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Application of Vermichar, Thrichoderma and Biostimulants on Eggplant (*Solanum melongena* L.)

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Abstract
Aim: This study aimed to determine the effects of integrating inorganic fertilizer with organic amendments on the growth and yield of eggplant.
Methodology: A field experiment was carried out at the College of Agriculture, Isabela State University Cauayan Campus, City of Cauayan, Isabela, to evaluate the response of eggplant (*Solanum melongena* L.) to varying levels of inorganic fertilizer in combination with vermichar and seaweed extract as biostimulants. Generally, the study aimed to determine the effects of integrating inorganic fertilizer with organic amendments on the growth and yield of eggplant. A total of seven treatments, including a control, were laid out in a Randomized Complete Block Design (RCBD).
Results: Findings of the study showed that among the treatment's combinations, the application pf 80-20-30 kg NPK ha^{-1}, 10 bags of Vermichar, and Trichoderma consistently outperformed all the measured parameters such as plant height at 30, 60 and 90 days after planting, number of branches and fruits. Other parameters such as the length, diameter, weight of fruits per plant, per sampling area and computed fruit yield per 1000 square meters were produced by the aforementioned treatment. This treatment also resulted in increased fruit production by 13.93% over the control.
Conclusion: Demonstrating the beneficial combination of inorganic fertilizer with organic biostimulants like Trichoderma and Vermichar resulted to better plant growth and fruit development. These findings highlight the synergistic effect of integrating inorganic fertilizer with organic biostimulants such as Vermichar and Trichoderma resulted to an enhanced nutrient availability and increased crop productivity.
Keywords: *Trichoderma, vermichar, seaweed extract, biostimulants, synergistic effect*

INTRODUCTION

Eggplant (*Solanum melongena* L.) is widely cultivated in tropical and subtropical climates, particularly valued for its nutritional content, including bioactive compounds such as vitamins, minerals, phenolic compounds, dry matter, and essential macronutrients. The secondary metabolites in eggplant, including glycoalkaloids, antioxidants, and vitamins, are considered the primary contributors to its health-promoting properties (Saha et al., 2023).

Eggplants grow best in well-drained, fertile soils like sandy loam or clay loam, with a pH level ranging from 5.5 to 6.8. Their deep taproot system allows them to endure dry conditions. In the Philippines, eggplant is one of the top vegetable crops in terms of production value, cultivated across more than 20,000 hectares, primarily by smallholder farmers with plots ranging from 0.5 to 2 hectares. The national yield averages about 9.95 tons per hectare, which is considerably lower than the average yield seen in Asia and globally. Eggplant farming is crucial for smallholder farmers, providing them with vital income while helping to meet the growing food demand associated with population growth.

Despite its significance, the excessive use of chemical fertilizers in eggplant cultivation has led to soil degradation, diminished microbial diversity, and adverse environmental impacts. This highlights the urgent need to adopt sustainable agricultural practices that preserve plant health and soil fertility. The exploration of alternative organic

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fertilizers is critical for not only improving eggplant yields but also fostering more sustainable, environmentally friendly farming methods.

One such alternative is vermichar, a blend of vermiculture and biochar that has been enriched with Trichoderma. This combination has demonstrated benefits in improving soil structure, increasing water retention, and enhancing plant growth. Trichoderma, a genus of fungi, is also recognized for its ability to act as a biocontrol agent and plant growth enhancer. It works by outcompeting harmful pathogens, enhancing plant immunity, and improving nutrient absorption. Additionally, seaweed-based foliar fertilizers, derived from seaweed extracts, are known to supply essential nutrients, growth-promoting hormones, and to improve plant resistance to various stressors, including drought, salinity, and pest infestations.

