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Growth and yield of yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis*) applied with organic fertilizer

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ABSTRACT

The study evaluated the effects of different organic fertilizers on the growth, yield, and soil health of yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis*) under field conditions at the Institute of Agricultural Technology, Isabela State University, Cauayan Campus. The experiment was arranged in a randomized complete block design with four treatments: control (no fertilizer), compost, vermicompost, and organic manure, each applied at 10 t ha^{-1} and replicated three times. Growth parameters, yield and yield components, and selected soil health indicators were measured during the growing period and after harvest. Results showed that organic fertilizer application significantly enhanced vegetative growth compared to the control. At 8 weeks after planting, compost- and vermicompost-treated plants attained greater heights (45.5 and 47.3 cm, respectively) than the control (35.8 cm). These treatments also produced higher leaf numbers and thicker stems. Yield performance was markedly improved under organic fertilization. Compost recorded the highest pod yield (5.40 kg $plot^{-1}$ and 0.35 kg $plant^{-1}$), longest pods (75.30 cm), and greatest number of pods per plant (8.50), followed closely by vermicompost, while the control produced the lowest values. Soil health parameters were positively influenced by organic amendments. Compost increased soil organic matter from 1.20% in the control to 3.50%, raised soil pH from 5.20 to 6.20, and improved nitrogen (0.22%) and phosphorus (18.50 ppm) levels after harvest. Overall, the findings demonstrate that compost and vermicompost are effective organic nutrient sources for improving growth, yield, and soil health of yardlong bean, supporting their use in sustainable production system.

Key words: Yardlong bean, Organic fertilizer, Compost, Vermicompost, Yield, Soil health, Sustainable agriculture

INTRODUCTION

Yardlong bean (*Vigna unguiculata* subsp. *sesquipedalis*) is an important leguminous vegetable crop widely cultivated in tropical and subtropical regions. It is valued not only for its long, tender pods that are consumed as a vegetable, but also for its high nutritional content, including proteins, dietary fiber, vitamins, and essential minerals. In many developing regions, yardlong bean contributes significantly to household nutrition and income, making it an important component of smallholder farming systems.

Beyond its nutritional importance, yardlong bean plays a beneficial role in soil fertility improvement through biological nitrogen fixation. However, despite these advantages, yield levels of yardlong bean in many production areas remain suboptimal. Poor soil fertility, continuous cropping, and inappropriate fertilizer management are among the major constraints limiting productivity. To overcome these limitations, farmers often rely heavily on synthetic fertilizers to boost growth and yield.

The long-term and excessive use of chemical fertilizers, however, has raised serious concerns regarding soil degradation, declining soil organic matter, nutrient imbalance, and environmental pollution. These issues have intensified interest in sustainable and environmentally friendly nutrient management strategies. In recent years, organic fertilizers have gained renewed attention as viable alternatives to synthetic inputs due to their ability to improve soil structure, enhance microbial activity, and provide a slow and sustained release of nutrients (Anwar and Kazi, 2016; Batool and Saeed, 2021).

Organic fertilizers such as compost, vermicompost, and animal manure are known to improve both crop performance and soil health. Compost contributes to increased organic matter content and improved water-holding capacity, while vermicompost supplies readily available nutrients and beneficial microorganisms that stimulate plant growth. Organic manure, on the other hand, serves as a valuable source of macro- and micronutrients and enhances nutrient cycling in agricultural soils. Previous studies have reported positive effects of organic fertilizers on the growth and yield of leguminous and vegetable crops, including yardlong bean (Adediran and Ojeniyi, 2013; Sharma and Singh, 2016; Jeyakumar and Raman, 2015).

In addition to improving crop growth and yield, organic fertilizers play a crucial role in restoring soil health. Increased soil organic matter, improved soil pH, and enhanced nutrient availability associated with organic amendments contribute to long-term soil productivity and sustainability (de Souza and Silva, 2020; Lal, 2021). These benefits are particularly important in regions where soils are prone to nutrient depletion and acidity due to intensive cultivation.

Despite the growing body of research on organic fertilization, location-specific studies remain necessary because the response of crops to organic amendments depends on soil type, climate, and management practices. In the Philippines and similar agroecological zones, information on the comparative performance of different organic fertilizers on yardlong bean is still limited. Understanding how compost, vermicompost, and organic manure influence crop growth, yield, and soil properties under local conditions is essential for developing practical and sustainable production recommendations.

