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Growth and yield of sweet corn (*Zea mays L. saccharata*) applied with organic and inorganic fertilizers supplemented with locally-made biostimulant

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Abstract
Aim: This study aimed to evaluate the growth and yield performance of sweet corn (*Zea mays L. saccharata*) as influenced by different concentrations of locally made biostimulant applied as foliar spray supplementation.
Methodology: The study employed a Randomized Complete Block Design conducted in Brgy. Ripang, Conner, Apayao from July to October 2025. Four treatments were tested: T1 (control), T2 (20 ml biostimulant per liter of water), T3 (30 ml/L), and T4 (40 ml/L), each replicated across three blocks. Data were analyzed using analysis of variance (ANOVA) to determine significant differences among treatments.
Key Results: Results revealed that higher concentrations of biostimulant significantly influenced plant growth during the early vegetative stage. While no significant differences were observed in the number of leaves and days to tasseling, yield parameters such as ear length, diameter, number of kernels, and ear weight were significantly improved. The application of 40 ml biostimulant per liter of water (T4) consistently produced the highest values across yield components and exhibited greater resistance to pest and disease incidence compared to other treatments.
Conclusion: The findings indicate that the application of locally made biostimulant, particularly at 40 ml per liter of water, enhances sweet corn productivity and contributes to sustainable agricultural practices by improving yield performance and plant resilience. This supports the use of biostimulants as an eco-friendly alternative to conventional inputs in crop production systems.

Keywords: *biostimulant, sweet corn, yield performance, sustainable agriculture, crop productivity*

INTRODUCTION

On a global scale, the agricultural sector is grappling with the dual necessity of achieving United Nations Sustainable Development Goals (SDGs), specifically SDG 2 (Zero Hunger) and SDG 13 (Climate Action). As the world population surges toward 10 billion, the pressure to ensure food security is mounting against a backdrop of escalating climate change. Traditional reliance on intensive synthetic fertilization has reached a critical breaking point, leading to severe soil degradation, groundwater pollution, and high greenhouse gas emissions. In response, the international scientific community is prioritizing "Sustainable Intensification"—the strategic use of biostimulants and bio-fertilizers to enhance crop resilience and nutrient uptake without the ecological costs associated with chemical inputs (Sagala et al., 2026; Sara et al., 2025).

In the Philippines, sweet corn (*Zea mays L. saccharata)* is a cornerstone of the agricultural economy, providing vital income and employment for over a million farmers. It is prized for its short growth cycle, all-year-round cultivation potential, and high consumer demand driven by its distinct sweetness. In the province of Apayao, corn production is a significant economic driver, with harvest areas expanding to 1,602.16 hectares in early 2024. However, in municipalities like Conner, the industry faces volatility; while corn remains a staple, overall production in specific sectors has fluctuated, highlighting a need for more stable and cost-effective management practices (Philippine Statistics Authority, 2023).

Zea mays L. saccharata also known as sweet corn of the family Poaceae, is one of the principal crops farmed in the Philippines which provides the majority of the income and employment for over a million Filipino farmers. The demand for locally produced waxy corn grains and green young corn has historically just been able to keep up with the growing population of Filipinos and the expansion of the market. Over other crops, green corn particularly sweet corn is better for boiling. It is a saleable crop that can be cultivated all year round, and has a quick income. Sweet corn is distinguished from other varieties due to its delicious taste and delightful sweetness which is the most important factor in consumer satisfaction.

Biofertilizers has become an integral part of the integrated supply system providing potential to enhance crop growth and yield. The use of biofertilizers was introduced due to the presence of different types of microorganism which can turn nutritionally important elements from unavailable to available forms and are more sustainable and cost-effective for local farmers compared to commercial synthetic fertilizer in the long run.

The integration of bio-fertilizers and biostimulants offers a transformative path to improve both crop yield and soil health. These substances utilize beneficial microorganisms to convert unavailable soil nutrients into plant-absorbent forms, promoting a more sustainable nutrient supply system. Locally, these biostimulants can be derived from readily available materials such as agricultural waste, animal manure, and plant matter. By utilizing these resources, farmers can improve soil structure and reduce their dependence on expensive, hazardous chemical fertilizers. Bio stimulants have a very positive impact on the environment and the preservation of resources by promoting a better use of nutrients by plants. It also contributes to the reduction of greenhouse gas emissions (through a better use of nitrogen). Bio stimulants contribute to the preservation of unrenewable resources through better absorption of certain nutrients. According to Calvo et al. (2014), bio stimulants enhance the uptake of water and nutrients from the soil, increase root growth and make plants more resistant to water and heat stress and excessive salinity. The height, stem diameter, leaf area, above-ground biomass and below-ground biomass of maize under the influence of bio stimulants were improved compared to the control under greenhouse conditions (Adoko et al., 2021).

The challenge today is to address farmers' concern how to decrease cost of production by not compromising the productivity of crop and hazardous activities in farming, and acquiring farmers a healthy life by consuming a chemical free food product. According to Clagnan et al. (2023) Modern "bioactivated" composts, enriched with beneficial microorganisms like zinc-solubilizing bacteria (ZSB), significantly enhance soil enzymatic activity and nutrient cycling compared to standard organic amendments.