Although individual studies have highlighted the positive effects of Trichoderma, vermichar, and seaweed-based foliar fertilizers on soil health and crop productivity, there is limited research on the combined application of these treatments, particularly concerning their impact on eggplant yield. The principles of organic farming, as outlined in Sustainable Development Goal (SDG) 2 Zero Hunger are integral in promoting efforts to reduce hunger, improve nutrition, and support a more sustainable global food system. Organic farming practices present a promising route to achieving these objectives. This study aims to provide farmers with an innovative, cost-effective approach to boost eggplant productivity while reducing reliance on chemical fertilizers.

Furthermore, this research supports SDG 12 Responsible Consumption and Production by encouraging sustainable consumption and production patterns. It also contributes to SDG 15 Life on Land by protecting and restoring terrestrial ecosystems, halting land degradation, and preventing biodiversity loss. These goals collectively enhance ecosystem resilience, protect productive land, and ensure its availability for future generations.

The integration of Trichoderma, vermichar, and seaweed-based foliar fertilizers has the potential to work synergistically, improving nutrient uptake, stimulating beneficial microbial activity in the soil, and boosting plant growth and yield. This approach offers a sustainable alternative to conventional chemical fertilizers.

Eggplant production faces significant challenges due to Fusarium wilt, a destructive pathogen that is difficult to control with conventional methods, such as synthetic fungicides. The persistence of soil-borne fungal spores, which can survive in the soil for long periods, makes long-term management of the disease complex. Biological control strategies, however, offer promising, eco-friendly alternatives to chemical fungicides. Beneficial microorganisms like Trichoderma spp. play a critical role in managing soil-borne pathogens by competing with harmful fungi, parasitizing them, and producing antifungal compounds (Savazzini et al., 2009).

Moreover, organic amendments such as biochar offer additional benefits by improving the physical, chemical, and biological properties of the soil. By increasing soil organic matter, biochar enhances crop yield and helps plants resist pests and diseases, providing a viable alternative to synthetic fertilizers. In light of global food demand, climate change, and the push for sustainable agriculture, biochar and other organic amendments are essential for promoting resilient and productive agricultural systems.

Objectives

This study was conducted to evaluate the effect of Trichoderma and vermichar supplemented with seaweed extract foliar fertilizer on the growth and yield of eggplant.

Specific objectives are the following:

1. determine the effect of Trichoderma, vermichar and seaweed extract on eggplant productivity;
2. determine the appropriate levels that increase the yield of eggplant; and
3. evaluate the return on investment (ROI) associated with eggplant production.

METHODS

Procurement of Seeds and Experimental Area Location

Hybrid eggplant seedlings (Calixto F_1) were sourced from a certified nursery dealer located in the vicinity. The research was conducted at the experimental field of the College of Agriculture, Cauayan Campus, in Cauayan City, Isabela. The study site had a level terrain with artificial irrigation, and it had previously been used for growing various vegetables.

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Collection of Vermichar and Trichoderma

Vermicompost was obtained from the Organic Production Center at Isabela State University, Echague, Isabela, while Trichoderma was sourced from the Regional Crop Protection Center, Department of Agriculture, in Ilagan City, Isabela.

Soil Sampling and Analysis

Soil samples were randomly collected from the experimental area using a shovel and pail. These samples were spread on newspaper and allowed to air dry. A composite sample weighing one kilogram was then carefully pulverized and cleaned to remove foreign materials. The sample was submitted to the Regional Integrated Laboratory – Cagayan Valley Research Center in Tuguegarao City for soil analysis. The NPK content of the soil was used to determine the fertilizer requirements for the study, which was set at 80-30-20 kg NPK per hectare.

Soil pH and Organic Matter Determination

Soil pH, organic matter content, and other micronutrients were analyzed prior to the start of the experiment.

Land Preparation

The experimental area was cleared of stubbles, grasses, and stones to ensure proper land preparation. The land was then plowed using a tractor and harrowed. Afterward, the field was left idle for two weeks to allow weeds to decay and for weed seeds to germinate before the final plowing.

Application of Trichoderma, Vermichar, and Seaweed Extract

Vermichar was applied at a rate of 10 bags per hectare, and Trichoderma was placed in each planting hole as a basal application, covered by a thin layer of soil. Seaweed extract was sprayed onto the plant leaves as a foliar application, following the recommended dosage. To avoid leaf scorching, foliar spraying was performed early in the morning or late in the afternoon.

