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THE EFFECT OF THE USE OF CHICKEN MANURE ON RED BEANS (*Phaseolus vulgaris* L.)

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Abstract

Red beans are a horticultural crop belonging to the annual legume group that grows upright and has a fairly high nutritional content. To obtain maximum growth and yield from red beans, several factors must be considered, including balanced fertilizer application. The factor of providing organic fertilizer from chicken manure with the right dosage is the target of this study. This study aims to determine the effect of red bean growth on the dosage of chicken manure fertilizer. This study was conducted from December 2024 to February 2025 and was carried out on the plantation land of the Department of Science Education, Faculty of Mathematics, Natural Sciences and Earth Sciences, Manado State University. The method used is a quantitative method with a type of experiment in the form of a Randomized Block Design (RAK) with five treatment combinations with each repeated three times. A0 = 0 (control), A1 = 1.00 kg, A2 = 1.50 kg, A3 = 2.00 kg, A4 = 2.50 kg, so there are 15 experimental bed units, and the data obtained are then analyzed using analysis of variance (ANOVA). The results of this study indicate that good plant height growth, number of leaves and stem diameter are found in treatment A1 with a dose of 1.00 kg of chicken manure fertilizer and A2 with a dose of 1.50 kg of chicken manure fertilizer because there is the most maximum growth.

Keywords: Chicken Manure Fertilizer, Fertilizer Dosage, Growth, Red Beans

INTRODUCTION

Red beans are a horticultural crop belonging to the annual legume group that grows upright and boasts a high nutritional value. This type of bean has local names such as jogo beans and brenebon beans (Sangjaya et al., 1990). Red beans and green beans, scientifically known as *Phaseolus vulgaris* L., have different growth and harvest characteristics. These plants are thought to have originated in South America and Mexico before spreading throughout the world (Astawan, 2009). Balanced fertilization is crucial for increasing growth and yields, and this means providing fertilizers that are suited to plant needs and soil conditions (Kasno, 2016). Organic fertilizers are a very popular type of fertilizer. Organic fertilizers play a vital role in supporting soil microbial life by providing an energy source. Organic fertilizers play a vital role in increasing soil biological activity by providing sufficient nutrients and energy for soil microorganisms (Firmansyah, 2011). Inorganic fertilizers are industrial products made through chemical, physical, or biological processes, such as NPK, Urea, KCl, Ammonium Sulfate, and TSP (Purba et al.,

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2021). Manure is an organic resource that is easily accessible to farmers in the surrounding area. The use of manure can optimize nutrient absorption and increase the efficiency of chemical fertilizer use (Martin et al., 2006). Manure functions as a provider of nutrients, nutrients, increases soil fertility, and improves the life of soil biota (Gedoan, S.P., et al., 2011). Chicken manure is a type of organic fertilizer that is popular among farmers due to its high nutrient content, including phosphorus, potassium, and calcium. Chicken manure is commonly used by farmers compared to fertilizers from other livestock manure (Setyorini, 2006).

Based on a survey conducted on farmers in Minahasa, especially those in Remboken, Langowan, Tompaso, and Kawangkoa, it was found that farmers who usually grow red beans are increasingly less interested in growing red beans because market demand for the past year has been very low, making it less profitable. Likewise, the use of chicken manure as fertilizer for horticultural cultivation in the Tomohon and Tondano areas is very low because it is considered troublesome and there is still a lack of information on how to manage chicken manure for fertilizer. Chicken manure is easily obtained in the Tondano area and its surroundings because many people raise chickens as a side business or even as a main business. Until now, many people still don't understand the benefits of chicken manure as fertilizer, and most consider it merely waste. However, chicken manure contains various important components, such as protein, fat, carbohydrates, vitamins, minerals, and microorganisms, which can be used as animal feed, organic fertilizer, and more (Sihombing, 2000).

The aim of this study was to determine the effect of using chicken manure fertilizer on the growth of red beans (P. vulgaris).

