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Optimizing Nutrient Management of Hybrid Glutinous Corn Using Double Row Planting Technology

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About Article

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ABSTRACT

This study was designed to determine the optimal nutrient management strategy for hybrid glutinous corn cultivated using the double-row planting method. Six treatments mixing organic and inorganic fertilizers with various foliar inputs were studied at Villa Cruz, San Mateo, Isabela, from August 15 to October 25, 2023. The treatments were laid out in a Randomized Complete Block Design with three replications. Among the treatments, the combination of half the recommended rate (½ RR) of inorganic fertilizer, 3 tons per hectare of vermicast, and Power Grow Foliar (T4) showed the most potential. T4 yielded the heaviest corn ears, the highest green corn production at 10.3 tonnes per hectare, and the largest ear diameter, both with and without husk. With a return on investment of 330.96%, it had the highest performance. The findings indicate that incorporating double-row planting with a balanced application of organic and inorganic inputs can substantially enhance the profitability and productivity of hybrid corn production. The study promotes future research to verify the success of this nutrient management approach in several environments and recommends acceptance of it.

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1. INTRODUCTION

One of the most often grown cereal crops worldwide, corn (Zea mays L.) is recognized for its role as a primary food source, animal feed, and industrial raw material. In developing nations, maize is essential for maintaining nutritional and food security, influenced by rising global food demand resulting from population increase, climate change, and resource constraints. The Food and Agriculture Organization (FAO, 2022) reports that corn is the most commonly cultivated grain worldwide, with an annual production exceeding 1.2 billion tons. Nevertheless, challenges such as soil degradation, inadequate fertilization, and unpredictable climatic conditions complicate the maintenance of this elevated production level. These issues highlight the growing imperative to implement advanced planting technologies that enhance efficiency and output, together with sustainable fertilizer management practices.

About 1.8 million farmers in the Philippines depend on maize for their livelihoods, making it the second most significant crop after rice (Philippine Statistics Authority, 2016). For many highland and rural areas, among the many types of corn being cultivated or produce in the country, glutinous corn or also known as "malagkit" is one of the preferred type of corn by most of Filipinos as also glutinous corn in particular is a vital staple during times of rice scarcity. The crop's increasing importance is reflected in production patterns from 2011 to 2015, which showed volume increases, area planted, and value. During the dry season, usually immediately following the rice harvest, corn is typically planted in lowland, rain-fed regions (FSSRI, 2000; Eusebio & Labios, 2001). Many Filipino farmers have included organic inputs in their nutrient management strategies due to economic and environmental factors (Gerpacio *et al.*, 2004; Guerrero, 2010; Maghirang *et al.*, 2011). Hence, balanced fertilizer treatment through appropriate assistance in assessing crop requirements, soil conditions, and the particular demands of each growing site remains crucial for generating high and sustainable yields. One of the more promising recent innovations in crop production is the double-row or twin-row planting system, which has shown potential to improve light exposure, nutrient absorption, and overall plant development. To improve efficiency in nutrient uptake and crop growth is the double-row planting system. This method arranges crops in paired rows placed closely together, with wider spacing between each pair, allowing for better plant distribution. Subekti *et al.* (2015) suggested that this setup helps outlying plants capture more sunlight, boosting photosynthesis and ultimately increasing yields. Similarly, Alimuddin *et al.* (2020) found that maize cultivated using the double-row technique yields 12.5% more than corn grown with conventional methods and that both root growth and stem thickness, which are important for effective water and nutrient uptake, were improved. The method enhances crop performance and optimizes resource utilization by providing each plant with up to 70% additional space. These studies, have focused particularly on filed corn varieties grown under controlled or temperate conditions. Empirical evidence about the response of glutinous corn to this system is insufficient, most especially under the lowland and rain-fed agroclimatic conditions of the Philippine corn production. The advancement of hybrid corn has gained from double-row planting; yet, the potential for glutinous corn, especially in Philippine agricultural settings, remains inadequately explored. Farmers in Region II, particularly within Nueva Vizcaya, Quirino, and Isabela, are gradually employing double-row planting, evidence on how this technique performs when combined with different fertilizers inputs, particularly the efficacy of mixing organic and inorganic fertilizers with double-row planting in improving plant growth, yield, and return on investment, is yet inadequate. The present work attempts to close that gap by assessing hybrid glutinous corn performance under several combinations of organic and inorganic fertilizers. It mains objectives are to determine which treatment provides the best return on investment, ascertain how double-row spacing increases the economic viability of glutinous corn production, , and determine the treatments gained the highest yield.

