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Effects of Varying Planting Distances of Growth, Yield and Quality of Sweet Corn (*Zea mays cv. saccharata var. rugosa*)

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Abstract: Sweet corn *(Zea mays saccharata var. rugosa)* is an important high-value crop in the Philippines because of its nutritional value, desirable taste, and increasing market demand. However, its growth, yield, and ear quality are greatly influenced by proper planting distance and plant population density. This study focuses on determining the effects of different row spacing and hill distance on the growth, yield, and quality of Bonanza 9 F1 sweet corn. Existing studies indicate that appropriate planting geometry promotes efficient utilization of sunlight, water, nutrients, and growing space, resulting in improved vegetative growth and crop productivity. Narrow spacing may increase competition among plants, affecting ear development and individual plant performance, while excessively wide spacing may result in inefficient land utilization and reduced plant population. Furthermore, the interaction between row spacing and hill distance plays an important role in determining yield components, including ear length, ear weight, and kernel development. Although previous studies have established the importance of optimum plant spacing, limited information is available regarding its effects on the performance and quality of modern tropical sweet corn hybrids under specific local conditions. Therefore, this study aims to evaluate the effects of different planting arrangements on Bonanza 9 F1 sweet corn to identify suitable spacing combinations that can improve crop productivity, ear quality, and economic viability under the agro-ecological conditions of Santiago, Ilocos Sur.

Keywords: *Sweet Corn, Bonanza 9 F1, Row Spacing, Hill Distance, Plant Growth, Yield, Ear Quality.*

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I. INTRODUCTION

Sweet corn (*Zea may saccharata* var. *rugosa*) also called sugar corn and pole corn is a variety of maize with high sugar content. It is the result of recessive mutation, and a naturally occurring high sugar variety, in which corn endosperm can be converted from sugar to starch. This variety of corn is a widely known crop with similar morphological characteristics and cultivation as other corn varieties, with some differences. Compared to other corn varieties, sweet corn has kernel rich with fat, protein and sugar. It is a considered as warm season vegetable that can be grown easily in any garden with sufficient light, fertility, growing season and space (Egos & Bañoc, 2024; Gavrić & Omerbegović, 2021).

In the Philippines, sweet corn has become an increasingly important crop due to its nutritional value and market demand. It is popular for its nutritional benefits and appealing taste, making it a favorable choice of snacks and meals to all ages. These had brought farmers to increase the usual production, and considering it to be a good venture for farming business due to its increasing demand and shorter time of maturity in field (Berdin & Corpuz, 2025; Canatoy 2018).

East-West Seeds *Bonanza 9 F1* is a premier high-yielding tropical hybrid sweet corn variety distinguishing bright, deep yellow color with noticeably sweeter, tender taste highly favored in the Philippines for fresh market consumption. Planting this variety in Santiago, Ilocos Sur leverages the municipalitys rich agricultural landscape which transitions well into high value crop cultivation after the local rice season. This hybrid variety is ideal to plant in Ilocos Region on the months of May to June for the wet season, and October to November to dry season crop (East-West Seed, 2026; ATI-CAR, 2014; Villalobos, 2026).

A farmer needs to understand and implement the best crop establishment technique to achieve the desired yield. Farmers may experience significant yield losses, lower crop quality and reduced income if they lack of knowledge in proper planting distance and density in sweet corn production. Sweet corn is highly valued as for its sweetness and juiciness, making it as a lucrative fresh-market crop. Managing planting distance and population density is one of

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the most critical factors for local farmers as it directly impacts sunlight penetration, nutrient uptake, ear size and total marketable yield.

Recent researches on the effects of different plant spacing on the growth, yield and quality of sweet corn have been documented in recent years revealing a complex relationship between plant density and overall performance. Therefore, this discussion focuses on sweet corn, its principle on planting geometry and spatial arrangement; effects of planting distance on vegetative growth parameters; effect of planting distance on yield components and ear quality; interaction effects of row spacing and hill distance. This chapter then identifies major gaps that provides the basis for the present study.

II. REVIEW OF RELATED LITERATURE

- *Principles of Planting Geometry and Spatial Arrangement*

According to Stansluos et al. (2024), and Ridwan & Harley (2026), plant spacing determines the spatial distribution of plants and resource utilization in sweet corn stands. An appropriate spatial arrangement can enhance canopy light interception and facilitate water and nutrient uptake. Conversely, the excessive plant density may intensify competition among plants and constrain individual plant growth. Therefore, selecting an appropriate plant spacing requires balancing plant population per unit area with the availability of resources needed to sustain growth.Consequently, the effectiveness of plant spacing should be assessed in relation to environmental conditions and weed management practices. Also, it is considerably to plant sweet corn in blocks or short multiple rows. Block planting improves pollination; corn drops pollen from its tassels down to the silks in the ears below (Drost, 2020).

Planting distance or spacing is an important factor that determines how each plant obtain sunlight, water nutrient and growing space. If the plant spacing is too close, plants will compete with each other in absorbing nutrients and receiving sunlight. The leaves may overlap disrupted photosynthesis and cob formation may not optimally occur. On the other hand, wide spacing can reduce plant population that will make land use inefficient (Aisyah *et* al., 2026). Improper spacing leads to decrease in the production of a plant. Due to fellow plants competing to resources which results in losses of farmers (Mauludi & Warganda, 2021).

