JUATIKA

JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 7 NO. 1 January 2025

DOI :https://doi.org/10.36378/juatika.v7i1.4153
eissn 2656-1727
pissn 2684-785X
pages : 294 – 300

RESEARCH ARTICLE Open Access

# Increasing the Growth and Yield of Long Bean Plants (*Vigna sinensis* L.) Against POC and NPK Fertilizers

Anggita Ferliani Faizah[1,*], Juli Santoso[1], Fadila Suryandika[1]

**Abstract**

Fertilization is a critical aspect of long bean cultivation. Fertilizers can be applied to the soil by adding NPK fertilizer or to the leaves using liquid organic fertilizer (POC). This study aims to investigate the interaction between POC and NPK fertilizer and identify the optimal POC concentration and NPK fertilizer dosage to enhance the yield of long bean plants. The research was conducted from September 2024 to November 2024 in Perbon, Tuban District, Tuban Regency, East Java Province, at an altitude of 5 to 182 meters above sea level, a temperature of 24 ℃ - 33 ℃, humidity ± 76%, and rainfall 1100-1500 mm/year. The research method used was a randomized block design (RAK) with two factors. The first factor is the POC (P) concentration with 4 levels, namely 0 ml / L, 4 ml / L, 8 ml / L, and 12 ml / L. The second factor is the NPK (N) fertilizer dose with 3 levels:10 g/plant, 16 g/plant, and 22 g/plant. The study showed that the combination treatment of 12 ml/L POC with 10 g/plant NPK affected the number of pods, pod weight per plant, pod weight per plot, and pod weight per hectare.

**Keywords:** Concentration, Long Beans, Dosage, NPK, POC

## 1. Introduction

Long beans (*Vigna sinensis* L.) are extensively grown by farmers in Indonesia. Long beans are cultivated as a sole crop in some agricultural settings, while they are utilized as intercrops in others. Long beans are considered a significant source of vegetable protein due to their elevated protein levels. According to Amalia et al. (2024), long beans are considered a vegetable source due to their composition of carbohydrates (70%), protein (17.30%), fat (1.50%), and water (12.20%). This content contributes to the popularity of long beans among the Indonesian population.

Fertilization is a critical aspect that should be considered when cultivating plants. Fertilization is performed to fulfill the plant's requirement for nutrients. Fertilization can be done through leaves and also soil (roots). The process of fertilization via the soil can contribute to the enhancement of soil properties. When considering the chemical properties, applying fertilizer can enhance the accessibility of essential macro and micronutrients in the soil, which are beneficial for the growth and progress of plants. Simultaneously, fertilization impacts the stability of soil aggregates and water retention capacity, along with promoting increased diversity and activity of soil organisms in relation to their physical and biological properties (Murnita and Taher, 2021).

Furthermore, apart from applying fertilizer through the soil, there is also the option of administering additional fertilizer through the plant leaves. Siyal (2022) suggests that foliar fertilization can enhance nutrient absorption in plants, notably the 10% of nutrients that are typically challenging for plant roots to uptake. This method of providing fertilizer through the leaves can increase nutrient absorption to as high as 90%. Hence, it is essential to apply fertilizer to both the soil and leaves to optimize the plants' uptake of nutrients.

Adding inorganic fertilizers, such as NPK fertilizer, achieves soil fertilization. This fertilizer comprises three essential nutrients plants require, specifically nitrogen, phosphorus, and potassium. Nitrogen contributes to the production of chlorophyll, the green pigments in plant leaves. Phosphorus is involved in plants' reproductive growth, leading to pods' development in long bean plants. Potassium is significantly involved in the regulation of stomatal aperture.

Fertilization through the leaves is facilitated by

*Correspondence: ferlianianggita@gmail.com
1) Universitas Pembangunan Nasional "Veteran" Jawa Timur - Jl. Rungkut Madya, Gn. Anyar, Kec. Gn. Anyar, Surabaya, Jawa Timur 60294, Indonesia

applying liquid organic fertilizer (POC), a type of organic fertilizer derived from the decomposition of organic materials, such as plant waste animal and human waste. The function of POC as a stimulant in promoting growth is particularly pronounced during the germination stage or the transition from the vegetative to the generative phase, thereby enhancing the development of fruits and seeds (Sitanggang et al., 2022). The application of POC, which has been dissolved in water, is achieved by spraying leaves, facilitating absorption through the stomata.