RESEARCH METHODS

The research was conducted from December 2024 to February 2025 and was carried out on the plantation land of the Science Education Department, Faculty of Mathematics, Natural Sciences and Earth Sciences, Manado State University. The tools used in the research were: hoes, shovels, buckets, machetes, measuring tape, pruning shears, scales, raffia rope, watering can, nameplates, calculators, cameras, and stationery. The materials used in the research were: red bean seeds and chicken manure.

The research procedure includes the following activities:

1. Planting Material Preparation: The seeds used will be red bean seeds sold by farmers in the market. Before planting, the seeds will be soaked in water for 24 hours.
2. Land Clearing: Before planting, the land is cleared for one week using a hoe to remove weeds and other debris. The soil is then loosened and leveled.
3. Land Management and Bed Construction: After the land is cleared, the soil is managed by hoeing to a depth of 30 cm. Beds are then created with a width of 50 cm, a length of 100 cm, and a distance of 40 cm between each bed, for a total of 15 beds. After the beds are completed, chicken manure is applied according to the planned treatment.
4. Planting: Labels were placed the day before planting, according to each treatment per plot, to facilitate

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treatment and observation. The soaked red bean seeds were planted in holes 3 cm deep, with two red bean seeds per hole.

5. Fertilizer Application: The organic fertilizer used in this study was fermented chicken manure for 7 days. The purpose of fermentation is to kill parasitic bacteria that can harm plants (Ismawati, 2007), accelerate the decomposition of organic matter, increase organic matter content, enhance nutrient content, eliminate harmful pathogens, reduce odor, and produce high-quality organic fertilizer. The chicken manure fertilizer was applied to the red bean plants two weeks before planting, mixing it into each bed with the five treatments described above.
6. Water Application/Watering: The red bean plants were watered manually using a 6-liter water bottle, applied to each treatment two days after planting.
7. Controlling pests and diseases in red bean plants. To increase red bean yields, it is necessary to clear weeds and wild plants around the planting area. Weeding is done manually with a small hoe to avoid root damage. If the plants are infested with pests and diseases, manual control will be carried out.

The obtained data were analyzed statistically using ANOVA. If the ANOVA revealed a difference, the BNT test was continued at the 5% level.

The mathematical model is as follows:

$Yij = \mu + ri + \beta j + pk + Ɛij$

Where:

Yij = Observation results for the i-th treatment, j-th group

μ = General mean

ri = Effect of the i-th replication - (i = 1, 2, 3)

b = Effect of the j-th fertilizer dose factor (j - 1, 2, 3, 4, 5)

Eij = Experimental error for the i-th replication and j-th treatment.

RESULTS AND DISCUSSION

Effect of Chicken Manure Fertilizer Use on Plant Height

Based on the results of the analysis of variance, the effect of using organic chicken manure fertilizer on the growth of red bean (*Phaseolus vulgaris* L.) plants significantly affected the height of red bean (P. vulgaris L.) plants at 2 weeks after planting and 4 weeks after planting, as shown in Tables 1 and 2.

Based on the first table shows the results of the analysis with the BNT test at 5% level at the age of 2 weeks after planting the best treatment was in treatment A1 = giving 1 kg of organic chicken manure fertilizer with an average (22.76 cm) and the lowest results were in treatment A0 = without giving organic chicken manure fertilizer with an average (18.86 cm) A1 = giving 1 kg of organic chicken manure fertilizer was significantly different from A4, A3, A2 and A0 while A2 was not significantly different from A4. At the age of 2 weeks after planting Treatment A1 = giving 1 kg of organic chicken manure fertilizer was the highest average plant height compared to other treatments.

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Table 1. Average height of red bean plants with chicken manure fertilizer given in the first observation (2 weeks after planting)

Age (WAP)	Treatment	Average Plant Height (cm)
2 WAP	A0= No application of organic fertilizer from chicken manure 0 kg	18.86[a]
	A1= Application of organic fertilizer from chicken manure 1 kg	22.76[d]
	A2= Application of organic fertilizer from chicken manure 1.5 kg	21.93[c]
	A3= Application of organic fertilizer from chicken manure 2 kg	20.31[b]
	A4= Application of organic fertilizer from chicken manure 2.5 kg	21.41[c]
LSD 5%		0,09%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

At 4 weeks after planting, the organic fertilizer treatment from chicken manure significantly affected plant height, as seen in Table 2.