Therefore, this study was conducted at the Institute of Agricultural Technology, Isabela State University, Cauayan Campus, to evaluate the effects of different organic fertilizers applied at a uniform rate on the growth, yield, and soil health of yardlong bean. Specifically, the study aimed to (i) assess the influence of organic fertilizers on key growth parameters, (ii) determine their effects on yield and yield components, and (iii) examine changes in selected soil health indicators following organic fertilizer application. The findings of this study are expected to contribute to the promotion of sustainable nutrient management practices for yardlong bean production in the region.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Institute of Agricultural Technology, Isabela State University, Cauayan Campus, Isabela, Philippines. The experimental area was well-drained and suitable for yardlong bean cultivation. The site represents typical lowland conditions where yardlong bean is commonly grown, making the results relevant to local production systems.

Experimental design and treatments

The experiment was laid out using a Randomized Complete Block Design (RCBD) with four treatments replicated three times. Each treatment was randomly assigned within each block to minimize the effects of field variability.

The treatments consisted of different organic fertilizer applications as follows:
T1: Control (no fertilizer)
T2: Compost applied at 10 t ha^{-1}
T3: Vermicompost applied at 10 t ha^{-1}
T4: Organic manure applied at 10 t ha^{-1}

A total of twelve experimental plots (4 treatments × 3 replications) were established.

Land preparation and fertilizer application

Prior to planting, the experimental area was cleared of weeds, crop residues, and debris. The soil was plowed to a depth of approximately 20 cm to improve aeration and root penetration. This was followed by harrowing to produce a fine and uniform seedbed.

Organic fertilizers corresponding to each treatment were applied once before planting. Compost, vermicompost, and organic manure were evenly distributed over the soil surface of the designated plots at a rate of 10 t ha^{-1} and incorporated into the topsoil during harrowing to ensure uniform nutrient distribution.

Crop establishment and management

Yardlong bean (Vigna unguiculata subsp. sesquipedalis) seeds were directly sown in the prepared plots at a spacing of 60 cm between rows and 30 cm between plants. Each plot contained 20 plants. Immediately after planting, the plots were irrigated to ensure adequate soil moisture for germination. Irrigation was applied regularly throughout the growing period to maintain optimal moisture conditions. Weed control was carried out manually using hand tools to minimize competition for nutrients and space. Pest and disease incidence was monitored regularly. Integrated pest management practices were employed, and organic control measures were applied when necessary to minimize crop damage.

Data collection

Data were collected from representative plants within each plot at different stages of crop growth.

Growth parameters

The following growth parameters were measured:

Plant height (cm): Measured from the base of the plant to the highest growing point at 4 and 8 weeks after planting (WAP).

Number of leaves: Counted per plant at 6 and 12 WAP.

Stem diameter (cm): Measured at the base of the plant at 6 and 12 WAP using a measuring tool.

Yield parameters

Yield and yield-related data were collected at harvest (75 days after planting):

Pod yield per plot (kg): Total weight of pods harvested from each plot.

Yield per plant (kg): Average pod weight per plant.

Pod length (cm): Measured from randomly selected pods per plot.

Number of pods per plant: Counted from representative plants at harvest.

Soil health parameters

Soil samples were collected from each experimental plot before planting and again after harvest to assess changes in soil properties resulting from the different treatments. The collected samples were analyzed for soil organic matter content, soil pH, and the concentrations of nitrogen, phosphorus, and potassium using standard laboratory procedures.

Harvesting

Yardlong bean pods were harvested manually at approximately 75 days after planting, when the pods had reached full length and marketable maturity. Harvesting was carried out carefully to avoid damage to plants and pods.

Statistical analysis

All collected data were subjected to analysis of variance (ANOVA) appropriate for a randomized complete block design. When significant differences among treatments were detected, treatment means were compared using Duncan's Multiple Range Test (DMRT) at the 5% level of significance, following standard statistical procedures for agricultural research (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Growth response of yardlong bean to organic fertilizers

The application of organic fertilizers had a clear and positive influence on the vegetative growth of yardlong bean (Table 1). From early growth stages up to later vegetative development, plants receiving organic amendments consistently performed better than those grown without fertilizer. This observation aligns with earlier findings that organic fertilizers improve nutrient availability and create a more favorable soil environment for leguminous crops (Adediran and Ojeniyi, 2013; Ali and Yousaf, 2017).