Review of Related Literature and Studies

Biostimulant in improving crop yield and soil health

The global agricultural landscape is currently undergoing a paradigm shift, transitioning from conventional chemical-intensive methods toward Sustainable Intensification. This movement is driven by the urgent need to harmonize crop productivity with environmental preservation. The following review examines the evolving roles of Integrated Nutrient Management (INM), biostimulants, and soil microbiology in modern corn production.

Products derived from the degradation of molecules physiologically present in plants can act as biostimulants precisely because of their ability to act as secondary signals, modulating different molecular and biochemical pathways (Di Sario et al., 2025). When an endogenous molecule, such proteins, complex sugars, carotenoids, or secondary metabolites, are degraded, the resulting compounds are not simply waste products, but they can be perceived by the plant as chemical messengers capable of activating preventive physiological responses (Chowdhury et al., 2025). In this way, the plant can quickly cope with potential stresses by modulating gene expression, activating antioxidant systems, regulating energy flows, and synthesizing protective metabolites (Mao et al., 2025). For example, sugars derived from starch degradation, such as maltose, can intervene in signaling energy stress or unfavorable osmotic conditions, inducing the accumulation of osmoprotectants and antioxidants (Bozdar et al., 2025). Similarly, phenolic products derived from the degradation of pigments or aromatic compounds can stimulate defense pathways and modulate the response to pathogens or environmental stress (Gatti et al., 2024). According to Liu (2025), biostimulants play important roles in several physiological processes in plants, such as promoting growth, enhancing flowering and fruit set, and improving resistance to abiotic stress.

Recent advances in agronomy highlight how the strategic combination of organic and inorganic inputs, known as Integrated Nutrient Management (INM), frequently surpasses pure chemical fertilization. Sara et al. (2025), found that combining Granular Organic Fertilizer (GOF) with a lowered rate of 75% NPK considerably improved the absorption of essential macronutrients (nitrogen, phosphorus, and potassium). This adjustment produced substantial yield peaks of up to 23,040 kg ha^{-1}, indicating that minimizing synthetic dependency does not affect productivity.

Unlike traditional fertilizers, which primarily deliver raw materials, biostimulants serve as physiological catalysts. While, Ebrahimi et al. (2020), observed that foliar sprays of amino acids and seaweed on corn increase 100-grain weight and ear numbers by regulating plant enzymes and enhancing internal nutrient mobility. Furthermore, Sagala et al. (2026), discovered that seaweed extracts derived from *Sargassum polycystum* cause a linear rise in plant height, stem diameter, and, most importantly, sweetness levels in sweet corn—a critical determinant of market value. Enzymes aid in the conversion of fixed, unavailable nutrients into soluble forms that corn roots can easily absorb (Clagnan et al., 2023), and the development of "bioactivated" composts—enriched with specialized microbes such as Zinc-Solubilizing Bacteria (ZSB)—has proven significantly more effective at nutrient cycling than standard organic amendments.

In terms of nutritional value, Ammar et al. (2023), stated that, in addition to yield, biofertilizers derived from live organisms contribute to food safety and quality. They biodegrade without leaving heavy metal residues and have been associated to increases in plant protein and vitamin content of 10% to 40%.

But according to Rouphael and Colla (2020), the research community and fertilizer industries urgently need to clarify the molecular and physiological mechanisms that will undoubtedly facilitate the diffusion of these products in the agricultural sector, even though biostimulants seem to be a novel and potential category of agricultural inputs complementing commercial fertilizer.

The collective evidence from recent literature indicates that the future of the sweet corn industry—particularly in localized contexts like Apayao—lies in the synergy between organic amendments and biostimulants. This approach effectively addresses the "Cost-Productivity-Health" trilemma by lowering reliance on expensive synthetic inputs while maintaining high-efficiency yields. By utilizing locally sourced agricultural waste and bio-extracts, farmers can achieve the high yields necessary for economic survival while adhering to Sustainable Development Goal (SDG) mandates for chemical-free, sustainable food systems. Ultimately, the transition to Sustainable Intensification ensures that the sweet corn industry can maintain its growth trajectory without sacrificing the long-term health of the soil or the profitability of the farmer.

Theoretical Framework

This study was anchored on the Plant Stress Physiology Theory and Sustainable Nutrient Management Theory.

Plant Stress Physiology Theory explains that plants exposed to abiotic stresses such as drought and nutrient limitation experience disruptions in physiological and biochemical processes, including reduced photosynthetic efficiency, impaired nutrient uptake, oxidative stress, and altered hormonal balance. According to this theory, plant adaptation and tolerance to stress depend on physiological adjustments such as enhanced root development, improved antioxidant defense, and osmotic regulation. Biostimulants support these adaptive mechanisms by modulating metabolic pathways, improving root architecture, and enhancing stress-responsive biochemical processes.

Sustainable Nutrient Management Theory emphasizes optimizing nutrient inputs to achieve maximum crop productivity while minimizing environmental impact. This theory supports the reduction of synthetic fertilizer use through alternative nutrient-enhancing inputs that improve nutrient-use efficiency and soil health. Biostimulants and beneficial microorganisms play a critical role in this framework by enhancing nutrient availability, stimulating soil biological activity, and improving plant nutrient uptake efficiency.