Through concentrating on glutinous corn, a crop with considerable cultural and commercially importance but limited scientific attention, this research offers new knowledge about the relationship between planting strategies and fertilizer management, therefore supporting sustainable agricultural development. In will directly inform local farmers and agricultural stakeholoders, particular within San Mateo, Isabela, and other agroclimatic regions, results may directly direct guide local farmers and agricultural players as well as serve in providing site-specific crop management strategies to the researchers and students the effect of planting systems and nutrient practices on crop productivity, and adaptable agricultural solutions.,. This work ultimately contributes to the broader initiative of employing science-based agricultural solutions to enhance food security and resilience.

2. LITERATURE REVIEW

This study aimed to examine the effects of double-row planting and optimal nutritional management on the growth and yield of hybrid glutinous corn. The literature review includes key issues such as planting strategies, sustainability, soil and water conservation, economic impacts, crop performance, agricultural practices, and fertilizer usage. Recent studies have highlighted the advantages of double-row or twin-row planting methods in maize farming. Zhang *et al.* (2024) discovered that in Shanxi, China, employing a double-row spacing of 40 + 80 cm with 67,500 plants per hectare significantly enhanced corn yields. This approach enabled increased photosynthesis, reduced leaf senescence, and a yield of 13,916.46 kg/ha. Likewise, the Palayan City Local Government Unit (2023) in the Philippines discovered that implementing a comparable planting method for maize intercropping improved yields while reducing pesticide requirements. A farmer in Nueva Vizcaya employed a spacing of 30 cm × 80 cm × 20 cm to achieve a yield of 10–13 tonnes per hectare, which is two to three times the conventional yield of 3–5 tons, as reported by Cabanayan (2022). Liu *et al.* (2024) supported these findings, demonstrating that nitrogen utilization efficiency in semi-arid maize systems was enhanced by increasing planting density and decreasing fertilizer application. Singh *et al.* (2023) and Silva *et al.* (2023) noted similar improvements in productivity and cereal production due to alterations in irrigation and double-row planting techniques.

Double-row planting techniques have demonstrated adaptability across various conditions. Cabanayan (2022) highlighted how smallholder innovation can augment sustainability by integrating hybrid seeds with balancing organic and inorganic fertilizers to boost productivity in Nueva Vizcaya. As reported by Peacock Seeds (2023), Malawi's twin-row systems greatly enhanced fertilizer absorption and weed control while increasing corn output from 240 to 320 bags per hectare. According to Jumpah (2024), row planting increased seedling density and production in Ghana but required more work, suggesting that mechanization could boost output. Mariano Marcos State University (2022) tested modified double rows for Chinese hybrid maize in conditions characteristic of the Northern Philippines and found improved adaptation and fertilizer response.

Sustainable agriculture requires both soil conservation and efficient use of water. Pinnamaneni *et al.* (2020) found that alternate-row irrigation with twin rows increased irrigation water use efficiency by 19% in Mississippi soybean fields. Zhang *et al.* (2023) demonstrated that wide-narrow row planting with mulching improved water use efficiency by 21.9% and preserved more soil moisture at 40–80 cm depths in Gansu, China. Shaxson (2024) implemented deep-bed systems in Malawi that improved root infiltration and development, tripling maize yields and decreasing erosion.

Zhou *et al.* (2010) found that narrower spacing improved soil moisture use in Northern China's rainfed systems. These results underscore the soil and water conservation advantages of double-row configurations.