A study by Kustiawan et al. (2024) on caisim plants revealed that applying 75% POC and 4.5 g NPK resulted in significant interactions on all observed variables. Furthermore, research on legume plants has been conducted by Ariani (2025) on green bean plants using rabbit urine POC and NPK. However, this study did not demonstrate a significant effect on the growth and yield of green beans. Consequently, this study was conducted using different types of POC to obtain interactions between POC and NPK and find the right POC concentration and NPK fertilizer dose to increase the yield of long bean plants.

## 2. Material and Methods

Research will be conducted from September 2024 to November 2024 in Perbon, Tuban District, Tuban Regency, East Java. Located at coordinates 6 °53' 11" S, 112 °2' 3" E and 7 meters above sea level. The tools used include mulch, hoe, stake, rope, a watering can, a sprayer, scissors, a measuring cup, a meter, scales, stationery, and a camera. The materials used include: Pangeran Anvi variety long bean seeds, manure, GDM POC, NPK pearl fertilizer (16-16-16), insecticide, and fungicide.

This study is a factorial experiment of two factors arranged using a Randomized Block Design (RAK). The first factor is the concentration of liquid organic fertilizer GDM (P) consisting of 4 treatment levels, namely 0 ml/L, 4 ml/L, 8 ml/L, and 12 ml/L. The second factor is the NPK fertilizer (N) dose with 3 levels, namely 10 g/plant, 16 g/plant, and 22 g/plant P 3 = 12 ml/L. The implementation of the research carried out includes:

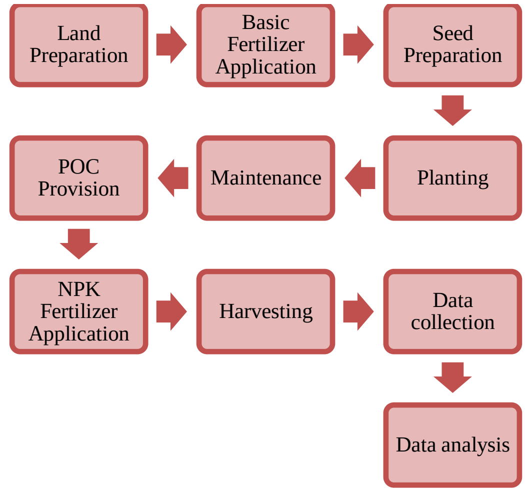


**Figure 1.** Research flowchart

Observation parameters in this study are plant length, number of leaves, age of flower emergence, number of pods per harvest, pod length, number of seeds per pod, weight per pod, pod weight per plant, pod weight per plot, pod weight per ha, fruit set. The obtained data was then analyzed using Microsoft Excel software in 2016 as a variance analysis or F test at the 5% and 1% levels. If the F test has a real and very real effect, then it is continued with the Least Significant Difference test at the 5% level, carried out using Excel in 2016.

## 3. Results and Discussion

### 3.1. Plant Length

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses on plant length showed no significant interaction at all observation ages. However, the single effect of NPK fertilizer dose had a significant impact on the length of long bean plants at 35 HST, while the single treatment of POC concentration was not significantly different at all observation ages. The average value of plant length due to the administration of POC concentration and NPK fertilizer dose is presented in Table 1.

**Table 1.** Average Length of Long Bean Plants Due to Combination of POC Concentration Treatment and NPK Fertilizer Dose Age 14 HST - 35 HST