In this study, the application of biostimulants combined with reduced inorganic fertilizer rates was theoretically expected to improve sweet corn physiological performance and yield by enhancing stress tolerance mechanisms and nutrient-use efficiency, thereby supporting sustainable crop production.

Statement of the Problem

The increasing demand for sustainable and cost-effective agricultural practices has led to the exploration of alternative inputs such as biostimulants to improve crop productivity while reducing dependence on synthetic fertilizers. In sweet corn (*Zea mays L. saccharata)* production, farmers face challenges related to high input costs, declining soil fertility, and environmental concerns associated with excessive chemical fertilizer use. Although biostimulants have been reported to enhance plant growth and yield, limited studies have been conducted on the effectiveness of locally formulated biostimulants under field conditions, particularly in Apayao, Philippines.

Furthermore, there is insufficient evidence regarding the optimal concentration of locally made biostimulants and their effects on agronomic performance, yield components, and economic returns in sweet corn production. Addressing this gap is essential to support sustainable agriculture, improve farmer income, and promote environmentally sound farming practices.

Thus, this study was conducted to evaluate the effects of different concentrations of locally made biostimulant on the growth, yield, and economic performance of sweet corn.

Research Objectives

General Objective

To evaluate the effectiveness of locally made biostimulant as a foliar spray supplement on the growth, yield, and economic performance of sweet corn (*Zea* mays *L. saccharata*).

Specific Objectives

1. To determine the effects of different concentrations of locally made biostimulant on the agronomic characteristics of sweet corn in terms of:
    - plant height
    - number of days to tasseling
    - number of days to silking
2. To evaluate the effects of locally made biostimulant on the yield and yield components of sweet corn in terms of:
    - ear length
    - ear diameter
    - ear weight
    - number of kernels
    - yield per plot and per hectare
3. To analyze the economic performance of each treatment in terms of production cost, gross income, net income, and return on investment (ROI).

Research Questions

1. How do different concentrations of locally made biostimulant affect the agronomic characteristics of sweet corn in terms of plant height, tasseling, and silking?
2. How does the application of locally made biostimulant influence the yield and yield components of sweet corn?
3. Which treatment provides the highest economic return in terms of cost efficiency and profitability?

Hypothesis

Null Hypothesis (H_0):

There is no significant difference in the growth, yield, and economic performance of sweet corn as influenced by different concentrations of locally made biostimulant.

METHODS

Research Design

The study utilized a quantitative experimental design following a Randomized Complete Block Design (RCBD) to analyze the physiological growth and yield responses of Sweet corn (*Zea mays L. saccharata)*. This design was strategically selected to manage environmental heterogeneity, such as gradients in soil fertility or moisture, which are common in field settings. By partitioning the experimental plots into three homogeneous blocks, the RCBD isolates field variability from the treatment effects, thereby reducing experimental error and enhancing the precision of the statistical analysis.

The experiment consisted of four treatments replicated across three blocks, totaling twelve (12) experimental units. The application of RCBD ensured that each treatment was randomly distributed within every block, effectively minimizing systematic bias and providing a robust framework for comparing the efficacy of locally-made biostimulants combined with varying rates of inorganic fertilizer. This structured approach ensures that any observed differences in crop performance are accurately attributed to the biostimulant applications rather than inherent field variations.

Experimental Site

The study was conducted at Ripang Conner Apayao from July 7, 2025 to October 10,2025, the area was left idle prior to the conduct of the study to ensure that the soil had time to rest. The experimental site is characterized by an inland valley ecology typical of the Apayao highlands, featuring well-drained terrain and a diverse biological environment. The area is classified under Type III of the Corona Climate Classification System, which is defined by seasons that are not very pronounced. The temperature range of 24°C to 32°C, coupled with high relative humidity. These conditions are highly conducive to the rapid metabolic processes of *Zea mays L. saccharata* and the microbial activation of applied biostimulants.

Systematic Selection of Representative Plants

The experimental population was established across twelve plots, structured according to the Randomized Complete Block Design (RCBD) layout. Each individual plot measured 5m x 4 m, providing ample space for uniform plant development.To ensure statistical accuracy, ten representative plants per plot were identified through systematic selection to serve as the primary samples for data collection. This sampling intensity was strategically chosen to provide a reliable cross-section of plant performance, ensuring that the physiological and yield data collected effectively reflected the impact of each treatment and replication across the entire experimental area.

Experimental Treatment

The following treatments were evaluated in this study are as follows:

T1 – Recommended Rate (Inorganic and Organic)

T2 – 20 ml Biofertilizer + RR (Inorganic and Organic)

T3 – 30 ml Biofertilizer +RR (Inorganic and Organic)

T4 – 40 ml Biofertilizer + RR (Inorganic and Organic)

Collection of Soil Sample and Analysis

To ensure the precision of the recommended fertilizer rates, representative soil samples were systematically collected from the experimental site using the random sampling method with a shovel. The collected samples were processed by spreading them onto portasol trays lined with newspaper, where they were air-dried for three days. Following the drying period, the soil was pulverized and screened to ensure a uniform consistency.