Table 2. Average Height of Red Bean Plants with Chicken Manure Fertilizer Application in the Second Observation (4 Weeks After Planting).

Age (WAP)	Treatment	Average Plant Height (cm)
4 WAP	A0= No application of organic fertilizer from chicken manure 0 kg	25.74[a]
	A1= Application of organic fertilizer from chicken manure 1 kg	33.08[c]
	A2= Application of organic fertilizer from chicken manure 1.5 kg	33.31[c]
	A3= Application of organic fertilizer from chicken manure 2 kg	30.31[b]
	A4= Application of organic fertilizer from chicken manure 2.5 kg	32.33[c]
LSD 5%		0,14%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

The best results were found in treatment A2 = application of 1.5 kg of organic chicken manure fertilizer with the highest average (33.31 cm) while the lowest results were found in treatment A0 with an average (25.74 cm). In treatment A2 = application of 1.5 kg of organic chicken manure fertilizer was significantly different from A3, and A0 but not significantly different from A1, A3 and A4.

The Effect of Using Chicken Manure Fertilizer on the Number of Leaves

The analysis results in Table 3 show that the application of organic chicken manure fertilizer on the growth of red bean (*Phaseolus vulgaris* L.) significantly affected the number of leaves. The average number of leaves on red bean plants at 2 weeks after planting and 4 weeks after planting can be seen in Tables 3 and 4.

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Table 3. Average Number of Leaves on Red Bean Plants with Organic Chicken Manure Fertilizer Application in the First Observation (2 Weeks After Planting).

Age (WAP)	Treatment	Average Number of Plant Leaves (Sheets)
2 WAP	A0 = No Organic Fertilizer from Chicken Manure 0 kg	3.7[a]
	A1 = Organic Fertilizer from Chicken Manure 1 kg	3.9[c]
	A2 = Organic Fertilizer from Chicken Manure 1.5 kg	3.9[c]
	A3 = Organic Fertilizer from Chicken Manure 2 kg	3.8[b]
	A4 = Organic Fertilizer from Chicken Manure 2.5 kg	3.9[c]
LSD 5%		0.009%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

Based on Table 3 above, the analysis results using the 5% LSD test showed that the best treatments at 2 weeks after planting were treatments A1, A2, and A4, with an average of 3.9 leaves. Treatments A1, A2, and A4 were significantly different from treatments A0 and A3. Treatments A1, A2, and A4 had the highest average number of leaves compared to treatments A0 and A3.

Table 4. Average Number of Leaves in Red Bean Plants with Organic Chicken Manure Fertilizer Application in the Second Observation (4 Weeks After Planting)

Age (WAP)	Treatment	Average Number of Plant Leaves (Sheets)
2 WAP	A0 = No Organic Fertilizer from Chicken Manure 0 kg	4.03[a]
	A1 = Organic Fertilizer from Chicken Manure 1 kg	4.73[e]
	A2 = Organic Fertilizer from Chicken Manure 1.5 kg	6,13[d]
	A3 = Organic Fertilizer from Chicken Manure 2 kg	35,23[c]
	A4 = Organic Fertilizer from Chicken Manure 2.5 kg	5,53[b]
LSD 5%		0.009%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

The best treatment at the age of 4 weeks after planting was in treatment A2 = 1.5 kg with an average (6.13 strands). In treatment A2 it was significantly different from treatments A4, A3, A1 and A0 then continued with BNT Test at the 5% level. In treatment A2 was the highest average number of leaves compared to treatments A4, A3, A1 and A0 while at the age of 2 weeks after planting the highest were A1, A2 and A4. At the age of 2 weeks after planting and 4 weeks after planting treatment A0 = without giving organic fertilizer chicken manure was the lowest average number of leaves, in this treatment it was seen that plant growth was not good, without giving organic fertilizer chicken manure, plants would not be optimal because chicken manure contains important nutrients such as Nitrogen (N) which is very much needed for growth in the vegetative phase of red beans (P. vulgaris L.).