| Treatment | Plant Length (cm) | | | |
|---|---|---|---|---|
| | HST | | | |
| | 14 | 21 | 28 | 35 |
| POC Concentration (P) | | | | |
| 0 ml/L (P0) | 25.7 ±0.72 | 77.2 ±3.68 | 123.7 ±4.43 | 202.9 ±6.05 |
| 4 ml/L (P1) | 24.4 ±0.75 | 84.9 ±4.13 | 139.4 ±5.33 | 213.5 ±5.77 |
| 8 ml/L (P2) | 25.1 ±0.51 | 85.2 ±4.90 | 146.2 ±7.20 | 204.9 ±8.98 |
| 12 ml/L (P3) | 26.9 ±0.55 | 87.2 ±5.89 | 134.5 ±6.80 | 198.9 ±9.29 |
| BNT 5% | tn | tn | tn | tn |
| NPK Fertilizer Dosage (N) | | | | |
| 10 g/tnm (N1) | 25.2 ±0.56 | 91.6 ±4.31 | 140.5 ±5.02 | 216.7 ± 5.28 c |
| 16 g/tnm (N2) | 25.8 ±0.63 | 78.8 ±3.97 | 134.0 ±6.05 | 191.7 ±6.54 a |
| 22 g/tnm (N3) | 25.6 ±0.62 | 80.4 ±3.10 | 133.4 ±5.78 | 206.7 ±6.12 b |
| BNT 5% | tn | tn | tn | 4.74 |

Description: Numbers followed by the same letter in the same column of each treatment show no significant difference in the 5% BNT test; tn = not significant.

The 5% BNT further test showed that the best length of long bean plants was found in the 10 g/plant treatment at 35 HST. The administration of 10 g/plant NPK fertilizer gave an average plant length of 216.72 cm, significantly different from the administration of a dose of 16 g/plant (191.67 cm) and a dose of 22 g/plant (206.72). The administration of NPK fertilizer with a dose of 10 g/plant was considered well absorbed by plant roots compared to other doses. The Nitrogen content in NPK fertilizer plays an essential role in forming chlorophyll in leaves, affecting plant growth. Nitrogen is a component of many compounds, such as amino acids needed in the formation or development of vegetative parts such as stems or, in this case, the length of the plant (Purwanto et al., 2019).

### 3.2. Number of Leaves

The results of the variance analysis of the combination of POC concentration and NPK fertilizer dosage treatments on the number of leaves showed no significant interaction at all observation ages. However, the single effect of NPK fertilizer dosage had a significant impact on the number of leaves at 21 HST, while the single treatment of POC concentration did not differ significantly at all observation ages. The average value of the number of long bean leaves due to the administration of POC concentration, and NPK fertilizer dosage is presented in Table 2.

**Table 2.** Average Number of Leaves of Long Bean Plants Due to Combination of POC Concentration Treatment and NPK Fertilizer Dose Age 14 HST - 35 HST

| Treatment | Number of Leaves (Shells) | | | |
|---|---|---|---|---|
| | HST | | | |
| | 14 | 21 | 28 | 35 |
| POC Concentration (P) | | | | |
| 0 ml/L (P0) | 6.56 ±0.44 | 15.04 ±1.10 | 21.37 ±1.13 | 32.22 ±2.05 |
| 4 ml/L (P1) | 6.26 ±0.32 | 15.78 ±0.54 | 23.59 ±0.83 | 30.85 ±0.99 |
| 8 ml/L (P2) | 6.33 ±0.29 | 15.70 ±0.98 | 23.85 ±0.66 | 33.19 ±1.11 |
| 12 ml/L (P3) | 6.70 ±0.48 | 17.44 ±1.26 | 25.30 ±1.70 | 36.56 ±2.29 |
| BNT 5% | tn | tn | tn | tn |
| NPK Fertilizer Dosage (N) | | | | |
| 10 g/plant (N1) | 6.33 ±0.33 | 16.47 ± 0.63 b | 23.42 ±0.75 | 32.45 ±1.12 |
| 16 g/plant (N2) | 6.69 ±0.36 | 14.00 ± 0.67 a | 21.97 ±0.95 | 32.17 ±1.54 |
| 22 g/plant (N3) | 6.36 ±0.32 | 17.50 ±0.99 c | 25.19 ±1.21 | 35.00 ±1.87 |
| BNT 5% | tn | 0.49 | tn | tn |

Description: Numbers followed by the same letter in the same column of each treatment show no significant difference in the 5% BNT test; tn = not significant.