A one-kilogram composite sample was subsequently submitted to the Department of Agriculture (DA) Cagayan Valley Research Center (CVRC) Soils Laboratory in Tuguegarao City, Cagayan, for comprehensive nutrient analysis. The laboratory results identified the soil as a sandy loam type with a pH of 6.41. This slightly acidic to near-neutral pH and well-draining soil texture provide an ideal baseline for evaluating the efficacy of biostimulants on sweet corn, as it allows for optimal nutrient availability and root aeration.

Preparation of Botanical-Microbial Biostimulant

The production of the locally-sourced biostimulant followed a standardized anaerobic fermentation process, utilizing a combination of bioactive botanical agents and microbial inoculants. The procedure was executed as follows:

1. The botanical components—comprising fresh ginger *(Zingiber officinale),* garlic *(Allium sativum),* hot pepper *(Capsicum annuum),* and ripe papaya *(Carica papaya)*—were thoroughly washed with distilled water to remove exogenous contaminants. Following cleansing, the materials were manually sliced to a uniform thickness of approximately 1.0 mm to maximize the surface area for microbial degradation and enzymatic extraction.
2. The sliced substrates were partitioned into equal masses of 250 g each. These were then combined with a nutrient and microbial matrix consisting of: 250 g of Molasses (as a carbon and energy source); 250 mL of Indigenous Microorganisms (IMO) solution; 80 mL of a commercial probiotic *Lactobacillus* carrier (Yakult) to ensure a stable lactic acid bacteria (LAB) population.
3. The mixture was homogenized in a sterile fermentation vessel and sealed with a semi-permeable membrane (cotton cloth) to facilitate gas exchange while preventing the entry of macro-contaminants. The vessel was stored in a controlled, dark, and cool environment at ambient temperature for a 15-day fermentation period. This duration allows for the biochemical breakdown of organic matter and the synthesis of secondary metabolites.
4. Post-fermentation, the crude mixture was filtered through a fine-mesh nylon net to separate the liquid extract from the solid residue. The resulting bio-extract was decanted into sterilized, airtight glass containers and stored in a refrigerated environment (4°C) to stabilize the microbial activity and preserve the integrity of the bioactive compounds prior to field application.

Land Preparation and Planting

The experimental location was cleared of existing plants and stubble with an animal-drawn plow. A two-week fallow period followed the initial tillage to allow for the degradation of organic wastes and the depletion of the weed seed bank through enhanced germination. To create an appropriate soil tilth and maximize seed-to-soil contact, final harrowing was done with a cultivator. Furrows were manually constructed and spaced 60 cm apart. Sweet corn seeds were seeded at a density of one seed per hill, with a 20 cm distance between hills and 60 cm between furrows (20 cm x 60 cm). After sowing, the seeds were coated with fine dirt and manually firmed to ensure uniform emergence. Immediate gap-filling (replanting) was performed following emergence to maintain a steady plant population. Following land preparation sowing, seeds were coated with fine dirt and physically firmed to achieve uniform emergence. To ensure a constant plant population throughout all plots, gap-filling (replanting) was performed soon after emergence.

Nutrient and Biostimulant Management

A stratified fertilization regime was employed, integrating organic, inorganic, and biological inputs:

- **Organic Amendment:** Vermicast was incorporated into the soil one week prior to planting at the recommended rate to allow for microbial stabilization and the gradual release of nutrients.
- **Inorganic Fertilization:** Basal fertilization utilizing a blend of 14-14-14, 16-20-0, and 46-0-0 was applied during planting to support early root morphogenesis. A supplementary split application of urea (46-0-0) and muriate of potash (0-0-60) was administered between 25 and 35 days after planting (DAP) to support the peak vegetative growth phase.
- **Foliar Biostimulant Application:** The locally formulated biostimulant was administered as a supplemental foliar treatment at seven-day intervals from 14 DAP to 56 DAP. Applications were conducted in the early morning hours to coincide with maximum stomatal conductance, thereby optimizing the absorption of the biological compounds.

Crop Maintenance and Protection

At 28 DAP, hilling-up was performed to reinforce the root system against lodging (mechanical bending) and to enhance rhizosphere aeration, which is critical for nutrient uptake and metabolic development. Integrated pest management (IPM) protocols were strictly followed; systemic and contact pesticides were applied only upon reaching the economic threshold of infestation or at the first sign of pathological symptoms to preserve the integrity of the experimental data.

Harvesting and Post-Harvest Classification

Harvesting was executed at approximately 75 DAP, corresponding to the milk stage of kernel development. Maturation was determined by the dark-brown coloration of the silk and the presence of full-sized, tender kernels that released a milky exudate upon puncture. To ensure the accuracy of the yield data, ears were harvested manually and categorized by treatment before being subjected to weight and quality analysis.