Experimental Layout and Design

The field area was divided into three blocks, each measuring 26.5 meters by 14 meters with a one-meter alley between blocks. Each block was subdivided into six equal plots, each measuring 4 meters by 4 meters, with a 0.5-meter gap between plots. The treatments were arranged using a Randomized Complete Block Design (RCBD), as follows:

T_1: 80-20-30 kg NPK ha^{-1} (RR)
T_2: 10 bags Vermichar per hectare
T_3: 80-20-30 kg NPK ha^{-1} + 10 bags Vermichar + Trichoderma
T_4: 60-15-22.5 kg NPK ha^{-1} + 10 bags Vermichar + 3 L Seaweed Extract + Trichoderma
T_5: 60-15-22.5 kg NPK ha^{-1} + 3 L Seaweed Extract
T_6: 60-15-22.5 kg NPK ha^{-1} + 2.5 bags Vermichar
T_7: 60-15-22.5 kg NPK ha^{-1} + 2.5 bags Vermichar + Trichoderma

Construction of Furrows, Transplanting, and Replanting

After the final harrowing, furrows were manually constructed. The seedlings were transplanted at a spacing of 40 cm between hills and 75 cm between furrows. Replanting was done seven days after transplanting to maintain plant population. The seedlings were handled carefully to prevent damage before transplanting.

Care and Management of the Plants

1. **Cultivation and Weed Control**: Hand cultivation was done twice or as necessary to aerate the soil and control weeds. Manual hilling was also performed to prevent excessive moisture accumulation, and hand weeding was carried out as required.
2. **Irrigation**: Irrigation was applied when necessary to meet the moisture requirements of the plants.

Harvesting

The first priming of eggplant fruits was harvested at 55 days after transplanting, once the fruits reached the marketable stage. Fruits from ten randomly selected sample plants in each plot, excluding the two outermost rows,

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were harvested. The fruits were placed in plastic bags, labeled, and tagged individually according to treatment to prevent sample contamination.

Data Gathered

1. **Plant Height (cm)**: Plant height was measured from the base to the tip of the primary stem of ten randomly selected plants at 30, 60, and 90 days after transplanting.
2. **Fruit Length (cm)**: The length of 10 randomly selected fruits from the sample plants was measured using a foot ruler.
3. **Fruit Diameter (cm)**: The diameter of the fruits was measured using calipers.
4. **Number of Branches per Plant**: The number of branches on the ten sample plants was counted during the final harvest. The total number of branches was divided by 10 to determine the average number of branches per plant.
5. **Number of Fruits per Plant**: The number of fruits per treatment was counted and recorded for each harvest. The total fruits from the first to the last harvest per plant were summed and divided by 10 to obtain the average number of fruits per plant.
6. **Fruit Weight per Plant**: Fresh fruit weights were recorded during each harvest. After the final harvest, the total weight was divided by 10 to determine the average weight per plant.
7. **Fruit Yield per Sampling Area**: The fruit yield was calculated based on the sampling area and projected to a per-hectare basis.
8. **Cost and Return Analysis**: A simple economic analysis was used to calculate the return on investment. The cost of production was based on local prices for farm inputs and labor. Gross income was determined based on the market price of eggplant per kilogram, and net income was calculated by subtracting the cost of production from gross income. The return on investment was calculated by dividing net income by the cost of production, then multiplying by 100.

Statistical Analysis

Data were analyzed using the Analysis of Variance (ANOVA) for the Randomized Complete Block Design (RCBD). Significant treatment effects were further compared using Tukey's Honestly Significant Difference (HSD) Test.

