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# The Effect of Rabbit Urine LOF and NPK Fertilizer on Green Bean Plants (*Vigna radiata* L.)

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**Abstract**

Green bean plants (*Vigna radiata* L.) are a staple food crop in Indonesia and are commonly consumed as legume food crops. Based on the Directorate General of Food Crops findings, there has been a decrease in the yield of green bean crops in Riau Province; therefore, measures must be taken to enhance productivity—green bean plant cultivation in the Riau Province. One potential method for improving the productivity of green bean plants involves the application of fertilizers. This study aimed to evaluate the impact of the interaction between liquid organic fertilizer rabbit urine and NPK fertilizer, as well as the individual effects of liquid organic fertilizer rabbit urine and NPK fertilizer, on the growth and yield of green bean plants (*Vigna radiata* L.) to determine the optimal treatment combination. The findings indicated no statistically significant impact on the development and production of green bean plants due to the combined application of rabbit urine LOF and NPK. The Rabbit urine Point of Concern (LOF) factor substantially impacts plant growth, including height, the abundance of productive branches, the number of full pods, and the weight of dry seeds per plot. The NPK fertilizer factor significantly influences various aspects of plant growth and productivity, including plant height, leaf count, root nodules effectiveness, branch productivity, pod yield, and seed weight per plot. The optimum treatment combination of 200 ml.l$^{-1}$ rabbit urine LOF and 300 kg.ha$^{-1}$ NPK fertilizer has been found to enhance green bean plants' growth and yield significantly.

**Keywords:** Green Bean Plants, NPK Fertilizer, Rabbit Urine LOF

## 1. Introduction

Mung bean plants (*Vigna radiata* L.) are a significant food source for the Indonesian population and are classified as leguminous crops. According to the Directorate General of Food Crops (2020), the production of mung beans in Riau Province was recorded at 322 tons in 2018, cultivated over an area of 334 hectares, resulting in a productivity rate of 0.96 tons per hectare. However, in 2019, there was a notable decline in production by 140 tons, with the cultivation area reduced to 245 hectares and the productivity rate dropping to 0.57 tons per hectare. These figures indicate a concerning trend in the productivity of mung bean cultivation in Riau Province. To enhance mung bean plants' productivity, applying fertilizers is recommended.

Fertilizers can be categorized as organic or inorganic, with liquid organic fertilizers derived from various organic materials, including animal waste. Among these, rabbit urine has been identified as a promising source for increasing mung bean productivity (Zulfa et al., 2023). Analysis conducted by Nuraini (2020) revealed that rabbit urine contains 4.24% nitrogen, 2.92% phosphorus, and 1.42% potassium. This finding aligns with multiple studies indicating that rabbit urine is rich in essential nutrients, particularly nitrogen, phosphorus, and calcium, crucial for optimal plant growth.

Budi (2022) asserts that the judicious selection of liquid organic fertilizers (LOF) and compost as a planting medium can enhance soil fertility, improve soil structure, and elevate produce quality. The utilization of organic fertilizers necessitates the concurrent provision of inorganic fertilizers, owing to the limited availability of essential nutrients inherent to organic fertilizers. Inorganic fertilizers with complete nutrient content, such as NPK fertilizers, are necessary for achieving optimal nutrient levels in the soil. The findings of Cahyanto et al. (2022) demonstrate that the

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application of a blend comprising 90 ml*l$^{-1}$ rabbit urine LOF and 250 kg ha-1 NPK exerts a significant influence on the characteristics of bean plants (Phaseolus vulgaris L.) cultivated in low-lying regions. This blend impacts the plant's stature, the quantity of leaves, leaf area, the number of pods, the length of the pods, the total yield per plant, the yield per plot, and the yield per hectare.

The study conducted by Ramadhan et al. (2022) examined the impact of applying NPK Mutiara fertilizer (16:16:16) at a dosage of 350 kg*ha$^{-1}$ on the growth of green bean plants, revealing notable enhancements in plant height, the number of primary branches, and pod count per plant. In contrast to previous studies, this investigation seeks to analyze the interaction between liquid organic fertilizer derived from rabbit urine and NPK fertilizer concerning the growth and yield of green bean plants.

The study employs a synergistic approach by integrating organic and inorganic fertilizers to promote the growth and productivity of green bean crops. It underscores the significance of appropriate fertilization practices in boosting green bean yields and explores the potential of rabbit urine as a viable organic fertilizer source. Although rabbit urine LOF is recognized as a fundamental component of organic fertilizers, its application in agricultural practices remains relatively underexplored.

## 2. Material and Methods

This study was conducted at the Experimental Garden of the Faculty of Agriculture, University of Riau, Binawidya Campus, located at Kilometer 12.5, Simpang Baru Village, Binawidya District, Pekanbaru. The following coordinates specify the geographical location of the experimental garden: 0.510574° N latitude and 101.455422° E longitude. The materials utilized in this study activity were green bean seeds of the Vima 1 variety. The following materials were used: LOF rabbit urine, NPK fertilizer 16:16:16, chicken manure, water, Furadan 3G, Dithane M-45, and Decis 25 EC. The following instruments were utilized in this study: hoes, machetes, stakes, label paper, wood, meters, watering cans, buckets, raffia rope, digital scales, measuring cups, stationery, and documentation tools.