Data Gathered

1. **Plant Height (cm).** **-** This was determined by measuring 10 sample plants in each treatment plot from ground level up to the tip of the longest extended leafusing a measuring tape. This was taken at the time of the first application of the biostimulant as supplemental foliar spray and was repeated 14, 21, 28, 35, 42, 49 and 56 days after planting (DAP).
2. **Number of Leaves.** This was determined by counting the number of leaves starting from the very first leaf starting fourteen (14) days after planting up to silking stage.
3. **Number of days from planting to tasseling -** This was determined by counting the number of days from planting to 50% of the population in each plot reached tasseling starting when hanging pollen (male flower) visible at the top of corn plant.
4. **Number of days from planting to silking -** This was determined by counting the number of days from planting to 50% of the population reached silking and/or when the silks are visible at the tip of the husk.
5. **Ear Length (cm).** **-** This was determined by measuring the 10 samples with husk and dehusked ears in each treatment plot beginning from the base to tip of the ear with using a ruler at harvest.

6. **Ear Diameter (cm). –**This was determined by measuring the diameter of 10 samples with husk and dehusked ears measured at the base, middle and tip portion in each treatment using a digital vernier caliper.
7. **Average Weight (g) of Young Corn dehusked and with Husk.** This was obtained by getting the average weight of the dehusked and with husk ears of ten (10) representative sample plant in each treatment plot.
8. **Number of Kernels per Ear.-** This was determined by counting the developed kernels per ear of ten (10) sample plants within the harvestable area of each treatment plot.
9. **Yield/Plot (kg). –** The weights of ears were summed up to obtain the total yield in each treatment plot.
10. **Computed Yield (t/ha).** The total yield per plot was projected into hectare using the principle of ratio and proportion.
11. **Return above costs.** The production cost was determined by recording all the expenses incurred throughout the conduct of the study from land preparation up to harvesting and farm inputs include fertilizers, materials and labor that were used in the conduct of the experiment. Total cost (material, labor, etc.) incurred was subtracted to the gross income to obtain the net income. The gross income was determined by multiplying the ear yield of each treatment plot by the current market price of sweet corn per kilogram. gross income, net income and return on investment were determined using the following formula:

Gross Income = Total Production (kg) X Price per kg
Net Income = Gross Income Less Total Production Costs
ROI = (Net Income)/(Total Costs) x 100

Statistical Analysis of Data

All data gathered was tabulated and analysed using the Analysis of Variance (ANOVA) following the Randomized Complete Block Design (RCBD). Data were computed and processed using the Statistical Tool for Agricultural Research (STAR) 2.0.1 2014 and Least Significant Differences (LSD) was used to compare means with significant differences.

Ethical Considerations

The study adhered to ethical research standards applicable to agricultural field experiments. No human or animal subjects were involved. Environmentally responsible practices were observed throughout the study, including proper handling of fertilizers, biostimulants, and pesticides in accordance with recommended agricultural guidelines to prevent environmental harm.

RESULTS and DISCUSSION

This section presents and discusses the results of the study in direct alignment with the research questions. Findings are interpreted using relevant literature to explain observed trends and mechanisms.

Growth Increment

Presented on table 1 is the weekly growth increment of sweet corn applied with locally made biostimulant, the 21st day of the study notable growth on the sweet corn plants was observed with mean ranges from 16.90 cm to 20.23 cm. However, no significant differences were observed. While on the 28th day of the study significant differences on the growth increment of the sweet corn plants was observed wherein, plants given lower doses of biostimulant had slower growth rate compared to those with higher concentrations of biostimulants this confirms that the application of higher concentrations (30 ml/L and 40 ml/L) of the locally made biostimulant significantly influences the growth rate during the early vegetative phase, achieving results comparable to or exceeding standard growth patterns. This is in accordance to the findings of Sagala et al. (2026), demonstrates that organic biostimulants provide a "growth surge" in the early weeks by enhancing nutrient availability, though growth rates may stabilize as the plant reaches reproductive maturity. This early-stage acceleration is critical for corn, as it establishes the leaf area index necessary for optimal photosynthesis and subsequent grain filling.

On the other hand, no significant difference in sweet corn plant growth increment was seen in the following weeks of the experiment. However, normal growth was observed on the sweet corn plants used in the study, this indicates that the later growth and development of the sweet corn was not affected by the treatments used in the study rather, it was the genetics of the sweet corns, it is in accordance to the observation of Liu (2025), who mentioned that the lack of divergence in later growth stages suggests that while biostimulants accelerate initial physiological development, they do not disrupt the plant's inherent genetic growth potential or cause phytotoxic abnormalities.

Table 1

Weekly Growth Increment of Sweet Corn Applied with Locally-Made Biostimulant (cm).

TREATMENT	Weekly Growth Increment(cm)					
	21st	28th	35th	42nd	49th	56th
T_1- Recommended Rate	19.40	26.10ᵃ	30.03	38.23	40.13	153.00
T_2- 20 ml Biostimulant/lt. of water + RR	19.73	25.87ᵇ	30.27	38.53	39.90	154.27
T_3- 30 ml Biostimulant/lt. of water + RR	16.90	26.10ᵃ	29.70	38.67	40.27	154.60
T_4- 40 ml Biostimulant/lt. of water + RR	20.23	26.20ᵃ	30.90	38.00	39.99	154.24
ANOVA	ns	*	ns	ns	ns	ns
LSD	-	0.19	-	-	-	-
CV (%)	9.20	0.37	3.28	3.35	3.35	1.38

Number of Leaves

The initial and weekly leaf counts of sweet corn as influenced by varying concentrations of locally formulated biostimulant are detailed in Table 2. No significant differences were observed on the initial and weekly number of leaves of the sweet corn observed in the study. However, numerical advantage was observed in plants applied 40 ml biostimulant per liter of water with 15 leaves on the 8th weeks, while all other treatments had 14 leaves.

