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Growth Response and Production of Mung Bean (*Vigna radiata* L.) to The Application of Different Types of Manure on Marginal Land (Case Study in Muna Regency)

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Abstract

Mung bean (*Vigna radiata* L.) is one of the most important legume crops besides soybean and peanut and is a widely consumed food ingredient among the Indonesian population. This research aims to determine the effect of different types of manure on the growth and yield of mung bean plants (*Vigna radiata* L.) The research was conducted at BPP Napabalano, Pentiro Village, Napabalano District, Muna Regency, for a duration of four months. The study was designed using a Randomized Block Design (RBD) with a single-factor experiment consisting of four treatment levels: no manure application, application of chicken manure at a dose of 20 t ha^{-1}, application of cow manure at a dose of 20 t ha^{-1}, and application of goat manure at a dose of 20 t ha^{-1}. The results showed that the application of different types of manure had a significant effect on the growth and production of mung bean plants. The application of cow manure resulted in the best growth and production, with an average productivity of 1.04 tons ha^{-1}.

Keywords: Marginal, Mung Bean, Response, Type Manure

1. Introduction

Mung bean (*Vigna radiata* L.) is a widely known legume crop in tropical regions. This plant belongs to the Leguminosae family and is considered one of the most important legumes after soybeans and peanuts. It has numerous benefits in daily life as a source of plant-based protein. Due to its status as an essential food ingredient, the demand for mung beans remains high (Triyanutama, 2020; Alamsyah et al., 2022). According to the DJTP Annual Report (2021), mung bean production in Indonesia has been continuously declining. In 2021, Indonesia's mung bean production was recorded at 211,176 tons, a decrease compared to 222,629 tons in 2020. Similarly, mung bean productivity in Indonesia also declined from 1.203 tons/ha in 2020 to 1.142 tons/ha in 2021.

Mung beans (*Vigna radiata* L.) are one of the most significant food sources in Indonesia, providing a valuable supply of plant-based protein to the community. Full of protein, fiber, vitamins, and minerals, mung beans are often utilized in various processed foods such as porridge and flour (Wu et al., 2019; Apriliani et al., 2025). Mung bean plants (*Vigna radiata* L.) are a significant food source for the Indonesian population and are classified as leguminous crops (Ariani et al., 2025).

Mung bean (*Vigna radiata* L.) plants contain various nutrients, including amylum, protein, iron, sulfur, calcium, fatty oil, manganese, magnesium, niacin, and vitamins (B1, A, and E). In terms of nutritional content, per 100 grams of mung beans contain 21.04 grams of protein, 1.64 grams of fat, 63.55 grams of carbohydrates, 11.42 grams of water, 2.36 grams of ash, and 2.46% fiber (Aminah & Hersoelistyorini, 2019; Sarita et al., 2021).

According to data from the Central Bureau of Statistics BPS tahun 2020, mung bean production in Southeast Sulawesi was 510.11 tons in 2018, decreasing to 421.09 tons in 2019, but increasing to 802.20 tons in 2020. Meanwhile, mung bean production in Muna Regency was 30.66 tons in 2018 and increased to 33.82 tons in 2019 and 50.60 tons in 2020 (Badan pusat Statistik Kabupaten Muna, 2020). The BPS data indicates that while mung bean production in Southeast Sulawesi increased in 2020, it remained low compared to national production. Similarly,

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mung bean production in Muna Regency was still lower than that of Southeast Sulawesi and national production. One of the main reasons for the low mung bean production in Muna Regency is that most mung bean farming is carried out on dry land with low fertility levels.

Soil in dryland areas have low organic matter content, resulting in a low cation exchange capacity (CEC). The decomposition of organic matter in humid tropical regions is highly intensive, while leaching rates are also high, leading to low organic matter levels (Lidya & Rahmi, 2019).

The dryland conditions in Muna Regency include red and yellow podzolic soils, with textures dominated by clay, loam, and silt. The soil pH ranges from 5.6 to 6.6, with low nutrient content (Ando et al., 2020). Meanwhile, the climatic conditions include very low annual rainfall, ranging from 37 to 800 mm per year, a prolonged dry season lasting 8 to 9 months, erratic rainfall patterns during the wet months, uneven rainfall distribution, and an average daily temperature between 28°C and 32°C (Hinarti et al., 2012)

Efforts to increase the production of mung bean crops on dry land require appropriate cultivation technology, such as the application of organic materials in the form of manure, to ensure optimal plant growth and maximum yield (Sutrisno & Priyambada, 2019). Manure is one of the organic fertilizers that plays a crucial role in plant growth and production. The benefits of manure include improving the physical properties of the soil, such as soil permeability, porosity, cation exchange capacity, and water retention. The use of manure can enhance soil conditions, provide a supply of macro- and micronutrients, and even release growth hormones such as auxins and cytokinins, which improve soil fertility and increase crop production (Amri et al., 2018).

