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The Effect of Green Manure from Turi Plants (*Sesbania grandiflora*) on the Growth and Yield of Yardlong Bean (*Vigna sinensis L.*) Variety Guarda

Muhammad Zidan Cipta Raihan, Bakhrully Bintang Ramadhan, Achmad Faqih
Universitas Swadaya Gunung Jati, Indonesia
*zidanciptaraihan7@gmail.com, bakhrullybintang@gmail.com

Keywords

Green Manure;
Turi Plant;
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ABSTRACT ;

This research aimed to determine the effect of green manure derived from turi (Sesbania grandiflora) on the growth and yield of yardlong bean (Vigna sinensis L.) cultivar Guarda, as well as to identify the most effective application rate. The research was conducted from November to January 2026 in Cibunar, Tegal Regency, using a single-factor Randomized Complete Block Design with five levels of green manure application: 5, 10, 15, and 20 tons/ha, and 10.8 kg per plant. Each treatment was replicated five times, resulting in a total of 25 experimental units. The observed parameters (plant height, number of leaves, stem diameter, leaf area, pod weight per plant, and pod weight per plot), were analyzed using ANOVA followed by Duncan's Multiple Range Test. The results showed that turi green manure had no significant effect on plant height, number of leaves, stem diameter, and pod weight per plant at various observation times. However, a significant effect was observed on leaf width at 21 days after planting, where the application rate of 15 tons/ha produced wider leaves compared to other treatments, potentially enhancing photosynthetic efficiency. In addition, pod weight per plot differed significantly at 45 and 49 days after planting, with the control treatment (0 tons/ha) producing the highest yield at the first harvest (45 days), while the 5 tons/ha treatment showed the best result at 49 days. Overall, turi green manure provided limited benefits, with the optimal application rate ranging from 5 to 15 tons/ha depending on the growth stage and observed parameters.

INTRODUCTION

Economic growth in developing countries has changed consumption patterns, which previously prioritized energy-source foods, but have now shifted toward protein-rich products (Popkin, 2006). In Indonesia, the development of industries based on long beans, as well as the feed industry, has significantly increased the demand for long beans (Arwanto et al., 2022; Munarso et al., 2024; Rozi et al., 2022).

According to Raksun (2019) cited in Fauzan et al. (2024), long bean plants contain high nutritional value, consisting of 70.00% carbohydrates, 17.30% protein, 1.50% fat, and 12.20% water. Long beans are a good source of protein, carbohydrates, and vitamin A, especially in their young pods. They can be consumed either raw or cooked.

In addition, long bean plants have strong potential to be developed as an agricultural commodity due to their ease of cultivation and promising market demand (Pertanian et al., 2019). The increasing demand for this vegetable aligns with growing public awareness of healthy lifestyles and balanced nutrition (Chermon et al., 2024; Clemente-Suárez et al., 2024; Harris et al., 2023; Mannucci et al., 2023; Muonde et al., 2024; Silva et al., 2023). Therefore, strategic efforts are needed to increase long bean production, one of which is through the addition of nutrients derived from inorganic fertilizers.

Fertilizers can be classified into organic and inorganic types, consisting of one or more nutrients. Continuous use of inorganic fertilizers without the addition of organic fertilizers can reduce the physical, chemical, and biological quality of the soil. Excessive fertilization is not only wasteful but can also make plants more susceptible to pests and diseases, and may cause environmental pollution. Organic fertilizers can help bind primary soil particles into stable aggregates (Bali et al., 2022). To meet global food needs without damaging the soil, sustainable agriculture practices such as the use of green manure are necessary. Green manure is derived from certain plants that are deliberately cultivated to improve soil fertility and increase crop yields. One potential plant for green manure is turi (*Sesbania grandiflora*) (Hairiah & Rahayu, 2007). Turi plants are known as leguminous plants that have the ability to enrich soil nitrogen through biological nitrogen fixation. In addition, turi biomass is rich in essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K), which are crucial for plant growth. According to research by Kurniati (2020), after being incorporated into the soil, organic matter from turi undergoes decomposition, which improves soil structure, increases nutrient availability, and supports soil microbial activity.

Several previous studies have examined the use of green manure from various leguminous plants on vegetable crops. Hartatik & Widowati (2015) concluded that organic fertilizers play an important role in improving the physical, chemical, and biological fertility of soil and in increasing the efficiency of inorganic fertilizer use. Dahlianah (2014) emphasized that green manure is environmentally friendly as it does not leave harmful residues like chemical fertilizers. Specifically on long beans, Bali et al. (2022) investigated the effect of green manure on growth parameters but did not focus on turi plants. Meanwhile, Kurniati (2020) explored the potential of turi mini (*Sesbania rostrata*) in agriculture, yet that study did not specifically examine its application to yardlong bean (*Vigna sinensis* L.) nor the variety Guarda. Furthermore, most existing research has concentrated on vegetative growth parameters such as plant height and leaf number, with limited attention to yield components like pod weight per plot across multiple harvest times.