These results indicate that leaf emergence is a highly conserved genetic trait in *Zea mays* that is not easily altered by foliar supplementation alone (Hochholdinger, 2016). The data suggests that while the biostimulant may enhance other parameters such as stem thickness or ear weight, the rate of leaf primordia development remains comparable between treated and untreated plants. This lack of significance in leaf count, despite significant differences in other growth increments, aligns with findings of Rouphael and Colla (2020), that biostimulants often optimize physiological efficiency and biomass quality rather than the sheer quantity of vegetative organs .

Table 2

Initial and Weekly Number of leaves of Sweet Corn Applied with Locally-Made Biostimulant.

TREATMENT	Initial	Number of Leaves					
		3rd	4th	5th	6th	7th	8th
T_1- Recommended Rate	4.00	7.00	10.00	12.00	13.00	14.00	14.00
T_2- 20 ml Biostimulant/lt. of water + RR	4.00	7.00	10.00	12.00	13.00	14.00	14.00
T_3- 30 ml Biostimulant/lt. of water + RR	4.00	7.00	10.00	12.00	13.00	14.00	14.00
T_4- 40 ml Biostimulant/lt. of water + RR	4.00	7.00	11.00	13.00	14.00	15.00	15.00

ANOVA	ns	ns	ns	ns	ns	ns	ns
CV (%)	7.07	6.16	5.54	4.54	4.20	3.86	3.86

Number of Days From Planting To Tasseling and Silking

The phenological progression of sweet corn, specifically the duration from planting to the tasseling and silking stages, is presented in Table 3.

No significant differences were observed on the number of days to tasseling which ranges from 49 to 51 days after planting. However, slight numerical variation was observed wherein plants in T3 (30ml/L) and T4 (40ml/L) biostimulant initiated tasseling earlier compared to the T1. This indicates a subtle acceleration in the plant's metabolic readiness, which coincides with the observation of Rouphael and Colla (2020), that biostimulants containing fermented microbial metabolites are known to enhance nutrient use efficiency and photosynthetic capacity early in the life cycle. This enhanced vigor allows the plant to reach the critical biomass threshold required for reproductive induction slightly faster than untreated counterparts.

Also, the lack of statistical differences, coupled with the concurrent silking across all treatments, points toward the "canalization" of reproductive phenology. In sweet corn, the interval between tasseling and silking (the Anthesis-Silking Interval or ASI) is a critical indicator of plant stress. The fact that all units silked concurrently suggests that the biostimulant did not disrupt the internal hormonal balance (auxin-cytokinin ratio) that governs female inflorescence development (Liu, 2025). These findings suggest that while foliar supplementation may enhance vegetative vigor and final yield, the timing of reproductive transitions in sweet corn is primarily governed by genetic factors and cumulative growing degree days rather than supplemental nutrient stimulants (Hochholdinger, 2016).

Table 3

Number of days from planting to tasseling up to silking.

TREATMENT	Number of Days to Tassel	Number of Days to Silking
T_1- Recommended Rate	51.00	57.00
T_2- 20 ml Biostimulant/lt. of water + RR	50.00	57.00
T_3- 30 ml Biostimulant/lt. of water + RR	49.00	56.00
T_4- 40 ml Biostimulant/lt. of water + RR	49.00	57.00
ANOVA	ns	ns
CV (%)	1.50	1.14

Length and Diameter of Sweet Corn Ear with Husk and Without Husk

The length and diameter of sweet corn ear with husk and without husk applied with locally made biostimulant as supplement in the growth and yield of sweet corn is presented in table 4.

Significant differences were observed on the length of sweet corns observed in the study, it was observed that plants applied with biostimulant produced longer ear length with husk with mean ranges from 27.57 cm to 29.77 cm, while shorter ears was produced by plants with no biostimulant applied. Seemingly, significant differences were observed on the diameter of ear with husk, wherein T4 (40ml/L) produced larger ear diameter with mean 8.17 cm compared to other treatment groups.

Also, significant differences were observed on the unhusk ear length and diameter, wherein T4 (40ml/L), consistently produced longer and larger ears. These results show that applying a biostimulant to sweet corn improves ear length and diameter, which indicates a higher yield.

These findings align with Ebrahimi et al. (2020), who noted that growth stimulants improve nutrient concentration and yield responses by optimizing the plant's physiological efficiency. Recent research by Sagala et al. (2026) also corroborates that organic biostimulants contribute to superior reproductive morphology, ensuring that ears reach their full genetic potential in terms of size and marketability.

Table 4

Ear Length and Diameter (cm) with Husk and Without Husk.