The composition of manure varies depending on the type of animal waste. On average, well-matured livestock manure that is ready to be applied to the soil contains 0.5% nitrogen, 0.25% folic acid, and 0.5% potassium, along with small amounts of micronutrients such as calcium, magnesium, and sulfur (Lingga & Marsono 2008). Furthermore, Sajar (2023) stated that the nutrient content of chicken manure includes 3.21% nitrogen (N), 3.21% phosphorus pentoxide (P_2O_5), 1.57% potassium oxide (K_2O), 1.57% calcium (Ca), 1.44% magnesium (Mg), 250 ppm manganese (Mn), and 315 ppm zinc (Zn). Meanwhile, cow manure contains 2.33% nitrogen (N), 0.61% phosphorus pentoxide (P_2O_5), 1.58% potassium oxide (K_2O), 1.04% calcium (Ca), 0.33% magnesium (Mg), 179 ppm manganese (Mn), and 70.5 ppm zinc (Zn). As for goat manure, it contains 2.10% nitrogen (N), 0.66% phosphorus pentoxide (P_2O_5), 1.97% potassium oxide (K_2O), 1.64% calcium (Ca), 0.60% magnesium (Mg), 233 ppm manganese (Mn), and 90.8 ppm zinc (Zn).

Several studies on manure application have shown the best plant responses. Research by (Hinarti, 2011) on dry land in Muna Regency found that applying chicken manure at a dose of 15 t ha^{-1} increased corn production by 4.08 t ha^{-1}, or by 41.67% compared to without chicken manure application. Additionally, a study by Fahri et al (2022) showed that applying cow manure at a dose of 40 t ha^{-1} increased mung bean production by 38.46% compared to without cow manure application on dry land in PMK, Kuantan Singingi Regency. Applying 20 t ha^{-1} of goat manure resulted in the best plant growth and produced 1.43 t ha^{-1} of dry shelled waxy corn kernels.

The novelty of this research lies in its holistic approach, which not only examines the effect of a single type of manure but also evaluates multiple types of manure. This allows farmers to choose the type of manure that provides the most optimal results for increasing mung bean production. The findings of this study can certainly benefit farmers and the community, especially amid the scarcity and high prices of fertilizers available on the market.

2. Material and Methods

2.1. Time and Location

This research was conducted at BPP Napabalano, Pentiro Village, Napabalano District, Muna Regency, at the coordinates 4°39'50.15"S 122°41'45.49"E, at an altitude of 14 meters above sea level (masl), and lasted for four months.

2.2. Materials and Equipment

The materials used in this study included local mung bean seeds obtained from local farmers, chicken manure, cow manure, and goat manure sourced from community farms, as well as Decis 25EC pesticide, Urea fertilizer, TSP, KCl, and Furadan 3G. The equipment used included a machete, hoe, weighing scale, measuring tape, caliper, watering can, bucket, rope, scissors, plastic bags, and writing tools. This study was designed using a completely randomized block design (CRBD) with a non-factorial approach, consisting of four treatment levels and three replications, resulting in a total of 12 experimental units. Each experimental unit consisted of 12 plants per plot, with 5 plants selected as samples. The application of manure was carried out with four treatment levels as follows: No manure application (control), Chicken manure at a dose of 20 t ha^{-1}, equivalent to 4.8 kg per plot, Cow manure at a dose of 20 t ha^{-1}, equivalent to 4.8 kg per plot, Goat manure at a dose of 20 t ha^{-1}, equivalent to 4.8 kg per plot

2.3. Research Implementation

Land Preparation. The land was cleared of weeds and other plants before being plowed using a hole to a depth of 20 cm, followed by soil loosening. A total of 12 plots were prepared, each measuring 2 m × 1.2 m. The spacing between plots within a group was 30 cm, while the spacing between groups was 50 cm. Planting was done by making planting holes 3 cm deep using a dibber. Three seeds were sown per hole at a spacing of 50 cm × 40 cm, and the holes were then covered with soil. The fertilizers used were chicken manure, cow manure, and goat manure. Before application, the manure was cleaned of impurities and air-dried for one week. Chicken manure was applied once, one week before planting, by spreading it evenly over the plots and mixing it with the soil. The manure dosage was applied according to the treatment levels. In addition to manure, basal fertilizers were also applied, including Urea (100 kg ha^{-1}), KCl (75 kg ha^{-1}), and SP-36 (100 kg ha^{-1}), which were applied at planting). Basal fertilization was conducted once at the time of planting. Weeds around the plants were removed to prevent competition for nutrients and ensure optimal mung bean growth. Weak or unhealthy plants were removed by cutting 10 days after sowing (DAS Pest and disease control was carried out using Decis 25EC pesticide. Mung beans are harvested when the plants are ready, with 90% of the pods turning brown and black, the pods becoming hard, and 70% of the leaves turning yellow and falling off. Harvesting is done by picking the pods directly from the plant. After harvesting, the pods are sun-dried for 2–3 days until the pod shells easily open. **Data Analysis.** The data were analyzed using Microsoft Excel Software and SPSS Statistics software version 26.0. An F test was conducted with a significant level of 5%. If the results of the F test were significantly different, further testing was carried out using the BNJ test at a significant level of 5%. For more details, we can see in Figure 1.