Adopting double-row planting not only improves yields but also offers economic gains. Arigela and Ramireddy (2024) reported that a twin-row maize planter improved field efficiency by 76.9–87%, cutting operational costs by 20%, with a payback period of just 1.78 years. Croatian trials using KWS hybrids under twin-row spacing yielded 7.52% more grain than traditional spacing. In cotton, Quintana-Ashwell *et al.* (2022) showed improved canopy light interception and profitability with twin-row systems principles applicable to corn. Jumpah (2024) observed that row planting raised maize yields but increased labor needs, highlighting a balance between productivity and labor efficiency.

Double-row planting benefits are further supported by glutinous corn-specific studies. Lazo *et al.* (2024) discovered that the MMSU Glut 1 variety's plant height, ear development, and yield were greatly enhanced by a modified double-row spacing of 80:30 cm × 20 cm combined with 200-100-100 kg N-P_2O_5-K_2O/ha. With better soil pH and organic matter, yield climbed by 105% when compared to unfertilized plots and by 29.53% when compared to traditional spacing with the same fertilizer rate. Twin-row planting has been shown to improve light interception and yield, according to Novacek *et al.* (2013). However, they also warned that increased density may encourage foliar diseases, necessitating integrated pest and disease management.

In a straight comparison, double-row techniques have more advantages than traditional farming methods. It was said by Cabanayan (2022) that using hybrid seedlings and balanced fertilization with two rows of crops distinct raised the production in Nueva Vizcaya from 3–5 tons/ha to 10–13 tons/ha. This advocates for transitioning from conventional broadcasting to precise planting to enhance yield and profitabilityas supported by the study of Alimuddin *et al.* (2020) conducted at South Sulawesi, Indonesia, evaluated how double-row planting strategies affected profilic and non-prolific hybrid corn cultivars due to changes in the number of grains per row, number of ears per plant, and the contribution of the second ear to total production, the double-row technique greatly raised grain yield. Likewise, confirmed by Bruns *et al.* (2012), assessed twin-row against single-row corn production. Higher grain yields and more effectively canopy light interception shown by results from twin-row planting suggested that this arrangement would boost photosynthetic efficiency and production.

Efficient nutrient management is essential for optimal corn production. Bhanvadia *et al.*(2023) discovered that the combination of 75% inorganic and 25% organic fertilizers enhanced maize height, grain yield, and nutrient absorption. According to Ramos (2023), the use of manure for nitrogen control assisted in increasing maize silage output. In contrast, Das *et al.* (2023) pointed out the need for coordinated nutrient management for the progress of soil health and sustainability. Through the use of modeling, Chauhdary *et al.*(2024) showed that crop yields of maize were improved within the setting of environmental changes by verifying the application of nutritional time and spacing was adequate. Beck's Hybrids (2023) indicates that banded phosphorus and potassium treatments enhanced nutritional utilization efficiency. Aided by the University of Nebraska Extension (2023) and the University of Illinois Extension (2025), site-specific, data-informed management of nitrogen can assist achieve sustainability in yield. Sudding *et al.* (2021) reported an increase in the average yield of 5.9 tons per hectare followed by the application of 400 kg of lime combined with 100 kg of urea or 450 kg/ha of NPK 15-15-6-4. The Oba Super 6 hybrid achieved the highest output published by Udo *et al.* (2023) with an application of 400 kg/ha of NPK 20:10:10 in the soil. Sari *et al.* (2024) observed that the application of an appropriate combination of nitrogen, phosphorus, and magnesium significantly increased nutrient levels in both the soil and the plant leaves, hence improving plant development and increasing production.

