variety presented an average of 7 leaves damaged by *Spodoptera frugiperda*, while no damage was observed in Canilla variety, which could be related to a greater tolerance or induced defense mechanisms of the latter.

These results are relevant, as leaf integrity directly affects photosynthetic efficiency and, consequently, grain filling. A plant with a greater number of healthy leaves can

better sustain biomass production and maintain its yield, especially under biotic stress conditions. Resistance to pests, such as *S. frugiperda* represents a desirable attribute to reduce losses and minimize the agrochemical uses (Rodríguez et al., 2018).

Stem diameter in cm

Stem diameter is an indicator of the plant's structural robustness and plays an essential role in its ability to support the weight of the cob, resist wind lodging, and facilitate water and nutrient transportation. It is determined stem thickness by both the variety's genetics and edaphoclimatic conditions and agronomic management (Vásquez y Ruiz, 2010). The results presented in *Table 3* indicate statistically significant differences between the two evaluated varieties ($p < 0.05$).

The TGH variety exhibited an average diameter of 3.40 cm, significantly higher than that recorded for Canilla variety (2.51 cm). This difference suggests that TGH has greater structural strength, which could be an advantage under conditions of high cob load or intense winds.

No.	Treatments	Average (cm)
1	Tayuyo Gigante Holguinero Variety (TGH)	3.40 a
2	Canilla Variety	2.51 b
	Standard Error (SE)	0.445

Table 3. Stem diameter (cm)

Equal letters for p=5% do not differ statistically.

Cob Weight in g (COW)

Cob weight is one of the yield main components, as it is directly related to the amount of grain produced per unit area. This parameter is influenced by cob length,

cob diameter, the number of rows and kernels per row, as well as the efficiency of grain filling.

In *Table 4*, highly significant differences ($p < 0.05$) are shown between both varieties. Canilla variety reached an average of 521 g per cob, while TGH barely achieved 240 g.

This difference is particularly striking considering that TGH is characterized by its large morphological size. The low cob mass in TGH could be explained by poor grain filling, possibly influenced by suboptimal soil management, low nutrient availability, or pest stress, as suggested by the shown leaf damage.

In return, Canilla variety demonstrated high efficiency in converting biomass into harvestable product, indicating better adaptation to less fertile soils and adverse climatic conditions. According to research through trials (Becerra-Fonseca et al., 2024), point that brown carbonated and red ferralitic soils particularly favor the development and productivity of the TGH variety, due to their good aeration, moisture retention capacity, and nutrient availability.

No.	Treatments	Average (g)
1	Tayuyo Gigante Holguinero Variety (TGH)	240 b
2	Canilla Variety	521 a
	Standard Error (SE)	0.0

Table 4*.* Cob weight (g)

Equal letters for $p = 0.05$ do not differ statistically.

These results highlight the importance of considering not only the apparent size of the plants but also the actual efficiency in cob filling as a selection criterion for high-yielding grains.

Cob Length in cm

Cob length is a determining component of yield, as it directly affects the number of rows and, consequently, the number of kernels per cob. This character depends on both genetic and environmental factors, especially soil conditions and nutrient availability (Cadet-Díaz & Guerrero-Escobar, 2018).

Table 5 shows the results, where no statistically significant differences were found between the evaluated varieties. Canilla variety reached an average length of 17.6 cm, while the TGH variety obtained 17.2 cm.

No.	Treatments	Average (cm)
1	Tayuyo Gigante Holguinero Variety (TGH)	17.2 a
2	Canilla Variety	17.6 a
	Standard Error (SE)	0.20

Table 5. Cob length (cm)

Equal letters for p=5% do not differ statistically.

These results coincide with those reported by (Santiesteban, 2019), who refers to lengths between 12 and 18 cm for varieties cultivated under similar conditions. Thus, Arellano et al. (2010) mention that Canilla variety can reach up to 19 cm, indicating its good morphological behavior. The similarity in this character between both varieties suggests a shared genetic potential for the development of the reproductive axis under optimal conditions.

Yield in t. ha^{-1} (RH)

Yield is the integrative result of all the evaluated agronomic variables and reflects the interaction between the genetic potential of the variety and the environmental conditions. It is, therefore, the final criterion for determining crop productivity.

Table 6 shows a significant difference in yields between the two evaluated varieties. Canilla variety reached a mean of 5.3 t·ha^{-1}, overcoming the TGH variety, which obtained an average of 4.1 t·ha^{-1}.

These values fall within the ranges reported by (Khalily et al., 2017), who indicate that yields in developing countries range between 2.4 and 6.7 t·ha^{-1}.

This trial results reflect the good productive performance of Canilla variety, attributable to its efficiency in grain filling, its resistance to pests, and its better adaptation to the environment.

No.	Treatments	Average (t·ha^{-1})
1	Tayuyo Gigante Holguinero Variety (TGH)	4.1
2	Canilla Variety	5.3
	Standard Error (SE)	0.60

Table 6. Yield (t·ha^{-1})

Equal letters for p=5% do not differ statistically.

Grain yield is the ultimate expression of corn productivity, and increasing its value is always the primary goal of any crop improvement strategy.

CONCLUSIONS

The evaluated varieties show no significant differences regarding cob length and diameter; both cultivars show similar morphological characteristics, indicating an equivalent response under homogeneous edaphoclimatic conditions. No statistical differences were detected in the number of rows per cob between the varieties. This suggests that this character has a strong genetic determination and lower sensitivity to environmental conditions in the evaluated varieties. Canilla variety significantly surpassed TGH in the number of kernels per cob, which may be associated with better fertilization and pest resistance, favoring the effectiveness of grain filling.

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