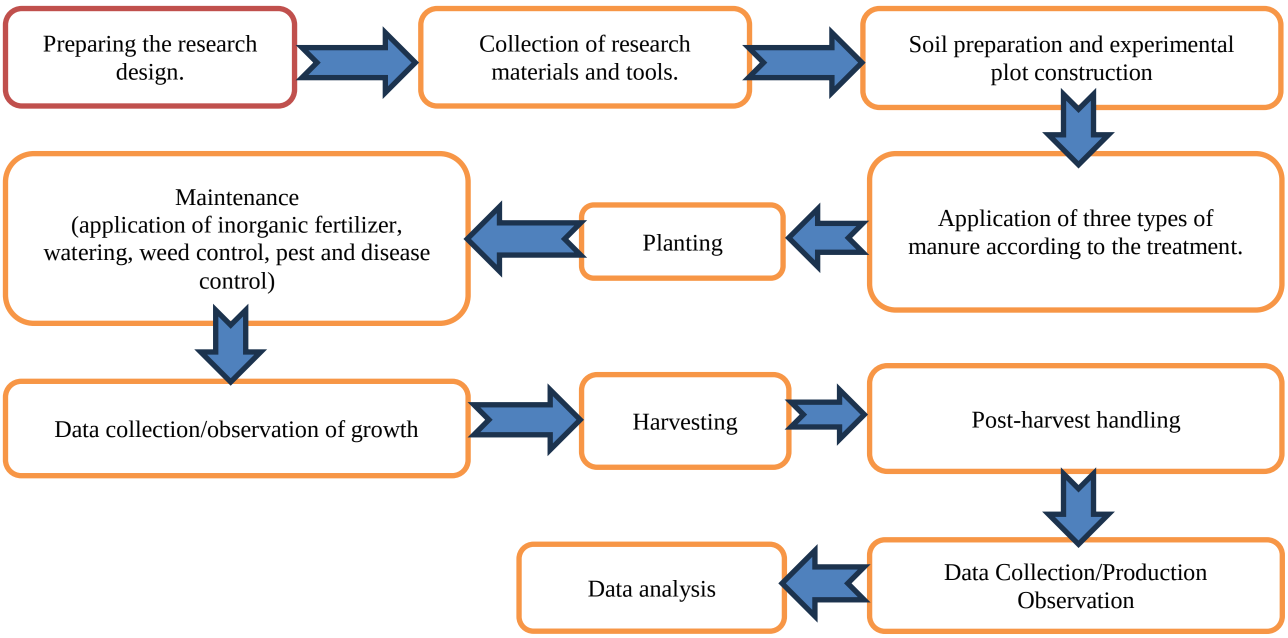

Figure 1. Research flow diagram

3. Results and Discussion

The summary of variance analysis on the effect of different types of manure on the growth and yield of mung bean (*Vigna radiata* L.) is presented in Table 1.

Table 1. Summary of Variance Analysis on the Effect of Different Types of Manure on the Growth and Yield of Mung Bean (*Vigna radiata* L.)

No	Observed Variables Growth and Yield Variables	F-Test Results (Effect of Manure Type Manure Type
1	Plant Height (cm)	
	- At 14 DAS	**
	- At 28 DAS	**
	- At 42 DAS	**
2	Stem Diameter (cm)	
	- At 14 DAS	**
	- At 28 DAS	**
	- At 42 DAS	**
3.	Number of Pods per Plant (pods plant^{-1})	**
4.	Weight of 100 Seeds (g)	**
5	Dry Seed Weight per Plot (g plot^{-1})	**
6.	Productivity (ton ha^{-1})	**

Note: ** = Highly significant effect. The F test is conducted with a 5% significance level. With A Randomized Block Design (RBD) non-factorial consisting of four treatment levels and three replications. Thus, this study consists of 12 experimental units. Each experimental unit consists of 12 plants/plots, with 5 of them used as samples.