The gap in the literature lies in the absence of a comprehensive study that evaluates the dose-response relationship of turi green manure (*Sesbania grandiflora*) on both growth and yield parameters of the yardlong bean variety Guarda, particularly across different growth stages from vegetative phase to multiple harvest periods. Moreover, previous studies have rarely compared the effectiveness of various application rates (ranging from 5 to 20 tons/ha) on this specific variety under tropical highland conditions (600–800 meters above sea level). The novelty of this research lies in: (1) the use of turi (*Sesbania grandiflora*) as a green manure source specifically applied to yardlong bean variety Guarda, which has not been extensively documented; (2) the evaluation of both growth parameters (plant height, leaf number, stem diameter, leaf area) and yield parameters (pod weight per plant and per plot) across multiple harvest times (45, 47, 49, 51, and 53 days after planting); and (3) the identification of the optimal dosage range (5–15 tons/ha) based on differential responses at various growth stages, providing practical recommendations for farmers in similar agroecological conditions.

The main objective of this study is to determine whether green manure affects the growth and yield of long bean plants, as well as to identify the appropriate dosage of green manure that influences crop yield. The findings are expected to benefit farmers by providing a low-cost organic fertilizer alternative and reducing the degradation of soil nutrients.

METHOD

This study was an experimental quantitative research using a single-factor Group Random Design (RAK) design. The research was conducted from November to January 2026 in Cibunar, Tegal Regency, Central Java (600–800 meters above sea level, with daily temperatures ranging from 20°C to 30°C). The study used a Randomized Block Design (RBD) with a single factor, namely the dosage of turi green manure consisting of five levels: P0 (0 kg/plant), P1 (2.7 kg/plant), P2 (5.4 kg/plant), P3 (8.1 kg/plant), and P4 (10.8 kg/plant).

Each treatment was replicated five times, resulting in 25 experimental units. The seeds used were long bean variety Guarda obtained from a reliable source, with high germination rates, uniform size and shape, and free from pests and diseases. Green manure preparation involved chopping turi plants into small pieces (± 5–10 cm), spreading them on the field or planting holes, and allowing them to decompose naturally for 2–4 weeks until becoming humus.

Observed parameters included plant height, number of leaves, stem diameter, leaf area, pod weight per plant, and pod weight per plot. Data were analyzed using ANOVA followed by Duncan's Multiple Range Test (DMRT) using SPSS software.

RESULTS

Table 1. Average height of long bean plants at 14, 21, 28 hst

Treatment	Average Plant Height At 14 hst (cm)	Average Plant Height At 21 hst (cm)	Average Plant Height At 28 hst (cm)
P0	3.156 [a]	1.453 [a]	5.308 [a]
P1 (5 tons/ha)	2.285 [a]	1.322 [a]	4.007 [a]
P2 (10 tons/ha)	3.381 [a]	1.101 [a]	3.614 [a]
P3 (15 tons/ha)	2.809 [a]	1.584 [a]	4.358 [a]
P4 (20 tons/ha)	2.587 [a]	1.602 [a]	4.994 [a]

Source: Primary data processed, 2026

The average number followed by different letters in the same column is significantly different in the 5% DMRT test

The results of the table above explain that the treatment of giving a dose of green fertilizer is not equal to the positive treatment. Which at 14hst in the subset Sig = 0.991 (.0.05). at 21hst all treatments were in subset 1 with Sig = 0.949 and 28 hst with Sig = 0.879 which means that (>0.05) there was no significant difference.

Table 2 Average length nut stem diameter at treatment 14, 21, and 28 hst

Treatment	Average rod diameter at 14 hst (cm)	Average rod diameter at 21 hst (cm)	Average rod diameter at 28 hst (cm)
P0	0.451a	0.202 [a]	0.433 [a]

P1 (5 tons/ha)	0.302 a	0.425 a	0.46 a
P2 (10 tons/ha)	0.629 a	0.511 a	0.521 a
P3 (15 tons/ha)	0.331 a	0.399 a	0.411 a
P4 (20 tons/ha)	0.476 a	0.555 a	0.589 a

Source: Primary data processed, 2026

The average number followed by different letters in the same koom is significantly different in the DMRT test at the 5% level

As stated in the table above, green fertilizer as a whole does not have a significant effect on stem diameter at all stages

Table 3 number of long bean leaves at treatment 14,21,28 hst

Treatment	**Average rod diameter at 14 hst (cm)**	**Average rod diameter at 21 hst (cm)**	**Average rod diameter at 28 hst (cm)**
P0	0.46 a	0.805 a	1.324 a
P1 (5 tons/ha)	0.415 a	0.953 a	1.284 a
P2 (10 tons/ha)	0.583 a	0.498 a	0.415 a
P3 (15 tons/ha)	0 a	0.363 a	0.434 a
P4 (20 tons/ha)	0.456 a	0.522 a	0.953 a

Source: Primary data processed, 2026

The average number followed by different letters in the same koom is significantly different in the DMRT test at the 5% level

Post Hoc data for leaf count showed no significant difference between treatments at all plant ages, as all treatments were always in one subset and Sig .0.05 where pad 14 hst with Sig = 0.519 (>0.05), 21 hst with Sig = 0.061 (>0.05) and 28hst with Sig = 0.526 (>0.05). Although the results of the post hoc data concluded that there was no significant difference between the treatment of all plant ages on the number of leaves, there are several reasons, one of which is the overlapping between plant leaves so as to reduce the area of leaves that receive light, limited light causes the photosynthesis process to not run optimally(Widiastuti & Cahyono, 2024)

Table 4 Leaf width at treatment 14, 21, 28 hst.