RESULTS AND DISCUSSION

Plant Height (cm). The impact of the treatments on plant height was significant at 30, 60, and 90 days post-transplanting (Table 1). The tallest plant, measuring 46.77 cm, was observed at 30 days in the treatment combining 80-20-30 kg NPK ha^{-1} (RR), 10 bags of Vermichar, and Trichoderma (T_3). Other treatments involving either single or combined applications of inorganic fertilizers, seaweed extract, and Trichoderma also resulted in similar increases in plant height, with average heights of 43.43 cm (T_1), 42.20 cm (T_4), and 39.10 cm (T_5). Plants that received only organic fertilizers exhibited similar growth but were generally shorter than those treated with inorganic fertilizers or combinations, especially when compared with treatments involving 80-20-30 kg NPK ha^{-1} (T_1) and T_3 (80-20-30 kg NPK ha^{-1} + 10 bags Vermichar + Trichoderma).

At 60 days after transplanting, plants treated with organic amendments like Vermichar, Seaweed Extract, and Trichoderma, as well as a reduced NPK rate, showed better growth compared to others. The combination of 80-20-30 kg NPK ha^{-1} (RR) + 10 bags of Vermichar + Trichoderma (T_3), 60-15-22.50 kg NPK ha^{-1} + 10 bags of Vermichar + 3 L Seaweed Extract + Trichoderma (T_4), and 80-20-30 kg NPK ha^{-1} (T_1) resulted in the tallest plants. Notably, treatments without Trichoderma and those with only the recommended rate of inorganic fertilizer had shorter plants, highlighting the synergistic effect of combining organic and inorganic fertilizers in promoting taller plant growth.

By the final measurement, plants from the treatment with 80-20-30 kg NPK ha^{-1} (RR), 10 bags of Vermichar, and Trichoderma showed a 4.75% increase in height, reaching an average of 98.02 cm (T_3). These plants were taller than those fertilized with solely inorganic fertilizer, while plants receiving only organic fertilizers (T_2) had the shortest growth, suggesting limited effectiveness of organic fertilizers alone.

The combination of inorganic fertilizer (80-20-30 kg NPK ha^{-1}) with 10 bags of Vermichar and Trichoderma led to the greatest increase in plant height, likely due to an optimal balance of nutrients and improved soil health. This supports the idea that a well-rounded nutrient supply, such as that from NPK, promotes vegetative growth by enhancing nutrient availability (Gastal & Lemaire, 2002). Furthermore, seaweed extract has been reported to substantially enhance

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plant growth (Abbas et al., 2020), and integrating NPK fertilizers with Trichoderma further contributes to increased plant height in crops like corn.

Table 1. Plant Height at 30, 60 and 90 Days after Transplanting (cm) as affected by the Application of Trichoderma, Vermichar and Biostimulant

TREATMENTS	MEAN		
	30 DAT	60 DAT	90 DAT
T_1- 80-20-30 kg NPK ha^{-1} (RR)	43.43ab	56.40ab	93.57b
T_2- 10 bags Vermichar per Hectare	34.20c	44.72d	72.87f
T_3- 80-20-30 kg NPK ha^{-1} (RR) + 10 bags Vermichar + Trichoderma	46.77a	60.25a	98.02a
T_4- 60-15-22.50 kg NPK ha^{-1} + 10 bags Vermichar + 3 L Seaweed Extract + Trichoderma	42.20abc	54.53abc	91.63bc
T_5- 60-15-22.50 kg NPK ha^{-1} + 3L Seaweed Extract	39.10abc	50.15bcd	86.43de
T_6- 60-15-22.50 kg NPK ha^{-1} + 2.5 bags Vermichar	36.63bc	48.15cd	83.00e
T_7- 60-15-22.50 kg NPK ha^{-1} + 2.50 bags Vermichar + Trichoderma	41.87abc	52.77bc	88.70cd
F- RESULTS	**	**	**
C. V. (%)	7.25	4.89	1.53

Means with the same letter are not significantly different using HSD Test
***- significant at 1% level*