The Effect of Chicken Manure Fertilizer Use on Stem Diameter

The analysis results in Table 5 show that the effect of chicken manure on the growth of red bean (P. vulgaris L.) plants significantly affected the observed stem diameter parameter.

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Table 5. Average Stem Diameter of Red Bean Plants with Chicken Manure Application in the First Observation (2 Weeks After Planting)

Age (WAP)	Treatment	Average Stem Diameter (cm)
2 WAP	A0 = No Organic Fertilizer from Chicken Manure 0 kg	2.87[a]
	A1 = Organic Fertilizer from Chicken Manure 1 kg	3.29[c]
	A2 = Organic Fertilizer from Chicken Manure 1.5 kg	3.35[d]
	A3 = Organic Fertilizer from Chicken Manure 2 kg	3.05[b]
	A4 = Organic Fertilizer from Chicken Manure 2.5 kg	3.34[cd]
LSD 5%		0.49%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

Table 5 also shows the results of the 5% LSD analysis. The best treatment at 2 weeks after planting was treatment A2, which was given 2.5 kg of organic chicken manure fertilizer, with an average of 3.35 cm. Treatment A2 was not significantly different from A4, and A4 was not significantly different from A1, while A2 and A4 were significantly different from treatments A0, A3, and A1. Treatment A2 had the highest average stem diameter compared to treatments A4, A3, A1, and A0.

Table 6. Average Stem Diameter of Red Bean Plants with Chicken Manure Fertilizer Application in the Second Observation (4 WAP)

Age (WAP)	Treatment	Average Stem Diameter (cm)
4 WAP	A0 = No Organic Fertilizer from Chicken Manure 0 kg	3.12[a]
	A1 = Organic Fertilizer from Chicken Manure 1 kg	3.64[b]
	A2 = Organic Fertilizer from Chicken Manure 1.5 kg	3.74[c]
	A3 = Organic Fertilizer from Chicken Manure 2 kg	3.59[a]
	A4 = Organic Fertilizer from Chicken Manure 2.5 kg	3.95[d]
LSD 5%		0.008%

Note: The same letters in the same column and row indicate no significant difference based on the 5% LSD test. tn: not significant; WAP: weeks after planting.

The best treatment at 4 weeks after planting was treatment A4 = 2.5 kg with an average of (3.95). Treatment A4 was not significantly different from treatments A3, A2, A1, and A0, while A3, A1, and A0 were significantly different from treatments A2 and A4. Treatment A4 had the highest average stem diameter compared to A3, A2, A1, and A0. Observations at 2 weeks after planting (A2 = 1.5 kg) and 4 weeks after planting (A4 = 2.5 kg) showed the highest average stem diameter compared to other treatments.

At the age of 2 weeks after planting and 4 weeks after planting, treatment A0 = without giving organic fertilizer chicken manure is the lowest average stem diameter with an average (2.87 and 3.12) in this treatment it can be seen that the growth of the stem diameter plant is not good, without giving organic fertilizer chicken manure the plant is not optimal because it lacks important nutrients needed for growth. Organic fertilizer from chicken manure contains Nitrogen, Phosphorus and potassium which increase the stem diameter and vegetative growth of red beans (*Phaseolus vulgaris* L).