This study examined two treatment factors to assess the impact of fertilization on plant growth—the first factor involved rabbit urine LOF, which was tested at four levels. The initial level was a control with no fertilizer applied, quantified as 0 per plot. The subsequent levels included a fertilizer application of 100 ml*l$^{-1}$, 200 ml*l$^{-1}$, and 300 ml*l$^{-1}$ per plot. The second factor is related to the application of NPK, which was evaluated at three levels: the first at a dosage of 150 kg*ha$^{-1}$, the second at 250 kg*ha$^{-1}$, and the third at 350 kg*ha$^{-1}$. The objective of combining these two factors was to elucidate how variations in the application of rabbit urine LOF and NPK influence the growth and yield of the studied plants. The analysis of variance results was further examined using the Multiple Range Test at a significance level of 5%. Data from variance analysis and subsequent tests were processed using the statistical analysis system (SAS) version 9.1. The methodological approach for observing the parameters included several critical components. Observations focused on plant growth metrics, such as measuring plant height in centimeters (cm) at designated time intervals, counting the number of leaves per plant, and assessing effective root nodules as a percentage. Additionally, the flowering age was recorded days after planting (DAP), along with the measurement of productive branches and harvest age, which were also expressed in DAP.

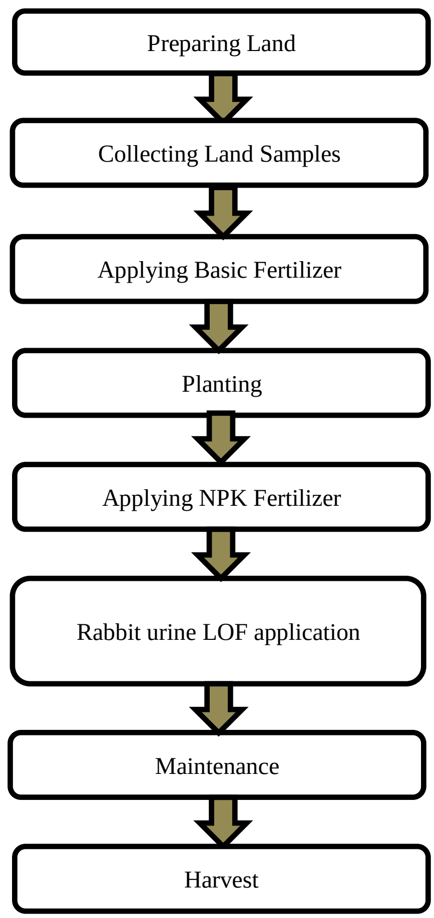


**Figure 1.** Research flow diagram

Next, the production parameters observed included the number of full pods per plant, the percentage of full pods, the weight of 100 seeds measured in grams (g), and the dry weight of seeds per plot, which was also expressed in grams (g). Data from all these parameters were then tested using analysis of variance (ANOVA) to determine whether there were significant differences between treatments. If there were significant differences, further testing was carried out using the multiple range test at the 5% level to identify which treatments were significantly different. With this approach, the study can provide a clearer picture of the effectiveness of the combination of liquid organic fertilizer from rabbit urine and NPK fertilizer in increasing the growth and yield of green bean plants.

## 3. Results and Discussion

### 3.1. Plant Height

The analysis of variance showed that the interaction of rabbit urine LOF and NPK fertilizer had no significant effect. In contrast, the rabbit urine LOF factor and the NPK fertilizer factor significantly affected the height of green bean plants. Subsequent test results, employing Duncan's multiple range test at the 5% level, are presented in Table 1.

**Table 1.** Height plant green beans (cm) given rabbit urine LOF And NPK fertilizer

| LOF Rabbit Urine (ml*l⁻ ¹) | NPK (kg*ha⁻ ¹) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 46.98 ± 0.73 c | 47.62 ± 0.83 c | 48.92 ± 0.71 abc | 47.84 ± 0.47 b |
| 100 | 47.06 ± 0.41 c | 48.76 ± 1.50 bc | 49.59 ± 0.51 abc | 48.47 ± 0.60 ab |
| 200 | 47.07 ± 0.38 c | 49.21 ± 0.62 abc | 50.91 ± 0.30 ab | 49.06 ± 0.60 ab |
| 300 | 47.16 ± 1.05 c | 50.69 ± 0.97 ab | 51.42 ± 0.61 a | 49.76 ± 0.80 a |
| Average | 47.07 ± 0.30 b | 49.07 ± 0.55 a | 50.21 ± 0.38 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 1 shows that the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and 450 kg*ha⁻ ¹ NPK increased the height of mung bean plants but was not significantly different from the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and 300 kg*ha⁻ ¹ NPK , the combination of giving a dose of 200 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹ , 300 kg*ha⁻ ¹ , the combination of giving a dose of 100 ml*l⁻ ¹ rabbit urine LOF and 450 kg*ha⁻ ¹ NPK , and a combination without giving rabbit urine LOF (0 ml*l⁻ ¹ ), and 450 kg*ha⁻ ¹ NPK but significantly different from other treatments. This result is because the combination of rabbit urine LOF with NPK fertilizer can increase the availability of nutrients and the absorption of nutrients needed by plants to support the rate of photosynthesis. This process produces photosynthate and is translocated to encourage plant height growth. This is supported by Hadisuwito's statement (2012) that when the plant's nutrient needs are met, the roots will absorb nutrients well, thus helping the process of plant cell enlargement and formation, which has an impact on increasing plant growth.