Number of Branches per Plant. According to the data shown in Table 2, there was a notable variation in the number of branches produced by eggplants across the different treatments. The treatment that combined inorganic fertilizer with 10 bags of Vermichar and Trichoderma (T_3) resulted in the highest average branch count at 7.00. This was followed by the application of sole inorganic fertilizer (6.67), the treatment with 60-15-22.50 kg NPK ha^{-1} + 10 bags of Vermichar + 3 L of Seaweed Extract + Trichoderma (6.00), and the treatment involving 60-15-22.50 kg NPK ha^{-1} + 2.5 bags of Vermichar + Trichoderma (5.67). Plants treated with seaweed extract alone also performed moderately well, averaging 5.33 branches. On the other hand, the fewest number of branches (3.33) was observed in plants that received only organic fertilizer, particularly those not supplemented with seaweed extract or Trichoderma (T_6).

The enhancement in branching observed in treatments combining organic and inorganic inputs, even at reduced fertilizer rates, is likely due to the presence of essential nutrients and growth-stimulating substances found in these amendments. These compounds help stimulate shoot development and branching (Karthik et al., 2020). Furthermore, the synergistic action of Trichoderma species and vermicompost has been reported to effectively manage stem rot disease in chili plants caused by Sclerotium rolfsii, achieving control rates between 73.33% and 100%. This synergy not only protects plants but also contributes to overall plant vigor and development.

The observed improvement in branch number may also be attributed to the supply of vital macro- and micronutrients from both organic and inorganic fertilizers, as well as the seaweed extract, all of which are essential for the development of plant tissues (Werner et al., 2001). Additionally, Trichoderma's capacity to colonize plant roots and form stable symbiotic relationships plays a significant role in boosting plant health and resilience (Montesano et al., 2003). Together, these factors positively influence plant growth and contribute to the enhanced formation of branches.

Number of Marketable Fruits. The number of marketable fruits per eggplant was significantly affected by the different treatments, as shown in Table 2. The highest number of fruits (15.00) was consistently recorded in plots treated with the full recommended rate of inorganic fertilizer, combined with 10 bags of Vermichar and Trichoderma (T_3). A comparable yield was observed in the treatment that used only the recommended 80-20-30 kg NPK ha^{-1} (T_1), which produced an average of 13.67 fruits per plant.

In contrast, lower fruit yields were noted in treatments that used reduced levels of inorganic fertilizer and Vermichar, especially those that did not include seaweed extract or Trichoderma. These results suggest that omitting biostimulants and applying lower nutrient inputs limits the plant's capacity to achieve its maximum fruit-bearing

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potential. The findings highlight the importance of both balanced nutrient application and the presence of beneficial biological inputs in supporting optimal fruit production.

The observed increase in fruit count can be attributed to the application of both inorganic fertilizers and Vermichar. These inputs promote efficient nutrient movement throughout the plant, supporting the development of key structures such as stems, leaves, and fruits. Enhanced nutrient uptake by plant roots—boosted by Vermichar's ability to improve soil structure and nutrient absorption—likely played a vital role in this outcome.

Length of Fruits (cm). Table 2 presents significant differences in fruit length among the treatments. Notably, treatment T_3—consisting of 80-20-30 kg NPK ha^{-1} (RR) combined with 10 bags of Vermichar and Trichoderma—resulted in a 13.77% increase in fruit length compared to the sole application of inorganic fertilizer, which recorded an average fruit length of 24.17 cm. This indicates that the inclusion of Trichoderma in the treatment positively influenced fruit elongation.

Conversely, treatments that excluded Trichoderma, such as T_6 and T_5, saw a reduction in fruit length by 27.89% and 27.27%, respectively. These results emphasize the beneficial role of Trichoderma, which is known to establish stable symbiotic relationships with plant roots, enhancing nutrient uptake and overall plant vigor (Montesano et al., 2003).

Meanwhile, the shortest fruits were produced by plants treated only with Vermichar at a rate of 10 bags per hectare. Although Vermichar contributes to better soil structure and increased microbial activity, it may fall short in providing adequate nutrients required for optimal fruit development. The limited nutrient availability in this treatment likely constrained the fruit elongation potential of eggplant plants.