Comprehensive evidence of the agronomic and financial benefits of double-row planting and ideal fertilization in hybrid cornproduction is shown by the literature examined. But these results largely come from research on conventional or filed corn, with little consideration being given to hybrid glutinous corn under Philippine conditions. Moreover, no research has investigated the interactions between row planting and nutrient dynamics, especially in environments of glutinous corn where local soil types, climate, and resource restrictions are unique.A conceptual framework is proposed to explain the hypothesized interaction between double-row planting and nutrient management in order to close this gap. Double-row planting, according to the framework, increases plant spacing efficiency, root availability of nutrient and water, and canopy light penetration so improving physiological processes like photosynthesis. Together with integrated nutrient management wherein organic and inorganic input acquires balanced soil fertility, improved nutrient availability, and more efficient absorption. Particularly in relation to glutinous corn production under lowland, rainfed Philippine conditions, the synergy between spatial layout and nutrient inputs is expected to affect plant vigor, grain development, as well as yield and return on investment.

3. METHODOLOGY

3.1. Procurement of seeds and fertilizers

The hybrid glutinous corn variety Sweet Pearl was purchased from an agricultural seed source in San Mateo, Isabela, while vermicast and inorganic fertilizers were purchased from agricultural input providers in Echague, Isabela.

3.2. Experimental site

The experiment was conducted at San Mateo, Isabela, at Barangay Villa Cruz. During the wet and dry seasons, lowland rice, corn, and mungbean are commonly grown at this location, which is next to an irrigation canal. According to local soil classification, sandy clay loam is the type of soil found in the area.

3.3. Soil sampling and analysis

Before land preparation, soil samples were randomly collected within the experimental area for analysis of nitrogen, phosphorus, and potassium content. The samples were air-dried, crushed, and passed through a 2 mm sieve. Then, the samples were labeled and taken to the Regional Integrated Soil Laboratory at Carig Sur, Tuguegarao City for the analysis of pH, N, P, and K using the standard procedures.

3.4. Experimental Layout and Design

An area of 559 square meters of land was used in the study. Each block was divided into three replications using a Randomized Complete Block Design (RCBD). The 4.4 m × 32.5 m blocks were separated into six 4.4 m × 5 m plots, with 0.5 m plot spacing and 1 m alleyways between each block.

3.5. Experimental treatments

The experiment consisted of six fertilizer treatments:

T1: Farmer's conventional practice

T2: Soil analysis-based NPK application (120-90-0 kg ha^{-1})

T3: ½ recommended NPK + 3 t ha^{-1} vermicast + NEB foliar spray

T4: ½ recommended NPK + 3 t ha^{-1} vermicast + Power Grow foliar spray

T5: ½ recommended NPK + 3 t ha^{-1} vermicast + AMO foliar spray

T6: ½ recommended NPK + 3 t ha^{-1} vermicast + Prime foliar spray

3.6. Land preparation

The first step in preparing the land was tractor plowing, which was followed by harrowing. For two weeks, the land was kept fallow to allow the weed seeds to naturally decompose. An animal-drawn plow was used to finalize the pulverization of the land before planting.

3.7. Furrow construction and fertilizer application

A double-row planting design was used to create the furrows, with 80 cm separating rows and 30 cm separating hills. Applications of fertilizer followed treatment guidelines. Before planting, a complete fertilizer was applied at the base of the furrows, and 30 days after planting, urea was used as a side dressing. For the matching treatments, vermicast was mixed into furrows at planting time.

3.8. Planting and thinning

Planting was done by placing one seed per hill at an intra-row spacing of 20 cm and inter-row spacing of 80 cm × 30 cm. Seeds were covered lightly with fine soil and gently pressed to enhance soil-seed contact. At 10 days after emergence, thinning was done to maintain a uniform plant population.

3.9. Crop Care and Management

Soil aeration and weed control were achieved through routine cultivation. To improve root anchoring and avoid waterlogging, hilling-up was carried out during early vegetative growth. The use of suitable chemical pesticides upon detection was part of the control of pests and diseases. Following crop water requirements, irrigation was provided as needed and manual weeding was used.

3.10. Harvesting procedure

Corn ears were harvested at the soft dough stage. To prevent data misunderstanding, sample plants from each treatment plot were tagged before harvest. Data was only collected from tagged plants.