Administering 300 ml*l⁻ ¹ rabbit urine LOF can increase the height of green bean plants compared to without rabbit urine LOF (0 ml*l⁻ ¹ ) but is not significantly different from the administration of 100 ml*l⁻ ¹ and 200 ml*l⁻ ¹. The increase in the height of green bean plants is influenced by the availability of nutrients that support plant growth. The nutrient nitrogen (N) is essential as chlorophyll's main component, which supports photosynthesis and plant metabolism processes. The availability of sufficient nutrients contributes to the level of plant growth. Based on Danger et al . (2024), The nitrogen content in rabbit urine is 4.24 %. According to the study results of Cahyanto et al. (2022), the provision of a combination of 90 ml*l⁻ ¹ liquid organic fertilizer from rabbit urine and 250 kg*ha⁻ ¹ NPK fertilizer had a significant effect on plant height at 28 HST, 35 HST and 42 HST in bean plants ( Phaseolus vulgaris L.) in the lowlands.

Providing 450 kg.ha-1 NPK fertilizer significantly increased plant height compared to 150 kg*ha⁻ ¹ NPK fertilizer , but was not significantly different from 300 kg*ha⁻ ¹ NPK fertilizer . The application of 300 kg*ha⁻ ¹ NPK fertilizer is thought to be able to provide sufficient nutrients to increase the height of mung bean plants. NPK fertilizer with the right dose can meet the need for nutrients in sufficient quantities. One of the important nutrients in plant growth is nitrogen. According to Mansyur et al. (2021), the increase in the amount of N absorbed by plants so that the meristematic tissue at the stem growth point becomes more active causes many stem segments to form and the plants to grow taller. This is in line with research Yulhasmir et al. (2021) that the compound NPK fertilizer treatment of 300 kg*ha⁻ ¹ was a better treatment than the compound NPK treatment. The 200 kg*ha⁻ ¹ and compound NPK fertilizer 300 kg*ha⁻ ¹ produce the highest average in soybean plant height.

### 3.2. Number of Leaves

The results of the variance analysis demonstrated that the interaction of rabbit urine LOF and NPK fertilizer, as well as the rabbit urine LOF factor, exhibited no significant effect. Conversely, the NPK fertilizer factor significantly affected the number of green bean leaves. Subsequent test results, employing the Duncan's multiple range test at the 5% level, are presented in Table 2.

Table 2 shows that the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and 450 kg*ha⁻ ¹ NPK increased the number of leaves of mung bean plants but was not significantly different from the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and NPK, 300 kg*ha⁻ ¹, 150 kg*ha⁻ ¹, the combination of giving a dose of 200 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, 150 kg*ha⁻ ¹, the combination of giving a dose of 100 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, the combination without giving a dose of 0.05 ml*l⁻ ¹ ) and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹ but significantly different from other treatments. This is thought to be because the combination of rabbit urine LOF and NPK fertilizer can increase the nutrients contained in the soil. Nitrogen is a nutrient that plays a role in the vegetative period of plants. According to Nurhidayah (2023), the element N plays a role in the formation and growth of vegetative parts of plants, such as leaves, stems, and roots.

**Table 2.** Number of leaves peanut green (strand) given rabbit urine LOF And NPK fertilizer

| LOF Rabbit Urine (ml*l⁻ ¹) | NPK (kg*ha⁻ ¹) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 22.33 ± 0.73 b | 23.50 ± 0.90 ab | 24.08 ± 1.02 ab | 23.30 ± 0.52 b |
| 100 | 22.91 ± 1.30 b | 24.00 ± 0.25 ab | 24.25 ± 1.39 ab | 23.72 ± 0.59 ab |
| 200 | 23.25 ± 0.66 ab | 24.16 ± 0.22 ab | 25.25 ± 0.43 ab | 24.22 ± 0.37 ab |
| 300 | 23.50 ± 1.64 ab | 25.25 ± 0.00 ab | 26.16 ± 0.58 a | 24.97 ± 0.64 a |
| Average | 23.00 ± 0.51 b | 24.22 ± 0.28 ab | 24.93 ± 0.47 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

The administration of 300 ml*l⁻ ¹ rabbit urine LOF significantly increased the number of plant leaves compared to without the administration of rabbit urine LOF (0 ml*l⁻ ¹ ). Still, it was not substantially different from the administration of 100 ml*l⁻ ¹ and 200 ml*l⁻ ¹ rabbit urine LOF. The administration of rabbit urine LOF is thought to increase the number of green bean plant leaves because the soil nutrients are available in sufficient quantities to meet the nutrient needs of plants. Rabbit urine LOF contains nitrogen nutrients that can support the vegetative process of plants, such as leaves. Based on Danger et al. (2024), The nitrogen content in rabbit urine is 4.24 %. Giving fertilizer NPK 450 kg*ha⁻ ¹ real increased the number of leaves compared to NPK 150 kg*ha⁻ ¹, but was not significantly different from NPK 300 kg*ha⁻ ¹. NPK fertilizer dose of 300 kg*ha⁻ ¹ is suspected to have provided sufficient nutrients to increase the number of leaves of green bean plants. Green bean plants require adequate nutrients to produce healthy leaves. The nitrogen element contained in NPK fertilizer plays a role in the vegetative period of plants, one of which is the increase in plant leaves. This is in line with the results of the study Bayyani Roswy and Sudiarso (2022) that the provision of 300 kg*ha⁻ ¹ NPK fertilizer provided an increase in growth of up to 2.29% and 32.7% in plant height, 19.1% and 30.9% in the number of leaves, 17.6% and 29% in the number of branches in the Grobongan and Gepak Kuning varieties of soybean plants.