Fruit Diameter (cm). The combination of the recommended NPK fertilizer rate with organic amendments such as vermichar, seaweed extract, and Trichoderma significantly influenced the diameter of eggplant fruits, as shown in Table 2. The largest fruit diameter (3.90 cm) was observed in the treatment that integrated 80-20-30 kg NPK ha^{-1} with 10 bags of vermichar and Trichoderma. This was followed closely by the application of the full NPK rate alone (3.59 cm), and the treatment with a reduced NPK rate (60-15-22.5 kg ha^{-1}) supplemented with vermichar, seaweed extract, and Trichoderma, which yielded fruits averaging 3.54 cm in diameter.

In contrast, fruit size declined in treatments where the NPK rate was reduced and either seaweed extract or Trichoderma was excluded. This was evident in Treatment 7 (3.40 cm), T_5 (3.31 cm), T_6 (3.13 cm), and especially in T_2 (2.09 cm), which recorded the smallest fruit diameters. The reduced fruit size in these treatments can be attributed to limited nutrient availability and the lack of microbial support from beneficial organisms like Trichoderma.

Trichoderma harzianum, known for its antagonistic properties against various root and plant pathogens, plays a critical role in enhancing root development and nutrient absorption (Rajendiran et al., 2010). Similarly, seaweed extract, along with essential nutrients like nitrogen, phosphorus, and potassium, supports vigorous vegetative growth and contributes to improved fruit development (Kalay et al., 2020). The results highlight the importance of integrating both chemical and biological inputs for optimal fruit size and overall crop performance.

Weight of Marketable Fruits per Plant. The weight of marketable eggplant fruits varied significantly across treatments, as shown in Table 2. Factors such as the number of branches and fruits, along with fruit length and diameter, were found to be critical contributors to overall yield. The heaviest fruit weight was recorded in Treatment 3 (T_3), where the application of 80-20-30 kg NPK ha^{-1}, 10 bags of vermichar, and Trichoderma resulted in an average of 1.55 kilograms per plant. This high yield can be linked to the effective combination of balanced nutrients from chemical fertilizers and organic amendments, enhancing both nutrient availability and uptake, which in turn promoted robust plant growth and improved fruit development.

Following this, plants under the sole application of the recommended NPK rate (T_1) produced an average of 1.36 kg per plant, which was closely matched by T_4 with a yield of 1.29 kg. Meanwhile, moderately lower yields were recorded in treatments such as the combination of 60-15-22.5 kg NPK ha^{-1} with 2.5 bags of vermichar and Trichoderma (1.22 kg), T_5 (1.21 kg), and T_6 (1.20 kg). The lowest yield was observed in Treatment 2 (T_2), where only 10 bags of vermichar per hectare were applied, resulting in a significantly reduced fruit weight of 0.77 kg per plant.

These findings clearly highlight the importance of applying either the full recommended NPK rate or combining it with suitable organic inputs to maximize eggplant yield. Potassium from both the inorganic fertilizer and vermichar plays a key role in this process by helping regulate crucial plant functions such as maintaining turgor pressure and optimizing carbon assimilation, which supports fruit development and weight retention (Kumar et al., 2006). In addition, Trichoderma enhances the plant's capacity to absorb water and nutrients more effectively, leading to healthier growth, more uniform fruits, and improved overall productivity.

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Table 2. Growth and Yield Parameters as Influenced by the Application of Trichoderma, Vermichar and Biostimulant