Further test results on the number of leaves at 21 HST, giving a dose of NPK fertilizer of 22 g/plant, showed an average leaf yield of 17.50 pieces. These results significantly differed from the administration of NPK fertilizer with a dose of 10 g/plant (16.47 pieces) and a dose of 16 g/plant (14.00 pieces). The NPK treatment with the highest dose of 22 g/plant gave the best results on the number of leaves. The availability of nutrients such as nitrogen and phosphate greatly influences leaf formation. Nitrogen and phosphate nutrients absorbed by the roots will be distributed to all plant organs, such as the apical shoot part, which will later be used to form new leaves (Andriansyah et al., 2024). Perfect plant leaves will carry out photosynthesis activities well and then produce photosynthate that can be translocated through the vascular tissue (phloem) to all parts of the plant body, such as the roots, stems, leaves, flowers and fruit (Chairiyah, 2022).

### 3.3. Age of Appearance of Flowers and Fruit Set

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses showed no significant interaction between the age of flower emergence and fruit set of long bean plants. The single factors of POC concentration and NPK fertilizer dose did not significantly affect the age of flower emergence. However, it significantly affected the fruit set. The average value of the age of flower emergence and fruit set of long bean plants due to the administration of POC concentration and NPK fertilizer dose is presented in Table 3.

A single application of POC affects the fruit set. Further tests on the parameter of fruit weight per plant in week 1 show that the best POC concentration is 12 ml/L with an average weight of 98.00 g. These results are significantly different from all POC concentrations, namely 0 ml/L (55.67 g), 4 ml/L (70.78 g), 8 ml/L (68.56 g). Further tests on the fruit set parameter show that the POC concentration of 12 ml/L gives the best results, with an average fruit set of 83%. These results are significantly different from all POC concentrations, namely 0 ml/L (67%), 4 ml/L (72%), 8 ml/L (75%).

The increase in the concentration of POC given gave positive results on the fruit set of long bean plants. The higher the concentration of POC given, the higher the fruit set of the plant. This is thought to be due to micronutrients in GDM POC. These micronutrients include Fe, Mn, Cu, Zn, B, Co, and Mo, which increase the fruit set of long beans. Zn, B, and Mo are essential micronutrients that can increase flowering and fruit formation. In addition, Fe and Cu also play a role in the photosynthesis system. Fe is part of certain enzymes and proteins that carry electrons in photosynthesis and respiration. At the same time, Cu is a chlorophyll-forming material that helps in the photosynthesis electron transport system (Sutiyoso, 2006).

**Table 3.** Average Age of Flower and Fruit Set in Long Bean Plants Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments

| Treatment | Flowering Age (days) | *Fruit Set* (%) |
|---|---|---|
| POC Concentration (P) | | |
| 0 ml/L (P0) | 33.67 ±0.43 | 67 ±3.88 a |
| 4 ml/L (P1) | 33.19 ±0.40 | 72 ±2.93 b |
| 8 ml/L (P2) | 33.18 ±0.71 | 75 ±3.51 b |
| 12 ml/L (P3) | 32.56 ±0.58 | 83 ±2.78 c |
| BNT 5% | tn | 0.03 |
| NPK Fertilizer Dosage (N) | | |
| 10 g/plant (N1) | 33.39 ±0.56 | 80 ±2.45 b |
| 16 g/plant (N2) | 33.03 ±0.39 | 71 ±3.68 a |
| 22 g/plant (N3) | 33.03 ±0.46 | 72 ±3.18 a |
| BNT 5% | tn | 0.02 |

Description: Numbers followed by the same letter in the same column of each treatment show no significant difference in the 5% BNT test; tn = not significant.

The 5% BNT further test on the fruit set parameter showed that the best dose of NPK fertilizer was 10 g/plant with an average fruit set of 80%. These results significantly differed from the doses of 16 g/plant (71%) and 22 g/plant (72%). Based on the research that has been conducted, increasing the dose of NPK fertilizer does not affect the productivity of long bean plants. This is thought to be because giving fertilizer with a high dose makes the fertilizer solution more concentrated, making it more difficult for plant roots to absorb. This is in line with the opinion of Nuryani et al. (2019), who states that high doses of fertilizer can cause poisoning in plants, so yields no longer increase. NPK nutrients are essential nutrients plants need to fulfill the physiological and metabolic processes. In this generative phase, plants require phosphorus and potassium elements, which are more dominant than N elements. Plants need phosphorus during seed formation to become perfect shapes, accelerate fruit ripening, and resist drought (Nursayuti. 2021). Plants use potassium to increase carbohydrate synthesis and translocation so that the thickness of the cell wall is formed quickly and strengthens the plant stalk (Sudartik and Thamrin. 2019).