TREATMENT	With Husk		Without Husk	
	Length (cm)	Diameter (cm)	Length (cm)	Diameter (cm)
T_1- Recommended Rate	23.80^b	6.47^b	14.70^c	6.27^b

T_2- 20 ml Biostimulant/lt. of water + RR	27.57^{a}	7.10^{b}	16.43^{bc}	6.90^{b}
T_3- 30 ml Biostimulant/lt. of water + RR	27.97^{a}	7.03^{b}	17.43^{b}	6.83^{b}
T_4- 40 ml Biostimulant/lt. of water + RR	29.77^{a}	8.17^{a}	20.76^{a}	7.97^{a}
ANOVA	**	**	**	**
LSD	2.37	0.01	2.07	0.85
CV (%)	2.87	3.93	3.94	4.04

Note: Means with the same letter notation are comparable to each other.
***_ significantly different @ 1 % level.*

Average weight of young corn with and without husks

Table 5 shows the average weight of young corn with and without husks. It was observed that heavier young corn with husk was produced in treatment 4 (40 ml/L) biostimulant with mean of 402.03 grams, while other treatments with are found comparable to each other. This indicates that the higher dosage of biostimulant application increases the weight of young corn produced. Also, in terms of weight of young corn without husk treatment 4 (40 ml/L) biostimulant application produces the heaviest, followed by treatment 2 (20 ml/L) and treatment 3 (30 ml/L), with means 295.33 grams and 313.90 grams, while the lowest young corn weight was observed in treatment 1 with 276.37 grams. This result implies the importance of biostimulant application specifically at higher concentration enhances the yield of sweet corn. This is in accordance to Sagala et al. (2026), who observed that organic biostimulants contribute to higher moisture retention and cellular expansion within the kernels, leading to increased overall ear density. The results also align with the findings of Sara et al. (2025), where integrated nutrient management—combining organic supplements with inorganic foundations—resulted in a marked increase in crop biomass and marketable yield compared to conventional chemical applications alone.

Table 5
Average Weight (g) of Young Corn With Husk and Without Husk

TREATMENT	With Husk (g)	Without Husk (g)
T_1- Recommended Rate	276.37^{b}	226.17^{c}
T_2- 20ml Biostimulant/lt. of water + RR	295.33^{b}	283.07^{b}
T_3- 30ml Biostimulant/lt. of water + RR	313.90^{b}	298.85^{b}
T_4- 40ml Biostimulant/lt. of water + RR	402.03^{a}	362.20^{a}
ANOVA	**	**
LSD	36.76	82.00
CV (%)	4.08	4.63

Note: Means with the same letter notation are comparable to each other.
***_ significantly different @ 1 % level.*

Number of Kernels Per Ear

The number of kernels per ear as influence by the application of locally made biostimulant is presented in table 6. Analysis of variance reveals significant differences on the number of kernel per ear, the application of T4 (40ml/L) locally made biostimulant per liter of water obtained the highest number of kernels per ear with mean of 635.00 counts, followed by plants applied with 30 ml and 20 ml locally made biostimulant per liter of water with means of 550 and 511 counts, respectively, while the least kernel produced per ear was observed in treatment 1 with 446.00 counts. This means that the application of locally made bio stimulant in sweet corn increases the production of kernels due to the addition of nutrient and increases the stress tolerance of the plants. The observed increase in kernel production aligns with the findings of Ebrahimi et al. (2020), whose research on plant growth stimulants confirmed that such inputs significantly affect yield components, specifically increasing grain number per row. They posited that biostimulants optimize the internal chemical composition of the plant by modulating enzymatic activity and increasing nutrient mobility. Furthermore, this increased availability leads to superior nutrient accumulation, which manifests as higher grain yields and greater kernel counts, this conforms to the findings of Sagala et al. (2026), and Sara et al. (2025), mentioned that bio-organic extracts provide the physiological "surge" necessary to sustain a higher leaf area index, which in turn provides the photosynthates required to fill a larger number of kernels per ear.

Table 6
Number of Kernels per Ear.

TREATMENT	Number of Kernels
T_1- Recommended Rate	446.00^{c}
T_2- 20ml Biostimulant/lt. of water + RR	510.67^{bc}
T_3- 30ml Biostimulant/lt. of water + RR	550.00^{b}
T_4- 40ml Biostimulant/lt. of water + RR	635.33^{a}
ANOVA	**
LSD	82.00
CV (%)	5.06

Note: Means with the same letter notation are comparable to each other.
***_ significantly different @ 1 % level.*

Yield Per Plot (Kg) and Projected Yield Per Hectare

The yield per plot (kg) and projected yield per hectare of with and without husk of young sweet corn are presented in table 7. It was observed that the yield of young sweet corn per plot in kilogram with and without husk in the different treatment obtained significant result with the different treatment tested. It was observed that, plants supplemented with T4 (40 ml/L) of biostimulant per liter of water recorded the highest yield per plot of young corn with husk with a mean of 14.07 kilogram, followed by T3 (30 ml/L), T2 (20 ml/L) and the control treatment with mean of 10.97 kilograms, 10.48 kilograms and 9.42 kilograms. Likewise, significant differences were observed on the yield of dehusks young corn consistently, plants that were applied with of 40 ml per liter of locally made biostimulant produced higher yield with mean of 11.21 kilograms, followed by to T2, T3 and T1 with means of 8.38, 8.35 and 7.96 kilograms respectively.