TREATMENTS	MEAN				
	Number of Branches	Number of Marketable Fruits	Length of Fruits	Fruit Diameter	Weight of Marketable Fruits
T_1- 80-20-30 kg NPK ha^{-1} (RR)	6.67a	13.67ab	24.17b	3.59b	1.36b
T_2- 10 bags Vermichar per Hectare	3.33c	8.67d	16.33e	2.09f	0.77d
T_3- 80-20-30 kg NPK ha^{-1} (RR) + 10 bags Vermichar + Trichoderma	7.00a	15.00a	27.50a	3.90a	1.55a
T_4- 60-15-22.50 kg NPK ha^{-1} + 10 bags Vermichar + 3 L Seaweed Extract + Trichoderma	6.00a	12.67bc	23.00bc	3.54bc	1.29bc
T_5- 60-15-22.50 kg NPK ha^{-1} + 3L Seaweed Extract	5.33ab	11.67bc	20.00d	3.31d	1.21c
T_6- 60-15-22.50 kg NPK ha^{-1} + 2.5 bags Vermichar	4.00bc	10.67cd	19.83d	3.13e	1.20c
T_7- 60-15-22.50 kg NPK ha^{-1} + 2.50 bags Vermichar + Trichoderma	5.67ab	12.33bc	21.33cd	3.40cd	1.22c
F- RESULTS	**	**	**	**	**
C. V. (%)	12.50	6.87	3.63	1.85	2.73

Means with the same letter are not significantly different using HSD Test
***- significant at 1% level*

Weight of Marketable Fruits per Sampling Area (kg/4.25 m²). When evaluating the fruit yield per sampling area, Treatment 3 consistently produced the highest output across all treatments. This treatment yielded 21.75 kilograms per 4.25 m², representing a 13.93% increase compared to the control group, which yielded 19.09 kilograms.

Excluding the treatment that received only 10 bags of Vermichar per hectare, the yields from the other treatments showed only minor differences, ranging between 16.86 kg and 18.06 kg. These results suggest that while different nutrient combinations had some impact, fruit weight per sampling area remained relatively stable among most treatments—except where organic input alone was used, which yielded significantly less.

Table 3. Weight of Marketable Fruits Per Sampling Area (kg/4.25 m^2) as affected by the Application of Trichoderma-enriched Vermichar and Biostimulants

TREATMENTS	MEAN
T_1- 80-20-30 kg NPK ha^{-1} (RR)	19.09b
T_2- 10 bags Vermichar per Hectare	10.83d
T_3- 80-20-30 kg NPK ha^{-1} (RR) + 10 bags Vermichar + Trichoderma	21.75a
T_4- 60-15-22.50 kg NPK ha^{-1} + 10 bags Vermichar + 3 L Seaweed Extract + Trichoderma	18.06bc
T_5- 60-15-22.50 kg NPK ha^{-1} + 3L Seaweed Extract	16.94c
T_6- 60-15-22.50 kg NPK ha^{-1} + 2.5 bags Vermichar	16.80c
T_7- 60-15-22.50 kg NPK ha^{-1} + 2.50 bags Vermichar + Trichoderma	17.13c
F- RESULTS	**
C. V. (%)	2.73

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***- significant at 1% level*

Computed Weight of Marketable Fruits per 1000 m² (kg). The calculated yield of eggplant fruits per 1000 square meters revealed notable differences among treatments. The highest yield was recorded in Treatment 3, which involved the application of 80-20-30 kg NPK ha^{-1} combined with 10 bags of vermichar and Trichoderma, resulting in 365.79 kilograms. This significant yield increase is likely due to the balanced supply of nutrients from the inorganic fertilizer, enhanced by the organic matter in vermichar and the plant growth-promoting effects of Trichoderma.

This yield was considerably greater than that of the control treatment, which produced 321.03 kilograms. The superior performance of T_3 underscores the advantage of integrating synthetic and organic amendments for improved productivity. Additionally, T_3 outperformed Treatment 4 (60-15-22.5 kg NPK ha^{-1} + 10 bags vermichar + 3 L seaweed extract + Trichoderma), which produced a slightly lower yield of 303.76 kilograms.

Although the yields from the control plot were relatively close to those of T_7 (60-15-22.5 kg NPK ha^{-1} + 2.5 bags vermichar + Trichoderma), T_5 (60-15-22.5 kg NPK ha^{-1} + 3 L seaweed extract), and T6 (60-15-22.5 kg NPK ha^{-1} + 2.5 bags vermichar), these treatments still performed better than T_2, which involved only the application of 10 bags of vermichar per hectare and resulted in the lowest yield of 182.10 kilograms.