### 3.4. Number of Pods

The results of the analysis of variance on the combination of POC concentration and NPK fertilizer doses on the number of pods during 3 weeks of harvesting showed a significant interaction. The single effect of POC concentration and NPK fertilizer dose significantly affected the number of pods. The average value of the number of pods due to the administration of POC concentration and NPK fertilizer dose is presented in Table 4.

**Table 4.** Average Number of Long Bean Pods Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments at Week 1 to 3 of Harvest

| POC Concentration (ml/L) | Number of Pods | | |
|---|---|---|---|
| | NPK Fertilizer Dosage (g/plant) | | |
| | 10 (N1) | 16 (N2) | 22 (N3) |
| without POC (P0) | 24 ±7.94 df | 23.67 ± 7.62 d | 15.00 ±4.73 a |
| 4 (P1) | 22.67 ±7.06 cd | 19.33 ±6.17 bc | 16.33 ±5.04 ab |
| 8 (P2) | 25.33 ± 7.69 df | 17.00 ±5.29 ab | 30.00 ± 9.45 g |
| 12 (P3) | 36.33 ±12.03 h | 27.67 ±8.57 fg | 35.67 ± 11.41 h |
| BNT 5% | | 3.99 | |

Description: Numbers followed by the same letter in the combination treatment show no significant difference in the 5% BNT test.

The combination of 12 ml/L POC concentration treatment + 10 g/plant NPK fertilizer dose (P3N1) gave the best results in the number of pods per plant, which was 36.33 pieces. Based on the 5% BNT further test, the number of pods in the 12 ml/L POC concentration treatment + 10 g/plant NPK fertilizer dose (P3N1) was significantly different from all treatment combinations except the 12 ml/L POC concentration treatment + 22 g/plant NPK fertilizer dose (P3N3).

### 3.5. Pod Length and Number of Seeds

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses showed no significant interaction with pod length and number of seeds—long bean plants. The single factors of POC concentration and NPK fertilizer dose also did not significantly affect the length of pods and the number of seeds of long bean plants. The average values of pod length and number of long bean seeds due to the administration of POC concentration and NPK fertilizer dose are presented in Table 5.

**Table 5.** Average Pod Length and Number of Seeds of Long Bean Plants Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments

| Treatment | Pod Length (cm) | Number of Seeds (fruit) |
|---|---|---|
| POC Concentration (P) | | |
| 0 ml/L (P0) | 56.86 ±1.65 | 17.00 ±0.70 |
| 4 ml/L (P1) | 56.90 ±1.40 | 17.77 ±0.49 |
| 8 ml/L (P2) | 58.23 ±1.56 | 17.08 ±0.63 |
| 12 ml/L (P3) | 57.54 ±1.10 | 17.20 ±0.36 |
| BNT 5% | tn | tn |
| NPK Fertilizer Dosage (N) | | |
| 10 g/plant (N1) | 56.12 ±1.24 | 17.68 ±0.43 |
| 16 g/plant (N2) | 57.29 ±1.44 | 17.21 ±0.52 |
| 22 g/plant (N3) | 58.74 ±0.85 | 16.89 ±0.46 |
| BNT 5% | tn | tn |

Note: tn = not real

### 3.6. Pod Weight

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses on pod weight per pod did not provide a significant correlation. The single effect of POC concentration and NPK dose did not significantly affect pod weight per pod. The average value of pod weight due to the administration of POC concentration and NPK fertilizer dose is presented in Table 6.

**Table 6.** Average Weight per Long Bean Plant Pollen Due to Combination of POC Concentration and NPK Fertilizer Dose Treatments

| Treatment | Weight per Pod (g) |
|---|---|
| POC Concentration (P) | |
| 0 ml/L (P0) | 17.59 ±0.49 |
| 4 ml/L (P1) | 17.03 ±0.30 |
| 8 ml/L (P2) | 16.68 ±0.22 |
| 12 ml/L (P3) | 17.39 ±0.62 |
| BNT 5% | tn |
| NPK Fertilizer Dosage (N) | |
| 10 g/plant (N1) | 16.95 ±0.34 |
| 16 g/plant (N2) | 17.52 ±0.44 |
| 22 g/plant (N3) | 17.05 ±0.36 |
| BNT 5% | tn |

Note: tn = not real

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses on pod weight per plant showed a significant interaction with pod weight per plant. The single effect of POC concentration had a significant effect on pod weight per plant, while the single effect of NPK fertilizer dose had no significant impact on pod weight per plant. The average value of pod weight per plant due to the administration of POC concentration and NPK fertilizer dose is presented in Table 7.