3.11. Data collection

The parameters listed were collected and recorded:

i. Plant Height (cm) – a meter stick was used to measure the distance from the base to the meristem tip and the first tassel node, respectively at 30 and 50 days after transplanting.

ii. Ear Weight With and Without Husks (g) – A digital balance weighing scale was used to weigh the ten randomly sampled ears both with and without husks.

iii. Ear Length and Diameter (cm) – A vernier caliper was used to measure the diameter at the midpoint of the ear diameter while a ruler was used to measure the length of the corn ear from end to end.

iv. Yield from 6 m^2 Sampling Area (kg) – Each ear in the specified sampling area was collected, weighed, and recorded.

v. Computed Yield per Hectare (t ha^1) – the formula below was used in computing the $6m^2$ sampling data.

Yield (t ha-1) = (Yield from $6m^2/6$) x10,000

3.12. Statistical analysis

All quantitative data collected were subjected to Analysis of Variance (ANOVA) following the RCBD structure using the Statistical Tool for Agricultural Research (STAR) software. Treatment means with significant differences were compared using the appropriate post hoc test (e.g., LSD or HSD).

3.13. Cost and return analysis

To complete the economic evaluation, all variable and constant production expenses including labor and input costs were recorded. Gross income was determined through current market corn prices. Computed net income and return on investment (ROI) made one examine the profitability of each fertilizer treatment.

4. RESULTS AND DISCUSSION

4.1. Plant height at 30 and 50 days after planting

Double-row planting significantly influenced Plant Height 30 Days After Planting (DAP); Treatment 2 (Soil Analysis-based NPK) generated the tallest plants with Plant Height by 22.9% over Standard Practice (T1). Precision fertilization increases early plant vigor, according to Zhou *et al.* (2020) and Omondi *et al.* (2019), therefore nutrient management based on soil analysis is more successful than the full application used in T1. Strangely, T6 (with Prime Foliar) produced shorter plants while T4 (½ RR + Vermicast + Power Grow Foliar) performed similarly. This suggests that not all foliar supplements are created equal. There were no discernible variations in plant height between treatments at 50 DAP, indicating that early vegetative growth is more susceptible to nutritional fluctuations than in later stages when plant height levels off between treatments.

4.2. Corn ear weight (with and without husk)

Treatments combining organic inputs and foliar sprays greatly increased ear weight. Treatments 4 (T4) always produced the heaviest corn ears both with and without the husks; Treatments 5 (T5) and 3 (T3) received second and third accordingly. These treatments outperformed both the one based simply on inorganic fertilizers (T2) and the traditional approach (T1). This suggests that adding organic amendments with foliar fertilizer sprays helps enhance ear growth most likely using improving the availability of nutrients and absorption during basic reproductive times. These findings align with those of Singh *et al.* (2020) and Tewari *et al.* (2018), who emphasized the benefits of combining organic materials with targeted fertilization to boost crop growth and promote sustainability.

4.3. Ear length and diameter

Although ear length remained fairly consistent across all treatments, there was a clear difference in ear diameter, with Treatment 4 (T4) showing the most significant increase. This suggests that even though ear diameter can be more dependent on nutrition management, ear length may be more affected by genes. Recent studies by El-Shafey *et al.* (2021) and Zou *et al.* (2023) also confirm the conclusion that the foliar sprays applied in T4 most likely helped increase the growth of reproductive tissues during significant stages.

4.4. Yield per sampling area and hectare

Treatment 4 (T4) exceeded all other treatments and produced the highest yields in both the 6 m^2 plots and on a per-hectare basis, hence the findings revealed the ear weight values while Treatments T5 and T3 also showed significant yield increases over the usual method. These results revealed the studies of Kumar *et al.* (2022), who indicate that vermicast increases microbial activity and nutrient cycling, so increasing output. Our findings also concur with those of Patel *et al.* (2021) and Rao *et al.* (2020), who reported production increases of 10–15% when double-row planting was used. They attributed these benefits to improved resource efficiency, canopy light interception, and space utilization.