Significant result was also obtained in terms of the projected yield in tons per hectare of young corn both with husk and without husk. It was observed that the application of higher concentration at 40 ml biostimulant per liter of water recorded to have the highest yield in tons per hectare with a mean of 9.38 tons which statistically different when compared to other treatments, whereas lower concentration of application of biostimulant did not significantly vary to those plants with no application of biostimulant. This result highlights the potential impact of the locally made bio stimulants in increasing the yield of sweet corn, that higher concentration of application significantly boost the yield of sweet corn. This result is consistent with the findings of Sagala et al. (2026), who mentioned that foliar applications of various biostimulants, including seaweed extracts and amino acids, lead to notable increases in both vegetative growth and marketable yield and Ebrahimi et al. (2020), stated that the application of biostimulants helps to increase the yield components of corn by affecting the nutrients availability and plant enzymes leading for higher production.

Table 7
Yield per Plot (kg) and Projected Yield (t/ha)

TREATMENT	Yield per Plot (kg)		Projected Yield per Hectare (t)	
	With Husk	Without Husk	With Husk	Without Husk
T_1- Recommended Rate	9.92^{b}	7.96^{b}	6.61^{b}	5.31^{b}
T_2- 20ml Biostimulant/lt. of water + RR	10.48^{b}	8.38^{b}	6.98^{b}	5.58^{b}
T_3- 30ml Biostimulant/lt. of water + RR	10.97^{b}	8.35^{b}	7.32^{b}	5.56^{b}
T_4- 40ml Biostimulant/lt. of water + RR	14.07^{a}	11.21^{a}	9.38^{a}	7.54^{a}
ANOVA	**	**	**	**

LSD	1.94	0.63	1.29	0.37
CV (%)	6.78	7.71	6.78	4.83

Note: Means with the same letter notation are comparable to each other.
***_ significantly different @ 1 % level.*

Economic Return of Sweet Corn

Table 8 details the economic performance of sweet corn production under varying concentrations of locally made biostimulant. The economic viability was assessed by evaluating the relationship between total production expenditures and the resulting gross revenue for each treatment.

Results indicate that T4 (40 ml/L application) is the most economically superior option. This treatment generated a gross income of ₱3,376.00 and achieved the highest net income of ₱903.07, resulting in a notable Return on Investment (ROI) of 36.61 percent . Although T4 incurred the highest production costs, the substantial yield of 42.20 kg per plot more than compensated for the additional expenses. This suggests high input-use efficiency, where the biostimulant application effectively translated into marketable biomass.

In contrast, T2 (30 ml/L) demonstrated the lowest economic efficiency. While it generated a gross income of ₱2,514.40, its net income was significantly lower at ₱179.86, yielding a marginal ROI of 3.55 percent. This indicates that the costs associated with the T2 (20 ml/L) concentration increased disproportionately relative to the yield gain, leading to diminished profit margins. Meanwhile, the control treatment (T1) and other variations showed moderate and comparable efficiency levels, with ROIs of 7.91% and 7.33%, respectively. These findings suggest that the 40 ml/L concentration (T4) provides the optimal balance between cost and productivity for local sweet corn farmers.

Table 8
Economic return of sweet corn applied with locally made Biostimulant.

Particulars	**T1**	**T2**	**T3**	**T4**
Total Production (kg)	29.75	31.43	32.90	42.20
Total Production Costs	2,205.05	2,428.11	2,452.14	2,472.93
Gross Income	2,380.00	2,514.40	2,632.00	3,376.00
Net Income	174.50	86.29	179.86	903.07
ROI (%)	7.91	3.55	7.33	36.61

Conclusions

The study concludes that the application of locally made biostimulant significantly influences the yield performance and economic viability of sweet corn production. Among the treatments, the application of 40 ml biostimulant per liter of water consistently produced superior results in terms of ear size, kernel number, yield per hectare, and return on investment.

The findings demonstrate that biostimulants can enhance agricultural productivity by improving nutrient uptake and plant growth efficiency. Moreover, the use of locally sourced biostimulants contributes to sustainable agriculture by reducing reliance on synthetic fertilizers and promoting environmentally sound farming practices.
This study provides practical evidence supporting the integration of biostimulants in crop production systems, particularly for smallholder farmers aiming to increase productivity while minimizing environmental impact.

Recommendations

- Farmers may adopt the application of 40 ml locally made biostimulant per liter of water as a foliar supplement to improve sweet corn yield and profitability.
- Agricultural extension workers may promote the use of locally produced biostimulants as an environmentally sustainable alternative to synthetic fertilizers.
- Policymakers may support the development and dissemination of biostimulant technologies to enhance sustainable crop production and rural agricultural development.
- Future researchers may conduct further studies on the long-term effects of biostimulants on soil health, crop productivity, and climate resilience in different agro-ecological conditions

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