### 3.3. Effective root nodules

The results of the variance analysis demonstrated that the interaction of rabbit urine LOF and NPK fertilizer, in conjunction with the administration of rabbit urine LOF, exhibited no significant effect. Conversely, NPK fertilizer significantly affected the effective root nodules of green beans. Subsequent tests employing Duncan's multiple range test at the 5% level are outlined in Table 3.

**Table 3.** Effective root nodules of mung bean plants (%) given rabbit urine LOF And NPK fertilizer

| LOF Rabbit Urine (ml*l⁻ ¹) | NPK (kg*ha⁻ ¹ ) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 38.03 ± 1.91 c | 42.86 ± 2.07 abc | 44.51 ± 3.22 abc | 41.80 ± 1.57 b |
| 100 | 40.68 ± 2.82 bc | 43.86 ± 1.99 abc | 45.44 ± 1.70 ab | 43.33 ± 1.31 ab |
| 200 | 42.56 ± 2.55 abc | 44.78 ± 1.90 ab | 47.25 ± 1.70 ab | 44.86 ± 1.24 ab |
| 300 | 43.17 ± 0.44 abc | 46.04 ± 0.87 ab | 48.12 ± 1.09 a | 45.77 ± 0.83 a |
| Average | 41.11 ± 1.09 b | 44.38 ± 0.84 a | 46.33 ± 0.99 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 3 shows that the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and 450 kg*ha⁻ ¹ NPK increased the root nodules of green bean plants but was not significantly different from the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and NPK, 300 kg*ha⁻ ¹, 150 kg*ha⁻ ¹, the combination of giving a dose of 200 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, 150 kg*ha⁻ ¹, the combination of giving a dose of 100 ml*l⁻ ¹ rabbit urine LOF and NPK. 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, combination without giving rabbit urine LOF (0 ml*l⁻ ¹ ) and NPK 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹ but significantly different from other treatments. This is because giving rabbit urine LOF and NPK fertilizer can increase the effective root nodules of green bean plants. Giving rabbit urine LOF can provide environmental conditions suitable for Rhizobium sp's life. Rhizobium forms root nodules. The study by (Dewanti et al., 2023) showed that the interaction between fertilization and mung bean varieties also affected plant growth and yield. It was found that certain mung bean varieties showed a better response to fertilization, which had a positive impact on root nodule growth1. In addition, other studies have emphasized the importance of soil management and organic fertilization in improving root health and nodule numbers. According to Nopriani et al. (2021), the nutrient P is essential in plant growth and development, such as root development.

The administration of 300 ml*l⁻ ¹ rabbit urine LOF significantly increased effective root nodules compared to without the administration of rabbit urine LOF (0 ml*l⁻ ¹). Still, it was not substantially different from the administration of 100 ml*l⁻ ¹ and 200 ml*l⁻ ¹ rabbit urine LOF. Rabbit urine LOF positively affects the formation of root nodules in green bean plants. The higher the amount of rabbit urine LOF given to green bean plants, the more root nodules are produced due to the role of organic matter. Organic matter such as Rhizobium sp can stimulate the growth of microorganisms in the soil. In symbiosis with legume plants, this bacteria can infect plant roots and form root nodules. According to Salam (2020), the increase in organic matter in the soil is related to the rise in the population and activity of soil microorganisms.

The application of NPK fertilizer 450 kg*ha⁻ ¹ produces more effective root nodules than the provision of NPK fertilizer, 150 kg*ha⁻ ¹, but it is not significantly different from NPK fertilizer, 300 kg*ha⁻ ¹. The provision of NPK fertilizer with a dose of 300 kg*ha⁻ ¹ is thought to meet the nutrient needs in producing effective root nodules. This is because the need for NPK fertilizer has been met. NPK fertilizer contains macronutrients such as nitrogen, phosphorus, and potassium. According to Fegeria et al. (1997), N absorption during vegetative growth can maintain good initial growth and rapid root nodule development. N, P, and K are also crucial in developing plant roots. The availability of sufficient nutrients causes good root development, so the number of root nodules formed will increase. Based on the study's results (Yulianingsih et al . , 2021) Application of 21 t.ha -1 rice straw compost and 300 kg*ha⁻ ¹ NPK fertilizer can increase the number of effective root nodules, effective root nodule weight, number of flowers, number of primary branches, and seed weight per m2.

### 3.4. Productive branches

The analysis of variance showed that the interaction of rabbit urine LOF and NPK fertilizer had no significant effect. In contrast, the rabbit urine LOF factor and the NPK fertilizer factor significantly affected the number of productive branches. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 4.

**Table 4.** Number of productive branches of green bean plants (branches) given rabbit urine LOF and NPK fertilizer.

| LOF Rabbit Urine (ml*l⁻ ¹) | NPK (kg*ha⁻ ¹) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 7.83 ± 0.36 c | 8.17 ± 0.42 bc | 8.66 ± 0.22 abc | 8.22 ± 0.21 b |
| 100 | 7.91 ± 0.08 c | 8.66 ± 0.22 abc | 8.83 ± 0.36 abc | 8.47 ± 0.19 ab |
| 200 | 8.00 ± 0.29 bc | 8.75 ± 0.38 abc | 8.91 ± 0.22 ab | 8.55 ± 0.21 ab |
| 300 | 8.42 ± 0.30 bc | 8.91 ± 0.44 ab | 9.66 ± 0.22 a | 9.00 ± 0.25 a |
| Average | 8.04 ± 0.14 b | 8.62 ± 0.18 a | 9.02 ± 0.16 a | |