**Table 7.** Average Weight of Pods per Long Bean Plant Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments

| POC Concentration (ml/L) | Weight per plant | | |
|---|---|---|---|
| | NPK Fertilizer Dosage (g/plant) | | |
| | 10 (N1) | 16 (N2) | 22 (N3) |
| without POC (P0) | 225 ±21.00 cde | 177.67 ± 17.74 abc | 164.33 ±14.17 ab |
| 4 (P1) | 213.3 3 ±1.20 bdc | 259.33 ±79.11 def | 205.67 ± 21.67 bcd |
| 8 (P2) | 231 ±25.40 cde | 143.67 ± 3.18 a | 273.67 ±3.38 ef |
| 12 (P3) | 351.33 ±36.37 g | 290.33 ± 53.49 f | 208 ±34.04 bcd |
| BNT 5% | | 55.13 | |

Description: Numbers followed by the same letter in the combination treatment show no significant difference in the 5% BNT test.

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses on pod weight per plot showed a significant interaction on pod weight per plot. The single effect of POC concentration had a significant effect on pod weight per plot, while the single effect of NPK fertilizer dose had no significant impact on pod weight per plot. The average value of pod weight per plot due to the administration of POC concentration and NPK fertilizer dose is presented in Table 8.

**Table 8.** Average Weight of Pods per Plot of Long Bean Plants Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments

| POC concentration (ml/L) | Weight per Plot | | |
|---|---|---|---|
| | NPK Fertilizer Dosage (g/plant) | | |
| | 10 (N1) | 16 (N2) | 22 (N3) |
| without POC (P0) | 3.38 ±0.32 cde | 2.67 ±0.26 abc | 2.47 ±0.21 ab |
| 4 (P1) | 3.20 ±0.02 bcd | 3.89 ±1.19 def | 3.09 ±0.32 bcd |
| 8 (P2) | 3.47 ±0.38 cde | 2.16 ± 0.05 a | 4.11 ± 0.05 ef |
| 12 (P3) | 5.27 ±0.55 g | 4.36 ±0.80 f | 3.12 ±0.51 bcd |
| BNT 5% | | 0.83 | |

Description: Numbers followed by the same letter in the combination treatment show no significant difference in the 5% BNT test.

The results of the variance analysis of the combination of POC concentration and NPK fertilizer doses on pod weight per hectare demonstrated a significant interaction with pod weight per hectare. However, the single effect of POC concentration did not significantly affect pod weight per hectare. In contrast, the single effect of NPK fertilizer dose significantly impacted pod weight per hectare. The mean value of pod weight per hectare resulting from the administration of POC concentration and NPK fertilizer dose is delineated in Table 9.

**Table 9.** Average Weight of Pods per Hectare of Long Bean Plants Due to Combination of POC Concentration and NPK Fertilizer Dosage Treatments

| POC Const (ml/L) | Pod Weight per Ha | | |
|---|---|---|---|
| | NPK Fertilizer Dosage (g/plant) | | |
| | 10 (N1) | 16 (N2) | 22 (N3) |
| without POC (P0) | 6.75 ±0.63 bcde | 5.33 ±0.53 abcd | 4.93 ±0.43 ab |
| 4 (P1) | 6.40 ±0.04 bcd | 7.78 ± 2.37 bcdef | 6.17 ±0.65 abcd |
| 8 (P2) | 6.93 ±0.76 bcde | 4.31 ±0.10 a | 8.21 ± 0.10 ef |
| 12 (P3) | 10.54 ±1.09 g | 8.71 ± 1.60 f | 6.24 ± 1.02 abcd |
| BNT 5% | | 1.65 | |

Description: Numbers followed by the same letter in the combination treatment show no significant difference in the 5% BNT test.