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Discussion

In general, all the planted red bean plants grew well. Only three failed to grow, and they were replaced with backup plants planted simultaneously with the ones used for observation. Red bean plants require sufficient sunlight, regular watering, and loose soil to grow. They began to germinate on the fifth day after planting. The altitude was 360-460 m above sea level, with a minimum temperature of 24℃ and a maximum temperature of 27℃, and a humidity of 85%. Based on observations, plants treated with organic fertilizer from chicken manure showed better growth, including plant height, leaf number, and stem diameter, compared to those not treated with fertilizer. The fertilizer used in the study was chicken manure that had been fermented for 7 days then the tools and materials prepared before the fermentation were a little more than 2 liters of plain water, 200 grams of brown sugar, 200 grams of molasses and chicken manure fertilizer then mixed and stirred and let stand for about 30 minutes so that these microbes are active. Then after being mixed and stirred with chicken manure until the fertilizer becomes moist then filled in a sack and stored in a humid place for up to 7 days and then the content after fermentation of chicken manure fertilizer is; N, K, Ca and Mg. Plants that received the application of organic fertilizer were seen to grow more fertile and were slightly darker green than those not given organic fertilizer. The use of chicken manure as an organic fertilizer can increase soil moisture, nutrient release, and shoot initiation, so that plants grow more fertile and healthy (Enujeke, 2013). Theoretically, the more concentrated the nitrogen (N) contained in chicken manure, the more plants can absorb the N nutrient which is useful for their growth. Pranata (2004) stated that plants need nitrogen for the initial growth phase, namely the formation of healthy branches, leaves, and stems. The high chlorophyll in the leaves is determined by the amount of nitrogen obtained by the plant so that the photosynthesis process can function properly and optimally. The increase in organic fertilizer dosage in this study was not followed by a significant increase in plant height, but instead, the highest observed parameters were observed in treatments A1 and A2. This situation can be explained by the fact that for red beans, the optimal organic fertilizer dosage is in the range of 1 kg to 1.5 kg per bed. Exceeding this dosage will actually result in suboptimal plant growth and may even decline. Each plant has a different tolerance limit for nutrient absorption for optimal use. Nutrients are absorbed in the form of ions and absorption occurs through several mechanisms such as mass flow, diffusion, and root interception, which depend on several factors, one of which is soil pH (Alhapis, 2023).

The benefits of organic fertilizer for plants are diverse, including increasing nutrient uptake, improving soil structure, and increasing microbial activity. Widyanto (2007) states that organic fertilizer not only provides nutrients but also promotes root growth, increases plant resilience, and reduces dependence on pesticides, resulting in healthier plant growth and better water absorption and retention.

Chicken manure is beneficial for improving the physical and chemical properties of the soil, thus maximizing plant growth. Without additional nutrients, such as organic fertilizer, in this case chicken manure, the soil structure will deteriorate, infiltration will be impaired, and fertility and water absorption will be hampered. Kirchaner, Wolum, and King (1993) in Alhapis stated that the presence of organic matter

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improves soil structure, increases water infiltration, maintains soil fertility, and increases water absorption, allowing soil microorganisms to thrive and fix nitrogen for optimal plant growth.

The results of this study concluded that the application of chicken manure to kidney bean plants showed significant differences between plants without organic fertilizer (control) and plants treated with the lowest to highest doses. This is consistent with the research of Elfasari (2024) on the Effect of Chicken Manure Dosage on the Growth and Production of Tomato Plants (Lycopersicum esculentum Mill). Analysis showed that the application of chicken manure significantly affected plant height at 4 and 8 weeks after planting, the number of fruits per plant, and the weight of each fruit per plant. Likewise, the results of research from Wa ode Anti et al (2020) who found that the use of organic chicken manure fertilizer on bean plants had a positive effect on the number of leaves for plant ages 2, 3, and 4 WAP showed that the treatment of chicken manure had a very significant effect on the number of leaves. The results of the 0.05% BNJ test showed that the average number of leaves was 47.80 strands found in the treatment of chicken manure as much as 30 tons ha-1. According to Tobing and Maylani (2024) stated that the dose of organic chicken manure fertilizer given to corn plants after the honest significant difference (BNJ) test showed a significant effect on the height of corn plants from the age of 2 WAP to 7 WAP.

CONCLUSION

The use of organic chicken manure fertilizer has a positive effect on the growth of red bean plants in this case on plant height, number of leaves and stem diameter.

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