Table 1. Effect of organic fertilizers on growth parameters of yardlong bean

Treatments	Plant height at 4 WAP (cm)	Plant height at 8 WAP (cm)	Leaves at 6 WAP (no.)	Leaves at 12 WAP (no.)	Stem diameter at 6 WAP (cm)	Stem diameter at 12 WAP (cm)
T1	12.6 ± 0.8^{c}	35.8 ± 1.9^{c}	14.0 ± 1.0^{c}	25.0 ± 1.6^{c}	0.80 ± 0.05^{c}	0.90 ± 0.06^{c}
T2	18.4 ± 1.1^{b}	45.5 ± 2.1^{b}	21.0 ± 1.3^{a}	35.0 ± 2.0^{a}	1.20 ± 0.06^{a}	1.35 ± 0.07^{a}
T3	19.1 ± 1.2^{a}	47.3 ± 2.3^{a}	20.0 ± 1.2^{a}	34.0 ± 1.8^{a}	1.10 ± 0.05^{ab}	1.28 ± 0.06^{a}
T4	17.8 ± 1.0^{b}	43.2 ± 2.0^{b}	18.0 ± 1.1^{b}	30.0 ± 1.7^{b}	1.00 ± 0.05^{b}	1.15 ± 0.06^{b}

Note: T1= Control (no fertilizer); T2= Compost applied at 10 t ha^{-1}; T3= Vermicompost applied at 10 t ha^{-1}; T4= Organic manure applied at 10 t ha^{-1}.

Means followed by the same letter within a column are not significantly different at $p \leq 0.05$ by DMRT.

At 4 weeks after planting (WAP), plants supplied with vermicompost and compost already showed greater height compared to the control. This early response suggests that organic amendments supported rapid establishment, likely through improved microbial activity and gradual nutrient release in the root zone (Gajalakshmi and Ramasamy, 2018). Similar early growth stimulation under organic fertilization has been reported in vegetable and legume crops grown under comparable conditions (Belay and Mekonnen, 2020).

As the crop progressed to 8 WAP, the differences among treatments became more pronounced. Compost and vermicompost treatments produced significantly taller plants than the control, indicating sustained nutrient availability throughout the vegetative phase. This agrees with reports by Sharma and Singh (2016) and Jeyakumar and Raman (2015), who noted that organic fertilizers support continuous growth by improving soil structure and nutrient retention.

Leaf production followed the same pattern. Plants treated with compost and vermicompost produced more leaves at both 6 and 12 WAP, reflecting enhanced photosynthetic capacity. Increased leaf number under organic nutrient management has been associated with improved nitrogen availability and overall plant vigor (Anwar and Kazi, 2016; Kumar and Singh, 2017).

Stem diameter, an important indicator of plant strength and overall health, was also significantly greater in organically fertilized plants. Compost-treated plants developed the thickest stems at both sampling periods, suggesting improved biomass accumulation and stronger structural support. Similar responses have been attributed to balanced nutrient supply and enhanced root–soil interactions under organic amendments (Batool and Saeed, 2021; Ghaly and Alhattab, 2020).

Overall, the growth data indicate that compost and vermicompost were particularly effective in promoting vigorous vegetative development of yardlong bean.

Yield performance under organic fertilizer application

The positive effects of organic fertilizers on vegetative growth were reflected in the yield performance of yardlong bean (Table 2). All organic fertilizer treatments significantly increased yield and yield components compared to the control, confirming that improved growth translated into better reproductive performance. Similar trends have been reported for yardlong bean and other legumes under organic fertilization (Cabrera and Rojas, 2015; Bokhtiar and Kafi, 2016).

Table 2. Effect of organic fertilizers on yield parameters of yardlong bean

Treatment	Pod yield per plot (kg)	Yield per plant (kg)	Pod length (cm)	Pods per plant (no.)
T1	3.20 ± 0.18[c]	0.23 ± 0.02[c]	65.20 ± 2.4[c]	5.10 ± 0.4[c]
T2	5.40 ± 0.25[a]	0.35 ± 0.03[a]	75.30 ± 2.8[a]	8.50 ± 0.6[a]
T3	5.10 ± 0.23[ab]	0.33 ± 0.03[a]	73.80 ± 2.6[a]	8.20 ± 0.5[a]
T4	4.70 ± 0.21[b]	0.30 ± 0.02[b]	71.50 ± 2.5[b]	7.40 ± 0.5[b]

Note: T1= Control (no fertilizer); T2= Compost applied at 10 t ha^{-1}; T3= Vermicompost applied at 10 t ha^{-1}; T4= Organic manure applied at 10 t ha^{-1}.

Means followed by the same letter within a column are not significantly different at $p \leq 0.05$ by DMRT.

Compost application resulted in the highest pod yield per plot and yield per plant, followed closely by vermicompost. The higher yields observed in these treatments may be attributed to sustained nutrient availability during critical stages such as flowering and pod filling. Adediran and Ojeniyi (2013) and Sharma and Singh (2016) reported comparable yield improvements in yardlong bean when organic fertilizers were used as primary nutrient sources.