4.5. Economic analysis

T4 showed the highest return on investment (330.96%) in terms of economics, followed by T5 and T1. T2 had the lowest return on investment (ROI) while having a comparatively greater input cost. This highlights the fact that the cost-effectiveness of inputs is crucial and that maximum yield does not always equate to maximum profit. These results corroborate those of Patel *et al.* (2022), who emphasized the financial benefit of implementing double-row planting in conjunction with integrated nutrient management.

Table 1. Plant height (cm) of hybrid glutinous corn (sweet pearl) at 30 and 50 days after planting as influenced by double row planting technology.

Treatments	Plant Height (cm) at 30 DAP	Plant Height (cm) at 50 DAP
T1 – Conventional / Farmer's Practice	70.63^{b}	167.53
T2 – Soil Analysis (120-90-0 kg NPK ha^{-1})	86.77^{a}	156.60
T3 – ½ RR + Vermicast 3 t ha^{-1} + NEB Foliar	74.47^{ab}	165.53
T4 – ½ RR + Vermicast 3 t ha^{-1} + Power Grow Foliar	76.57^{ab}	163.33
T5 – ½ RR + Vermicast 3 t ha^{-1} + AMO Foliar	75.33^{ab}	171.13
T6 – ½ RR + Vermicast 3 t ha^{-1} + Prime Foliar	66.73^{b}	165.47
ANOVA Result	*	ns
C.V. (%)	6.19	4.42

Source: Field data

Table 2. Weight (g) of hybrid glutinous corn (sweet pearl with and without husk as influenced by double row planting technology.

TREATMENTS	With Husk	Without Husk
T1- Conventional / Farmer's Practice	96.50b	83.17b
T2 - Soil Analysis (120-90-0 kg NPK ha^{-1})	120.50a	104.07a
T3- ½ RR + Vermicast 3 tons ha-1 + NEB Foliar	126.83a	106.50a
T4- ½ RR + Vermicast 3 tons ha-1 + Power Grow Foliar	134.83a	114.33a
T5- ½ RR + Vermicast 3 tons ha-1 + AMO Foliar	129.00a	109.30a
T6- ½ RR + Vermicast 3 tons ha-1 + Prime Foliar	121.00a	103.13a
ANOVA RESULT	*	*
C.V. (%)	6.96	6.39

Source: Field data

Table 3. Length (cm) and diameter (cm) of hybrid glutinous corn (sweet pearl as influenced by double row planting technology.

TREATMENTS	Corn Ear Length (cm)	Corn Ear Diameter (cm)
T1 - Conventional / Farmer's Practice	12.62	3.58b
T2 - Soil Analysis (120-90-0 kg NPK ha^{-1})	13.93	3.75ab
T3 - ½ RR + Vermicast 3 tons ha^{-1} + NEB Foliar	14.37	3.84ab
T4 - ½ RR + Vermicast 3 tons ha^{-1} + Power Grow Foliar	14.13	3.90a
T5 - ½ RR + Vermicast 3 tons ha^{-1} + AMO Foliar	13.62	3.81ab
T6 - ½ RR + Vermicast 3 tons ha^{-1} + Prime Foliar	13.55	3.74ab
ANOVA RESULT	ns	*
C.V. (%)	4.29	2.48

Source: Field data

Table 4. Yield per sampling area (kg/6m^2) on the with and without husk per hectare of hybrid glutinous corn (sweet pearl as influenced by double row planting technology.