The combination of POC concentration treatment of 12 ml/L + NPK fertilizer dose of 10 g/plant (P3N1) gave the best results in pod weight per plant, which was 351.33 g, pod weight per plot, which was 5.27 kg, and pod weight per ha, which was 10.54 tons. Based on the further test of BNT 5%, pod weight per plant, pod weight per plot, and pod weight per ha significantly differed with all treatments. The harvest yield per plant affects the harvest yield per plot and harvest yield per ha.

The concentration of POC 12 ml/L is thought to increase the nutrient content that affects the production of long bean plants. The treatment of POC with the highest concentration can provide the highest results, allegedly due to an increase in the content of P and K and several other microelements that affect the process of photosynthesis and carbohydrate metabolism. Increasing the rate of photosynthesis can also increase the formation of flowers and fruits (Tanari and Jayanti. 2024).

The interaction between the treatment of POC concentration and NPK fertilizer dose has been demonstrated to occur exclusively in generative parameters, specifically following the onset of the flowering period or during the plant's developmental phase. The provision of POC, in conjunction with NPK fertilizer, has been hypothesized to contribute to an increase in pods directly proportional to the observed increase in plant weight.

**Figure 2.** Long bean plant harvest results for each treatment

Furthermore, the provision of POC has been shown to enhance the supply of macro elements, such as P and K, which play a crucial role in flowering and fruit ripening. POC is also a source of micronutrients such as Fe, Mn, and Cu, which facilitate the formation of chlorophyll, support photosynthesis, and contribute to plant respiration. Efficient photosynthesis increases photosynthate production in biomass, including roots, stems, and leaves (Utami et al., 2020). The application of POC through leaves can enhance plants' nutrient absorption. The provision of liquid fertilizer through leaves is more effective due to plants' enhanced absorption of macro and micronutrients, stimulating growth and increasing leaf metabolic efficiency (Masniawati et al., 2022).

POC and NPK fertilizer dosages can support the demand for macro and micronutrients, which play a role in developing long bean plants. It is imperative to note that providing fertilizers that align with the plant's nutritional requirements will yield optimal results. At the same time, an excess of nutrients will invariably lead to a decline in overall yield.

## 4. Conclusion

The findings of the research indicate that the implementation of the following treatment yielded notable outcomes:

1. The integration of POC 12 ml/L with NPK 10 g/plant exerted a significant influence on the number of pods per plant (36.33 fruits), the pod weight per plant (351.33 g), the pod weight per plot (5.27 kg), and the pod weight per hectare (10.54 tons).
2. A single treatment of 12 ml/L POC affected plant fruit set (83%).
3. Single treatment of NPK 10 g/plant affected the length of plants aged 35 HST (216.72 cm) and fruit set (80%). Meanwhile, the dose of 22 g/plant affected the number of leaves aged 21 HST (17.50 fruits).

**References**


Andriansyah, H., Suheri, I. K., & Ngawit. (2024). Pengaruh dosis pupuk NPK Plus dan Biosaka terhadap pertumbuhan dan hasil tanaman cabai rawit (*Capsicum frutescens* L.). *Jurnal Ilmiah Mahasiswa AGROKOMPLEK, 3*(3), 258-267. https://doi.org/10.29303/jima.v3i3.5717

Ariani, E. N., Lubis, G., Gusmawartati, S., Yoseva, I., Irfandri, & Hanum, M. (2025). The effect of rabbit urine LOF and NPK fertilizer on green bean plants (*Vigna radiata* L.). *JUATIKA: Jurnal Agronomi Tanaman Tropika, 6*(1), 101-115. https://doi.org/10.36378/juatika.v7i1.3901

Chairiyah, N., Murtilaksono, A., Adiwena, M., & Fratama, R. (2022). Pengaruh dosis pupuk NPK terhadap pertumbuhan vegetatif tanaman cabai rawit (*Capsicum frutescens* L.) di tanah marginal. *Jurnal Ilmiah Respati, 13*(1), 1-8. https://doi.org/10.52643/jir.v13i1.2197

Kustiawan, N., Maizar, M., Salman, S., & Riswandi. (2024). Application of rice washing water and organic NPK to increase caisim mustard plant (*Brassica juncea* L.) growth and production. *JUATIKA: Jurnal Agronomi Tanaman Tropika, 6*(1), 101-115. https://doi.org/10.36378/juatika.v6i1.3400