The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 4 shows that the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and 450 kg*ha⁻ ¹ NPK increased the productive branches of mung bean plants but was not significantly different from the combination of giving a dose of 300 ml*l⁻ ¹ rabbit urine LOF and NPK, 300 kg*ha⁻ ¹, 150 kg*ha⁻ ¹, the combination of giving a dose of 200 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, the combination of giving a dose of 100 ml*l⁻ ¹ rabbit urine LOF and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹, the combination without giving rabbit urine LOF (0 ml*l⁻ ¹ ) and NPK, 450 kg*ha⁻ ¹, 300 kg*ha⁻ ¹ but significantly different from other treatments. This is because rabbit urine LOF and NPK fertilizer can supply the availability of nutrients in the soil so that more productive branches are formed. Combining organic and chemical fertilizers creates a synergistic effect, where rabbit urine LOF supports long-term growth and NPK fertilizer provides fast nutrition so that green bean plants can grow more optimally and produce more productive branches. According to Mansyur et al. (2021), the availability of sufficient nutrients in the soil dramatically determines a plant's growth, development, and production rate.

Administering 300 ml*l⁻ ¹ rabbit urine LOF can increase the productive branches of green beans compared to not administering rabbit urine LOF (0 ml*l⁻ ¹ ). Still, it is not significantly different from the administration of 100 ml*l⁻ ¹ and 200 ml*l⁻ ¹ rabbit urine LOF. The administration of rabbit urine LOF can increase soil organic matter; through the decomposition process, the nutrients available in the soil will increase, so the productive branches of green bean plants will increase. P and K are the nutrients that play a role in the formation of productive branches of plants. The P element acts as energy for plants to carry out various metabolic processes to develop and divide plant cells. The K element acts as a stimulant for flower and fruit growth. The administration of 450 kg*ha⁻ ¹ NPK fertilizer significantly increases the productive branches of green bean plants compared to 150 kg*ha⁻ ¹ NPK fertilizer, but it is not substantially different from 300 kg*ha⁻ ¹ NPK fertilizer. This is thought to be because the administration of 300 kg*ha⁻ ¹ NPK dose can increase the availability of nutrients in the soil. The availability of nutrients in the soil causes plant growth to be better because mung bean plants more easily absorb nutrients, so that mung bean plants will form new branches well. Based on the study results of Syahrudin et al. (2017), increasing the dose of NPK fertilizer to 300 kg*ha$^{-1}$ can increase the number of productive branches to reach four branches compared to doses of 0, 100 and 200 kg*ha$^{-1}$ in tomato plants.

### 3.5. Harvest Age

The results of the variance analysis showed that the interaction of rabbit urine LOF and NPK fertilizer, the rabbit urine LOF factor, and the NPK fertilizer factor had no significant effect on the harvest age of green beans. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 5.

Table 5 shows the combination of rabbit urine LOF with NPK fertilizer and single factor rabbit urine LOF and single factor NPK did not differ significantly between treatments on the harvest age of mung bean plants. The harvest age of mung bean plants is closely related to the flowering age of mung bean plants. In general, mung bean plants that show a faster flowering age also tend to have a faster harvest age. According to Subandri et al. (2019), harvest age is usually closely related to flowering age. The faster a plant enters the flowering phase, the quicker the plant enters the harvest phase.

**Table 5.** Harvest age of green bean plants (DAP) given rabbit urine LOF and NPK fertilizer

| LOF Rabbit Urine (ml*l$^{-1}$) | NPK (kg*ha$^{-1}$) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 58.00 ± 0.58 a | 56.33 ± 1.20 a | 56.33 ± 0.67 a | 56.88 ± 0.51 a |
| 100 | 56.66 ± 0.88 a | 56.33 ± 0.67 a | 56.00 ± 0.58 a | 56.33 ± 0.37 a |
| 200 | 57.00 ± 1.53 a | 56.33 ± 0.33 a | 55.33 ± 0.88 a | 56.22 ± 0.57 a |
| 300 | 56.33 ± 0.67 a | 55.33 ± 0.88 a | 55.33 ± 0.67 a | 55.66 ± 0.41 a |
| Average | 57.00 ± 0.46 a | 56.08 ± 0.38 a | 55.75 ± 0.33 a | |

Notes: The numbers on the column and line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Genetic factors can also affect the harvest age of plants. According to Mangoendidjojo (2003), the appearance of a plant in certain environmental conditions results from the interaction between environmental factors and genetic factors. According to Ramadhan et al. (2022), the administration of NPK fertilizer at a dose of 350 kg*ha$^{-1}$ did not significantly differ on the flower age of green bean plants with the administration of NPK fertilizer at doses of 0, 150, and 250 kg*ha$^{-1}$, precisely at 34.48-34.93 days in green bean plants.

### 3.6. Number of Poultry Pods

The analysis of variance showed that the interaction of rabbit urine LOF and NPK fertilizer had no significant effect. In contrast, the rabbit urine LOF factor and the NPK fertilizer factor significantly affected the number of green bean pods. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 6.