TREATMENTS	With Husk	Without Husk
T1 - Conventional / Farmer's Practice	5.21b	4.49b
T2 - Soil Analysis (120-90-0 kg NPK ha^{-1})	6.51a	5.62a
T3 - ½ RR + Vermicast 3 tons ha^{-1} + NEB Foliar	6.85a	5.75a
T4 - ½ RR + Vermicast 3 tons ha^{-1} + Power Grow Foliar	7.28a	6.17a
T5 - ½ RR + Vermicast 3 tons ha^{-1} + AMO Foliar	6.97a	5.90a
T6 - ½ RR + Vermicast 3 tons ha^{-1} + Prime Foliar	6.53a	5.57a
ANOVA RESULT	*	*
C.V. (%)	2.48	4.29

Source: Field data

Table 5. Computed yield per hectare of hybrid glutinous corn (sweet pearl as influenced by double row planting technology.

TREATMENTS	Computed Yield (kg)	Computed Yield (tons)
T1- Conventional / Farmer's Practice	7485.00b	7.50b
T2 - Soil Analysis (120-90-0 kg NPK ha^{-1})	9365.00a	9.37a
T3- ½ RR + Vermicast 3 tons ha-1 + NEB Foliar	9585.00a	9.60a
T4- ½ RR + Vermicast 3 tons ha-1 + Power Grow Foliar	10290.00a	10.30a

T5- ½ RR + Vermicast 3 tons ha-1 + AMO Foliar	9836.67a	9.84a
T6- ½ RR + Vermicast 3 tons ha-1 + Prime Foliar	9281.00a	9.30a
ANOVA RESULT	*	*
C.V. (%)	6.39	6.39

Source: Field data

Table 6. Cost and return analysis of hybrid glutinous corn (sweet pearl as influenced by double row planting technology

Treatments	Cost Of Production	Gross Income	Net Income	ROI (%)
T1	46,420.00	187,125.00	140,705.00	303.11
T2	63,070.00	234,150.00	171,080.00	271.25
T3	59,560.00	239,625.00	180,065.00	302.33
T4	59,692.00	257,250.00	197,558.00	330.96
T5	60,070.00	245,925.00	185,855.00	309.40
T6	59,652.00	232,050.00	172,398.00	289.01

Source: Field data

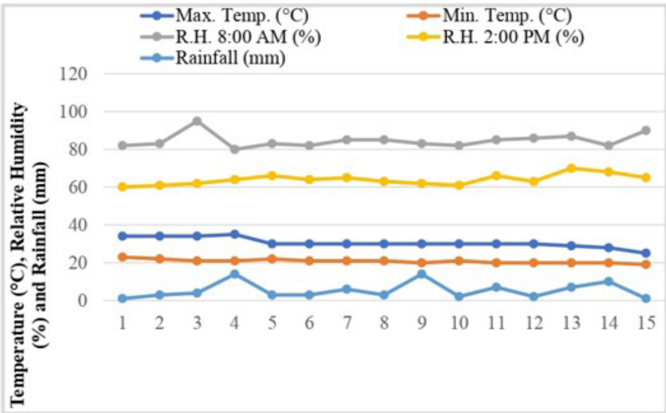

Figure 1. Climatic data during the conduct of the study.

5. CONCLUSION

An application under double-row planting of hybrid glutinous corn, T4 (½ RR + Vermicast 3 tons ha¹ + Power Grow Foliar) produced the tallest plants, heaviest ears, most significant ear diameter, and maximum green corn yield of 10.3 tons per hectare in this study. Its economic viability was further shown by the highest return on investment about 330.96%. These results stress the need to combine double-row planting with balanced nutrient management to improve productivity and profitability. While results were promising, the study was limited to a single growing season and location, which may affect the generalizability of findings. However, the production advantage and proven efficiency point to a high likelihood of broader adoption in comparable agroecological zones. Farmers who want to maximize income and land utilization while using fewer inputs should consider this strategy. To support suggestions for wider use, future research should confirm the findings in various climates and seasons.

To increase the adoption of this technology, policymakers are being asked to integrate double-row planting into local agricultural planned with nitrogen control strategies. With government help in subsidies, training, and demonstration farms, smallholder farmers might choose this approach. Strengthening extension services will also help to provide site-specific recommendations, encourage acceptance, and ensure long-term sustainability of practice.

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