Masniawati, A., Fahruddin, & Annisa, S. (2022). Pemanfaatan limbah daun bawang merah (*Allium ascalonicum* L.) sebagai pupuk organik cair (POC) dengan penambahan limbah tomat dan EM4. *Jurnal Ilmu Alam dan Lingkungan, 13*(2), 63-69. https://journal.unhas.ac.id/index.php/jai2

Mulianti, S., Amalia, A. P., Djarwatiningsih, & Retno Moeljani, I. R. (2024). Pengaruh pupuk bokashi kotoran sapi dan dosis pupuk NPK terhadap pertumbuhan dan hasil tanaman kacang panjang (*Vigna sinensis* L.). *RADIKULA: Jurnal Ilmu Pertanian, 3*(1), 16–27. https://doi.org/10.33379/radikula.v3i01.4724

Murnita, & Taher, Y. A. (2021). Dampak pupuk organik dan anorganik terhadap perubahan sifat kimia tanah dan produksi tanaman padi (*Oryza sativa* L.). *Menara Ilmu, 17*(2), 67-76. https://doi.org/10.31869/mi.v15i2.2314

Nursayuti. (2021). Pengaruh aplikasi Triple Super Phosphate (TSP) dalam meningkatkan produksi tanaman kacang panjang (*Vigna sinensis* L.). *Agrosamudra, 8*(1), 18-33. https://doi.org/10.33059/jupas.v8i1.3460

Nuryani, E., Haryono, G., & Historiawati. (2019). Pengaruh dosis dan saat pemberian pupuk P terhadap hasil tanaman buncis (*Phaseolus vulgaris* L.) tipe tegak. *VIGOR: Jurnal Ilmu Pertanian Tropika dan Subtropika, 4*(1), 14-17. https://doi.org/10.31002/vigor.v4i1.1307

Purwanto, I., Hasnelly, & Subagiono. (2019). Pengaruh pemberian pupuk NPK terhadap pertumbuhan dan hasil kacang panjang (*Vigna sinensis* L.). *Jurnal Sains Agro, 4*(1), 1-9. https://doi.org/10.36355/jsa.v4i1.246

Sitanggang, Y., Sitinjak, E. M., Marbun, N. V. M. D., Gideon, S., Sitorus, F., & Hikmawan, O. (2022). Pembuatan pupuk organik cair (POC) berbahan baku limbah sayuran/buah di Lingkungan I, Kelurahan Namo Gajah Kecamatan Medan Tuntungan, Medan. *Jurnal Pengabdian Ilmiah dan Teknologi, 1*(17), 14-20. Retrieved from https://akses.ptki.ac.id/jurnal/index.php/apitek/article/view/25

Siyal, L., Ayaz, A., Hossain, A., Siyal, F. K., Jatt, T., & Iram, S. (2022). Use of radioisotopes to produce high-yielding crops in order to increase agricultural production. *Chemistry Proceedings, 10*(86), 1-11. https://doi.org/10.3390/IOCAG2022-12267

Sudartik, E., & Thamrin, N. T. (2019). Penggunaan jarak tanam dan aplikasi dosis pupuk kandang sapi terhadap pertumbuhan dan hasil tanaman kacang panjang (*Vigna sinensis* L.). *Jurnal Pertanian Berkelanjutan, 7*(2), 163-171. Retrieved from https://core.ac.uk/download/pdf/267087422.pdf

Sutiyoso, Y. (2006). *Hidroponik ala Yos*. Penebar Swadaya.

Tanari, Y., & Jayanti, K. D. (2024). Respon tomat (*Solanum lycopersicum* L.) terhadap aplikasi pupuk organik cair rebung bambu. *Jurnal Bioindustri, 6*(2), 16-23. https://doi.org/10.31326/jbio.v6i2.1952

Utami, W. R., Barunawati, N., & Sitompul, S. M. (2020). Pengaruh pupuk kandang dan nitrogen terhadap pertumbuhan dan hasil kedelai (*Glycine max* [L.] Merr.). *Jurnal Produksi Tanaman, 8*(1), 172-181. Retrieved from https://protan.studentjournal.ub.ac.id/index.php/protan/article/view/1334/1351