**Table 6.** Number of full-bodied pods of green bean plants (pods) given rabbit urine LOF and NPK fertilizer.

| LOF Rabbit Urine ( ml*l$^{-1}$) | NPK (kg*ha$^{-1}$) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 18.91 ± 1.82 b | 21.16 ± 0.22 b | 23.75 ± 1.64 ab | 21.27 ± 1.00 b |
| 100 | 19.58 ± 0.79 b | 21.25 ± 0.38 b | 24.00 ± 3.04 ab | 21.61 ± 1.12 b |
| 200 | 19.83 ± 0.82 b | 23.83 ± 1.02 ab | 26.66 ± 3.11 a | 23.44 ± 1.39 ab |
| 300 | 20.33 ± 0.36 b | 26.50 ± 1.53 a | 27.50 ± 0.88 a | 24.77 ± 1.23 a |
| Average | 19.66 ± 0.49 b | 23.18 ± 0.77 a | 25.47 ± 1.12 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 6 shows that the combination of giving a dose of 300 ml*l$^{-1}$ rabbit urine LOF and 450 kg*ha$^{-1}$ NPK increased the number of full pods of mung bean plants but was not significantly different from the combination of giving a dose of 300 ml*l$^{-1}$ rabbit urine LOF and 300 kg*ha$^{-1}$ NPK , the combination of giving a dose of 200 ml*l$^{-1}$ rabbit urine LOF and NPK, 450 kg*ha$^{-1}$ , 300 kg*ha$^{-1}$, the combination of giving a dose of 100 ml*l$^{-1}$ rabbit urine LOF and 450 kg*ha$^{-1}$ NPK , and the combination without giving rabbit urine LOF (0 ml*l$^{-1}$ ), and 450 kg*ha$^{-1}$ NPK but significantly different from other treatments. Rabbit urine LOF and NPK fertilizer provide nutrients that play a role in the growth and production of mung bean plants. Rabbit urine LOF helps increase the availability of nutrients for plants and improves the physical properties of the soil; good physical soil conditions allow plant roots to develop sufficiently so that nutrient absorption will run smoothly. NPK fertilizer provides sufficient nutrients to support the formation of more full pods. Sutedjo (2010) stated that to achieve maximum results, organic fertilizers should be balanced with inorganic fertilizers so that both complement each other, and nutrients are available more quickly. The nutrients available in green bean plants will increase the photosynthate used for pod filling, increasing the number of full pods produced.

300 ml*l⁻ ¹ rabbit urine LOF can significantly increase the number of full pods compared to the combination without the administration of rabbit urine LOF (0 ml*l⁻ ¹ ) and 100 ml*l⁻ ¹ but is not significantly different from the administration of 200 ml*l⁻ ¹ rabbit urine LOF. This is thought to be because increasing the administration of rabbit urine LOF can increase the number of full pods in green bean plants. The nutrient that plays a role in forming pods and full pods is phosphorus—the soil conditions in the land support this. According to Nurhidayah (2023), phosphorus plays a role in increasing the percentage of flowers to fruit/seeds and helps in accelerating the flowering and ripening of fruit, seeds, or grain.

The application of NPK fertilizer of 450 kg*ha⁻ ¹ significantly increased the number of full-bodied pods of mung bean plants compared to NPK fertilizer of 150 kg*ha⁻ ¹, but was not substantially different from the NPK treatment of 300 kg*ha⁻ ¹. NPK fertilizer plays a role in increasing the nutrient content in the soil. The application of NPK fertilizer at a dose of 300 kg*ha⁻ ¹ is thought to increase the availability of nutrients in the soil, thereby increasing the number of full-bodied pods of mung bean plants. The number of pods produced by plants is related to the availability of phosphorus and potassium in the soil. According to Wijaya (2020), the nutrient P plays a role in protein and carbohydrate synthesis, while the nutrient K can increase seed weight. Based on the study results of Hapsoh et al. (2019) the application of NPK fertilizer of 250 kg*ha⁻ ¹ can increase the number of full-bodied pods per soybean plant, namely 87.8 pods compared to the application of NPK fertilizer of 0 and 125 kg*ha⁻ ¹, namely 69.2 and 72 pods.

### 3.7. Percentage of Potiony Pods

The analysis of variance showed that the interaction of rabbit urine LOF and NPK fertilizer as well as the rabbit urine LOF factor and NPK fertilizer factor, had no significant effect on the percentage of complete pods of green bean plants. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 7.

**Table 7.** Percentage of full-bodied pods of green bean plants (%) given urine LOF Rabbits and NPK fertilizer

| LOF Rabbit Urine ( ml*l⁻ ¹) | NPK (kg*ha⁻ ¹) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 88.47 ± 1.53 a | 89.10 ± 1.18 a | 89.72 ± 1.17 a | 89.10 ± 0.68 a |
| 100 | 88.79 ± 0.36 a | 89.48 ± 0.70 a | 89.82 ± 0.90 a | 89.36 ± 0.38 a |
| 200 | 89.03 ± 0.62 a | 89.69 ± 0.15 a | 90.81 ± 0.50 a | 89.84 ± 0.35 a |
| 300 | 89.23 ± 0.45 a | 90.57 ± 1.50 a | 91.04 ± 1.16 a | 90.28 ± 0.62 a |
| Average | 88.88 ± 0.38 a | 89.71 ± 0.46 a | 90.35 ± 0.45 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 7 shows that the combination of rabbit urine LOF with NPK fertilizer did not differ significantly between treatments on the percentage of full pods. This is because the nutrient requirements of the plants have been met, resulting in optimal green bean yields. The P element plays a role in seed formation to increase green bean plant production. Plant genetic factors also play a role in determining the resulting pods. According to (Gunawan et al., 2023), physical mutation induction can increase genetic diversity in mung beans, positively impacting agronomic characteristics such as seed size and number of pods per plant. This result suggests that genetic manipulation can improve desirable traits in mung beans. A previous study by Lestari et al. (2015) showed that the provision of residues from 5 and 10 tons of TKKS Compost with 300, 225, 150, and 75 kg*ha⁻ ¹ showed a percentage of full pods that was not significantly different, namely 68.17-78.73 in edamame soybean plants.