Treatment	**Average rod diameter at 14 hst (cm)**	**Average rod diameter at 21 hst (cm)**	**Average rod diameter at 28 hst (cm)**
P0	0.242 a	0.02b	0.024 a
P1 (5 tons/ha)	0.185 a	0.026a	0.062 a
P2 (10 tons/ha)	0.362 a	0.018c	0.026 a
P3 (15 tons/ha)	0.15 a	0.018d	0.04 a
P4 (20 tons/ha)	0.275 a	0.009bc	0.721 a

Source: Primary data processed, 2026

The average number followed by different letters in the same column is significantly different in the 5% DMRT test

Post hoc data for leaf width showed significant differences only at 21 hst, where the treatment was divided into several subsets (indicating different homogeneous groups). The significant difference in the post hoc shows that it is 15 tons/ha wider than the others, followed by 10 tons/ha and the smallest 20 tons/ha

Table 5 Pod Weights Clumps of long beans at treatment 45, 47, 49, 51, and 53 hst.

Treatment	Average weight of Clump Pods at 45 hst	Average weight of Clump Pods at 47 hst	Average weight of Clump Pods at 49 hst	Average weight of Clump Pods at 51 hst	Average weight of Clump Pods at 53 hst
P0	6.001 [a]	7.804 [a]	0.206 [a]	0.414 [a]	0.446 [a]
P1 (5 tons/ha)	3.848 [a]	4.923 [a]	0.388 [a]	0.276 [a]	0.385 [a]
P2 (10 tons/ha)	3.389 [a]	4.828 [a]	0.468 [a]	0.265 [a]	0.239 [a]
P3 (15 tons/ha)	1.705 [a]	3.823 [a]	0.52 [a]	0.626 [a]	0.597 [a]
P4 (20 tons/ha)	2.286 [a]	3.804 [a]	0.504 [a]	0.593 [a]	0.282 [a]

Source: Primary data processed, 2026

The average number followed by different letters in the same column is significantly different in the 5% DMRT test

From the table above, we can see that the dose of green fertilizer at the age difference of long bean plants does not have a significant effect because it is in subset one.

Table 6 Pod Weights Long bean plots in treatment 45, 47, 49, 51, and 53 hst.

Treatment	Average Pod Weight of Perpetak at 45 hst	Average Pod Weight of Perpedia at 47 hst	Average Pod Weight of Perpetak at 49 hst	Average Pod Weight of Plot at 51 hst	Average Pod Weight of Perpettier at 53 hst
P0	31.82b	36.706b	1.39bc	2.806 [a]	1.646 [a]
P1 (5 tons/ha)	5.459 [a]	32.98from	1.45c	3.085 [a]	1.103 [a]
P2 (10 tons/ha)	6.87 [a]	9.99 [a]	1.782abc	1.798 [a]	1.155 [a]
P3 (15 tons/ha)	3.782 [a]	10,895from	0.817 [a]	2.783 [a]	1.782 [a]
P4 (20 ton.ha)	6.348 [a]	16.165from	2,636from	1.386 [a]	3.344 [a]

Source: Primary data processed, 2026

The average number followed by different letters in the same column is significantly different in the 5% DMRT test

We can see that in 45 hst the P0 treatment has a higher weight than the others with Sig = 0.021 (.0.05) Then in 49 hst with Sig = 0.013 (<0.05) there is a post hoc difference showing the lowest 5 tons/ha, then control, 10 tons/ha and 0 tons/ha the lowest.

CONCLUSION

Based on the results of the study, it can be concluded that the application of green fertilizer from turi plants has an effect on the growth and yield of long bean plants, but not on all parameters and stages of growth. A significant effect was observed on leaf width at 21 hst (Sig. 0.00 < 0.05) where the dose of fertilizer made the leaves wider. Pod weight per plot was at 45 hst (Sig. 0.021 < 0.05) and 49 hst (Sig. 0.013 < 0.05), where yield yield (pod weight) differed between doses. Then for the effective dose, a dose of 15 tons/ha increased leaf width in mid-growth by 21 hst, showing benefits for photosynthesis. However, for yield (pod weight), control without fertilizer is better at the beginning of the harvest at 45 hst, while 5 tons/ha is better at the end of 49 hst. Overall, green fertilizers are not always superior; The optimal dose depends on the stage and parameters, with a dose of 5-15 tons/ha showing some limited advantages. It is recommended for farmers to use a dose of 5–15 tons/ha mainly for long-term soil quality improvement, not for instant yield improvement. For future researchers, it is recommended to conduct follow-up studies with a longer decomposition time (4–6 weeks), addition of combination treatments with low-dose inorganic fertilizers, measurements of soil nutrient content before and after application, and trials on different soil types and planting seasons to obtain more comprehensive results.

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