Increasing plant density is a vital cultivation practice to increase the yield by maximizing the available land and resources, leading to higher productivity. However, excessive planting to a density beyond the optimum level can lower the maize yield and quality. Therefore, it is essential to find the right balance: increasing plant density to enhance the sweet corn yield without compromising the quality (Dhaliwal & Williams, 2019; Ye *et* al., 2023).

- *Effects of Planting Distance on Vegetative Growth Parameters*

The combination of plant height, leaf count and leaf are collectively referred to as “plant growth metrics”, these parameters provide insights into the size, structure, and productivity of a plants canopy during its growth cycle. These spatial arrangement of plants within a field affects the plant architecture, light interception, competition to resources and crop yield. Proper row spacing is crucial for ensuring efficient use of available land and resources, where wider inter-row spacing provides more space between rows allowing individual corn crops to develop broader canopy and expand horizontally (Dizayee, 2023).

According to Chayanont *et* al. (2021), narrow spacing can increase plant height, but taller plants may have mor lodging and a slightly slower rate of plant maturation, and that the yield and quality characteristics are affected by plant spacing and the variety of the hybrid selected and planted. In comparison to the crops planted with narrower spacings like 60 cm x 15 cm, and 45 cm x 15 cm, to the sweet corn cultivated in wider spacing of 60 cm x 20 cm, Giftson *et* al. (2024) recorded higher plant height. So as with Ridwan & Harly (2026), who found out that wider spacing can record higher number of leaves and plant height.

- *Effects of Planting Distance on Yield Components and Ear Quality*

Intra-row or hill distance in sweet corn production directly controls the plant population density and resource competition, balancing total yield per hectare against individual ear size and quality. Several researchers such as Sher *et* al. (2017) stated that only in proper plant density, plants can achieve highest yield. The higher plant density decreased cob length, ear weight, number of kernels and stalk area. Stansluos et al (2024) noted that higher plant densities can compensate lower yield per plant, but too much crowding stress can reduce yield per unit area.

On the findings of Ye *et* al (2023), increasing plant density decreased the sweet corn filled ear length, but sweetness and tenderness are unaffected. Additionally, the sweet corn appearance quality including the ear traits and intrinsic eating quality, depends on the varieties.

- *Interaction Effects of Row Spacing and Hill Distance*

Interaction between inter-row spacing (distance between rows) and intra-row spacing (hill distance) in sweet corn production shapes plant spatial distribution, resource competition and final yield. Dizayee (2023) found out that the interaction effects in yield components of inter- and intra-row spacing treatment he used in his research, recorded a higher mean value of ear length and number of kernels per ear. Same findings with Ata *et* al (2022) who found out that row spacing and plant density interaction has been effective in fresh ear yield and many elements.

In addition to spacing, other factors also determine the success of sweet corn production, mainly soil fertility. Shanti et al. (2012), studied the influence of plant spacing and fertilizer doses on sweet corn, where the interaction

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between plant spacing and fertilizer dose was found to be significant for various parameters: cob girth and length, number of seeds cob, shelling percentage, 100 seed weight and seed yield plant.

➢ *Synthesis and Research Gaps*

While existing literature establishes that optimal planting arrangements generally enhance sweet corn productivity, a critical research gap remains concerning how localized geometric spacings interact with the specific canopy architecture of modern tropical hybrids like Bonanza 9 F1. Furthermore, past investigations heavily favored broad physical yield quantities, leaving a distinct empirical void regarding how macro-spatial plant density alters microclimate dynamics and subsequent physiological crop performance. Most notably, standard agronomic spacing trials often lack direct, quantitative assessments of internal kernel quality. Consequently, this study bridges these critical research gaps by evaluating the direct interaction effects of varying row and hill configurations not only in physical yield metrics, but also on the definitive agronomic traits and localized economic viability of sweet corn production under the specific agro-ecological conditions of Santiago, Ilocos Sur..

III. CONCLUSION

Optimizing planting distance is a critical agronomic strategy for maximizing the productivity and profitability of sweet corn (Zea mays cv. saccharata var. rugosa) without escalating input costs. While plant population density directly governs light interception, nutrient uptake, and inter-plant competition, localized empirical data on how specific geometric spacing configurations affect modern tropical hybrids like Bonanza 9 F1 under dry-season conditions in Santiago, Ilocos Sur remain limited. By evaluating the main and interaction effects of varying inter-row (70 cm, 80 cm, and 90 cm) and intra-row (20 cm and 30 cm) spacings using a Two-Factor Strip-Plot Randomized Complete Block Design, this study will systematically determine the spatial arrangement that balances vegetative development with marketable green-cob yield and ear quality. Furthermore, integrating a cost and return analysis ensures that the agronomic findings translate directly into practical economic viability. Ultimately, the successful completion of this research will establish a localized, evidence-based planting guide that empowers farmers, agricultural extensionists, and policymakers in the Ilocos Region to optimize land-use efficiency, enhance crop quality, and maximize Return on Investment (ROI) in sweet corn production.

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