### 3.8. Weight of 100 Seeds

The results of the variance analysis showed that the interaction of rabbit urine LOF and NPK fertilizer and the rabbit urine LOF factor had no significant effect. In contrast, the NPK fertilizer factor significantly impacts the weight of 100 mung bean seeds. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 8.

**Table 8.** Weight of 100 mung bean seeds (g) given rabbit urine LOF and NPK fertilizer

| LOF Rabbit Urine ( ml*l⁻ ¹) | NPK (kg*ha⁻ ¹) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 5.89 ± 0.11 b | 6.20 ± 0.04 ab | 6.21 ± 0.08 ab | 6.10 ± 0.07 b |
| 100 | 6.10 ± 0.03 ab | 6.21 ± 0.06 ab | 6.26 ± 0.04 ab | 6.19 ± 0.03 ab |
| 200 | 6.17 ± 0.05 ab | 6.25 ± 0.16 ab | 6.36 ± 0.12 a | 6.26 ± 0.06 ab |
| 300 | 6.20 ± 0.05 ab | 6.30 ± 0.34 ab | 6.53 ± 0.12 a | 6.34 ± 0.12 a |
| Average | 6.09 ± 0.05 b | 6.24 ± 0.08 ab | 6.34 ± 0.05 a | |

Notes: The numbers on column And line Which followed with letter small which the same different No real according to distance test multiple Duncan on level 5%.

Table 8 shows that the combination of giving a dose of 300 ml*l$^{-1}$ rabbit urine LOF and 450 kg*ha$^{-1}$ NPK increased the weight of 100 mung bean seeds but was not significantly different from the combination of giving a dose of 300 ml*l$^{-1}$ rabbit urine LOF and NPK, 300 kg*ha$^{-1}$, 150 kg*ha$^{-1}$, the combination of giving a dose of 200 ml*l$^{-1}$ rabbit urine LOF and NPK, 450 kg*ha$^{-1}$, 300 kg*ha$^{-1}$, 150 kg*ha$^{-1}$, the combination of giving a dose of 100 ml*l$^{-1}$ rabbit urine LOF and NPK, 450 kg*ha$^{-1}$, 300 kg*ha$^{-1}$, 150 kg*ha$^{-1}$combination without giving rabbit urine LOF (0 ml*l$^{-1}$ ) and NPK, 450 kg*ha$^{-1}$, 300 kg*ha$^{-1}$ but significantly different from other treatments. This is because the combination of rabbit urine LOF and NPK fertilizer causes the availability of nutrients in the soil so that plants can increase the weight of 100 green bean seeds. The P nutrient in rabbit urine LOF and NPK fertilizer can increase the weight of 100 green bean seeds. According to Hasniar et al. (2024), phosphorus plays a role in seed formation and flowering in plants, and this process requires adequate phosphorus to ensure optimal seed production, which is an essential aspect of plant reproduction.

Providing 300 ml*l$^{-1}$ rabbit urine LOF can increase the weight of 100 green bean seeds compared to the treatment without administering rabbit urine LOF (0 ml*l$^{-1}$). Still, it is not significantly different between 100 ml*l$^{-1}$ and 200 ml*l$^{-1}$. This is thought to be because the administration of LOF can increase the availability of nutrients in the soil. The P nutrient in rabbit urine, LOF, is needed by plants to form plant seeds, thereby increasing the weight of 100 green bean seeds. According to Soemarno et al. (2022), P is required by plants in seed formation.

Administering 450 kg.ha-1 NPK fertilizer significantly increased the weight of 100 mung bean seeds compared to 150 kg*ha$^{-1}$ NPK fertilizer but was not substantially different from the 300 kg*ha$^{-1}$ NPK treatment. This is thought to be because the application of 300 kg*ha$^{-1}$ NPK fertilizer has been able to meet the nutrient needs in the soil, resulting in a good weight of 100 mung bean seeds. Still, along with the increase in the dose of NPK fertilizer, the weight of 100 mung bean seeds increases. Adding NPK fertilizer helps improve the chemical properties of the soil because the nutrients nitrogen, phosphorus, and potassium become more available in the soil. Plants will absorb the available nutrients and then use them to increase the photosynthesis rate. The photosynthate produced is translocated to the seeds, increasing the weight of 100 mung bean seeds. Based on the study results of Gulo et al. (2020), the application of 300 kg*ha$^{-1}$ NPK fertilizer can increase the weight of 100 peanut seeds.

### 3.9. Dry Weight of Seeds Per Plot

The analysis of variance showed that the interaction of rabbit urine LOF and NPK fertilizer had no significant effect. In contrast, the rabbit urine LOF factor and the NPK fertilizer factor significantly impact the dry weight of seeds per plot. The results of further tests using Duncan's multiple range test at the 5% level are presented in Table 9.