Table 4. Computed Weight of Marketable Fruits Per 1000 m^2 (kg) as affected by the Application of Trichoderma-enriched Vermichar and Biostimulants

TREATMENTS	Per 1000 m^2
T_1- 80-20-30 kg NPK ha^{-1} (RR)	321.03b
T_2- 10 bags Vermichar per Hectare	182.10d
T_3- 80-20-30 kg NPK ha^{-1} (RR) + 10 bags Vermichar + Trichoderma	365.79a
T_4- 60-15-22.50 kg NPK ha^{-1} + 10 bags Vermichar + 3 L Seaweed Extract + Trichoderma	303.76bc
T_5- 60-15-22.50 kg NPK ha^{-1} + 3L Seaweed Extract	284.93c
T_6- 60-15-22.50 kg NPK ha^{-1} + 2.5 bags Vermichar	282.57c
T_7- 60-15-22.50 kg NPK ha^{-1} + 2.50 bags Vermichar + Trichoderma	288.07c
F- RESULTS	**
C. V. (%)	

Means with the same letter are not significantly different using HSD Test
***- significant at 1% level*

Cost and Return Analysis. Table 5 presents the cost and return evaluation for eggplant production using various combinations of vermichar, Trichoderma, and seaweed extract. Among all treatments, Treatment 3—comprising 80-20-30 kg NPK ha^{-1} (recommended rate), 10 bags of vermichar, and Trichoderma—yielded the highest return on investment (ROI) at 89.41%.

This was followed by Treatment 6 (60-15-22.50 kg NPK ha^{-1} + 2.5 bags vermichar), which achieved a return of 78.39%, and Treatment 5, which recorded an ROI of 75.05%. Treatment 1 (sole application of the recommended NPK rate) also produced a respectable return of 63.06%. Meanwhile, Treatment 4 showed a return of 56.56%, while Treatment 7 had a slightly higher ROI of 64.35%. The lowest return was observed in Treatment 2, which involved only the application of 10 bags of vermichar per hectare, with a modest return of 17.01%.

Table 5. Cost and Return Analysis per 1000 m^2 (%)

ITEM	T_1	T_2	T_3	T_4	T_5	T_6	T_7
TOTAL COST OF PRODN.	7875	6225	7725	7761	6511	6336	7011
GROSS INCOME	12841.2	7284	14631.6	12150.4	11397.2	11302.8	11522.8
NET INCOME	4966.2	1059	6906.6	4389.4	4886.2	4966.8	4511.8

ROI (%)	**63.06**	**17.01**	**89.41**	**56.56**	**75.05**	**78.39**	**64.35**

Cost of eggplant @P40/kg

Conclusions

The results of the study demonstrated that treatment combining 80-20-30 kg NPK ha⁻¹, 10 bags of Vermichar, and Trichoderma (T_3) significantly enhanced eggplant growth and yield as this treatment consistently produced the tallest plants, the highest number of branches, and the greatest number of marketable fruits. It also resulted in a 13.93% yield increase compared to the use of inorganic fertilizer alone. Such treatment likewise achieved the highest marketable fruit weight per 1000 m^2 indicating better nutrient uptake by the plants. Notably, it also records the highest return on investment.

Recommendations

Based on the findings of the study, the adoption of the integrated application of 80-20-30 kg NPK ha^{-1} combined with 10 bags of Vermichar and Trichoderma is recommended for improved growth performance and higher yield of eggplant. The combination consistently led improved growth and yield and outperformed all other treatments and registered a 13.93% yield increase and highest return on investment hence, further recommended.

For future study, it is recommended to explore the long-term effects on soil health and microbial activity and examining the treatment's effect on pest and disease resistance as well as fruit quality parameters such as shelf life and nutrient content of eggplant as affected by the treatment combinations.

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