Pod length, a key marketable trait of yardlong bean, was also significantly improved by organic fertilization. Compost and vermicompost produced longer pods than the control, which may be linked to improved assimilate production and translocation under better nutritional conditions (Ali & Yousaf, 2017; Zhang & Wang, 2018).

Likewise, the number of pods per plant was significantly higher in organically fertilized treatments. Increased pod number suggests improved flowering and fruit set, likely due to reduced nutrient stress and enhanced soil fertility (Jeyakumar & Raman, 2015; Singh & Saini, 2020).

These results demonstrate that compost and vermicompost not only enhanced vegetative growth but also maximized yield potential and pod quality in yardlong bean.

Changes in soil health following organic fertilizer application

In addition to improving crop performance, organic fertilizers significantly enhanced soil health parameters after harvest (Table 3). Soil organic matter content increased substantially in all organic fertilizer treatments compared to the control. Compost application resulted in the highest organic matter content, reflecting its strong contribution to soil carbon buildup. Increased soil organic matter is known to improve soil structure, moisture retention, and nutrient-holding capacity (Lal, 2021; de Souza and Silva, 2020).

Table 3. Effect of organic fertilizers on soil health parameters after harvest

Treatment	Organic matter (%)	Soil pH	Nitrogen (%)	Phosphorus (ppm)
T1	1.20 ± 0.08[c]	5.20 ± 0.10[c]	0.14 ± 0.01[c]	12.30 ± 0.9[c]
T2	3.50 ± 0.15[a]	6.20 ± 0.12[a]	0.22 ± 0.02[a]	18.50 ± 1.2[a]
T3	3.30 ± 0.14[a]	6.10 ± 0.11[a]	0.20 ± 0.02[ab]	17.20 ± 1.1[ab]
T4	3.00 ± 0.13[b]	5.80 ± 0.11[b]	0.18 ± 0.02[b]	15.60 ± 1.0[b]

Note: T1= Control (no fertilizer); T2= Compost applied at 10 t ha^{-1}; T3= Vermicompost applied at 10 t ha^{-1}; T4= Organic manure applied at 10 t ha^{-1}.

Means followed by the same letter within a column are not significantly different at $p \leq 0.05$ by DMRT.

Soil pH was also favorably influenced by organic fertilizers. While the control soil remained acidic, compost and vermicompost treatments raised soil pH toward near-neutral levels. This buffering effect improves nutrient availability and supports microbial activity, which are essential for sustainable crop production (Ghaly and Alhattab, 2020; Batool and Saeed, 2021).

Soil nutrient analysis further showed that organic fertilizers increased nitrogen and phosphorus levels after harvest. Compost-treated plots recorded the highest nutrient concentrations, followed by vermicompost and organic manure. These improvements can be attributed to the gradual mineralization of organic materials, ensuring a steady nutrient supply throughout the growing season (Hossain and Islam, 2017; Ibrahim and Ali, 2016).

Overall, the observed improvements in soil organic matter, pH, and nutrient content highlight the dual role of organic fertilizers in enhancing both crop productivity and long-term soil fertility.

CONCLUSION

This study demonstrated that the application of organic fertilizers markedly improved the growth, yield, and soil health of yardlong bean grown under the conditions of Isabela State University, Cauayan Campus. Compared with the unfertilized control, all organic fertilizer treatments enhanced vegetative development, reproductive performance, and post-harvest soil quality, confirming the effectiveness of organic nutrient management for this crop.

Among the treatments evaluated, compost and vermicompost consistently produced superior results. These treatments promoted early and sustained plant growth, as reflected in increased plant height, leaf production, and stem diameter. Improved vegetative growth under organic fertilization was subsequently translated into higher yields, longer pods, and greater numbers of pods per plant. This indicates that organic fertilizers not only support biomass accumulation but also enhance the plant's capacity to allocate assimilates efficiently toward yield formation.

Beyond crop performance, organic fertilizer application significantly improved soil health indicators. Increases in soil organic matter, moderation of soil pH, and enhanced nitrogen and phosphorus levels highlight the long-term benefits of organic amendments in restoring and maintaining soil fertility. These improvements suggest that organic fertilizers contribute to a more resilient soil system capable of sustaining productivity over successive cropping cycles.

Overall, the findings of this study support the use of compost and vermicompost as effective and sustainable nutrient sources for yardlong bean production. Their dual benefits—improving crop yield while enhancing soil quality—make them particularly suitable for environmentally sound and resource-efficient farming systems. Adoption of organic fertilizers can therefore play an important role in promoting sustainable vegetable production and improving soil health in the region.

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