**Table 9.** Dry seed weight per plot of green bean plants (g) given rabbit urine LOF and NPK fertilizer.

| Rabbit Urine LOF ( ml*l$^{-1}$ ) | NPK (kg*ha$^{-1}$) | | | Average |
|---|---|---|---|---|
| | 150 | 300 | 450 | |
| 0 | 150.31 ± 0.57 c | 158.63 ± 5.33 bc | 167.25 ± 4.50 abc | 158.73 ± 3.17 b |
| 100 | 152.13 ± 2.99 c | 165.32 ± 7.41 abc | 171.42 ± 7.44 abc | 162.95 ± 4.25 b |
| 200 | 152.67 ± 1.73 c | 175.83 ± 2.91 abc | 190.26 ± 2.76 a | 172.92 ± 5.62 ab |
| 300 | 157.87 ± 8.69 bc | 184.69 ± 5.99 ab | 191.97 ± 22.17 a | 178.18 ± 8.78 a |
| Average | 153.25 ± 2.17 b | 171.12 ± 3.85 a | 180.22 ± 6.09 a | |

Notes: The numbers on the column And line, followed by the letter small, are not significantly different according to distance test multiple Duncan on level 5%.

Table 9 shows that the combination of giving a dose of 300 ml*l$^{-1}$ urine LOF and 450 kg*ha$^{-1}$ NPK increased the dry seed weight per plot of mung bean plants but was not significantly different from the combination of giving a dose of 300 ml*l$^{-1}$ rabbit urine LOF and NPK, 300 kg*ha$^{-1}$, the combination of providing a dose of 200 ml*l$^{-1}$ rabbit urine LOF and NPK, 450 kg*ha$^{-1}$, 300 kg*ha$^{-1}$, the combination of giving a dose of 100 ml*l$^{-1}$ rabbit urine LOF and NPK, 450 kg*ha$^{-1}$, 300 kg.ha - 1, the combination without giving rabbit urine LOF (0 ml*l$^{-1}$ ), and NPK 450 kg*ha$^{-1}$ but significantly different from other treatments. This result is because the administration of rabbit urine LOF can improve the physical properties of the soil, which makes the soil loose so that the roots can develop and absorb water and nutrients. Optimal root development will increase the absorption of nutrients provided through NPK fertilization. The nutrient that plays a role in seed formation is the P element. This is in line with the opinion of Purba et al. (2021), that plants need the P element more in the formation, development, and ripening of seeds and fruits.

Administering 300 ml*l$^{-1}$ rabbit urine LOF resulted in a higher dry weight of mung bean seeds per plot compared to without the administration of rabbit urine LOF (0 ml*l$^{-1}$ ) and 100 ml*l$^{-1}$ , but was not significantly different from the administration of 200 ml*l$^{-1}$ . This is thought to be because rabbit urine LOF is able to increase nutrients in the soil, thereby increasing the dry weight of seeds per plot in mung bean plants. The administration of rabbit urine LOF can supply nutrients that can be absorbed by mung bean plants as a booster for the rate of photosynthesis so that they produce photosynthate. Lakitan (2015) stated that the higher the rate of photosynthesis, the higher the rate of photosynthate translocation, where the photosynthate produced is used by plants for seed filling so that it can increase the dry weight of seeds per plot.

Applying NPK fertilizer 450 kg*ha$^{-1}$ produces a higher dry weight of mung bean seeds per plot than applying 150 kg*ha$^{-1}$ NPK fertilizer , but is not significantly different from 300 kg*ha$^{-1}$ NPK fertilizer. This result of the increase in dry seed weight is related to the significant translocation of photosynthate into seeds. According to Kamil (1982), the increase in seed weight in plants depends on the availability of photosynthate and the ability of plants to translocate it to the seeds. Giving NPK fertilizer can increase the content of macronutrients in the soil so that the nutrients available to plants will increase. The increase in The nutrients available to plants causes an increase in the dry weight of seeds in green bean plants. Ismawati (2007) states that element P plays a role in forming energy (ATP) needed in seed formation. The results of the study by Gunawan et al. (2023) show that NPK fertilizer 400 kg*ha$^{-1}$ of green bean plants can produce a dry seed weight of 100.67 g.

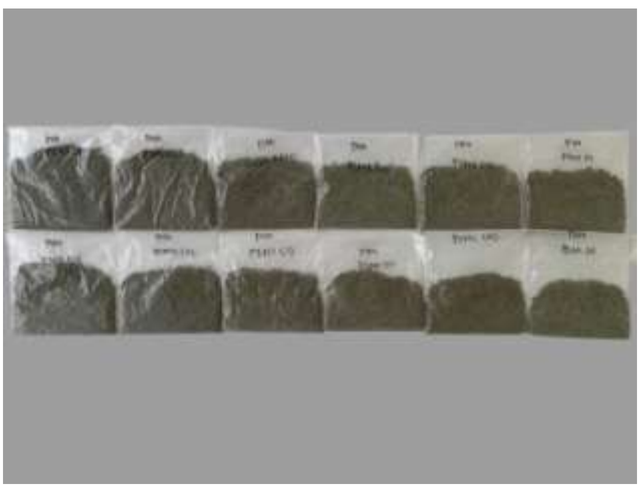

**Figure 2.** Dry seed weight per plot of green bean plants

## 4. Conclusion

A data study investigated the impact of rabbit urine LOF and NPK administration on green bean plant growth and production. The study found that the interaction between these two factors had no significant effect on plant growth and production parameters. However, the rabbit urine LOF factor substantially impacted plant height, productive branche, the number of full pods and the dry seed weight per plot.

Conversely, the fertilizer factor NPK substantially impacted plant height, number of leaves, effective root nodules, productive branches, the weight of 100 mung bean seeds number of full pods, and dry seed weight per plot. The most practical combination of treatments was 200 ml*l$^{-1}$ rabbit urine LOF and 300 kg*ha$^{-1}$ NPK fertilizer per hectare, substantially enhancing green bean plants' growth and yield.

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