3.1. Plant Height

The results of the variance analysis on mung bean plant height indicate that the application of different types of manure had a highly significant effect on plant height at 14 DAS, 28 DAS, and 42 DAS. The results of the BNJ 0.05 test on the effect of different types of manure on mung bean plant height at 14 DAS, 28 DAS, and 42 DAS are presented in Table 2 as follows:

Table 2. Average Plant Height of Mung Bean (cm) at 14 DAS, 28 DAS, and 42 DAS Under Different Types of Manure

Type of Manure	Plant Height (cm)		
	14 HST	**28 HST**	**42 HST**
No Manure	11,47±0,29a	22,80±0,70a	44,47±1,94a
Chicken Manure	13,67±0,29b	25,76±0,15b	51,67±1,37b
Cow Manure	14,20±0,23b	26,13±0,64b	52,86±0,59b
Goat Manure	12,87±0,29b	25,67±0,37b	50,73±1,18b
BNJ (0,05)	1,40	2,14	5,09

Note: Numbers followed by different letters indicate significant differences based on the BNJ test at a 95% confidence level.

Table 2 shows that the average height of mung bean plants at 14, 28, and 42 days after sowing (DAS) was highest in the treatment with cattle manure, measuring 14.20 cm, 26.13 cm, and 50.73 cm, respectively. This was significantly different from the treatment without manure but not significantly different from the treatments with chicken manure and goat manure. Meanwhile, the lowest plant height was observed in the treatment without manure, with values of 11.47 cm, 22.80 cm, and 44.47 cm, respectively. This was significantly different from the treatments with chicken manure, cattle manure, and goat manure.

Height of the plant is a variable that indicates the activity of vegetative growth, where an increase in height leads to cell division in the plant. The results of the BNJ test (Table 2) show that the treatment of applying cow manure provides better plant height growth compared to chicken manure and goat manure. This is suspected because the application of cow manure improves the physical properties of the soil, such as granulation, making the soil crumbly. In such conditions, the plant roots can develop well, thus increasing the root reach, which in turn allows for better nutrient absorption, fulfilling the plant's needs. Cow manure contains many essential nutrients needed by plants, such as N, P, K, Cl, and other elements. Nitrogen (N) is particularly required by plants in large quantities during all growth stages, especially in the vegetative growth stage, such as stem and leaf development. The nitrogen in manure can stimulate plants in the formation of amino acids into proteins (Aldin, 2021). The proteins formed are used to produce growth hormones, namely auxin, gibberellin, and cytokinin. Gibberellin will increase metabolic activity and the rate of photosynthesis (Nurjanah et al, 2020). The carbohydrates formed will also increase, and subsequently, the growth of roots, stems, and leaves will improve, leading to greater plant height.

3.2. Stem Diameter of Plants

The variance analysis results for the stem diameter of mung bean plants indicate that the application of different types of manure significantly affects the stem diameter at 14 DAS, 28 DAS, and 42 DAS. The results of the BNJ 0.05 test on the effect of different types of manure on the stem diameter of mung bean plants at 14 DAS, 28 DAS, and 42 DAS are presented in Table 3 as follows:

Table 3. Average Stem Diameter (cm) of Mung Bean Plants at 14 DAS, 28 DAS, and 42 DAS with Different Types of Manure

Type of Manure	Stem Diameter of Plants(cm)		
	14 HST	**28 HST**	**42 HST**
No Manure	0,13±0.01a	0,24±0.00a	0,51±0.01a
Chicken Manure	0,19±0.02b	0,29±0.01b	0,62±0.02b
Cow Manure	0,21±0.01b	0,31±0.01b	0,63±0.02b
Goat Manure	0,18±0.00b	0,29±0.00b	0,59±0.02b
BNJ 0,05	0,05	0,04	0,07

Note: Numbers followed by different letters indicate significant differences based on the BNJ test at a 95% confidence level.

Table 3 shows that the average stem diameter of mung bean plants at 14 DAS, 28 DAS, and 42 DAS was highest in the treatment with cow manure, measuring 0.21 cm, 0.31 cm, and 0.59 cm, respectively. This was significantly different from the treatment without manure but not significantly different from the treatments with chicken manure and goat manure. Meanwhile, the smallest stem diameter was observed in the treatment without manure, with values of 0.13 cm, 0.24 cm, and 0.51 cm, respectively. This was significantly different from the treatments with chicken manure, cow manure, and goat manure.

The diameter of the stem is a growth process resulting from the enlargement and differentiation of cells. The addition of several types of manure to the soil is suspected to increase the organic content in the soil. The significant differences between the treatments with different types of manure indicate that the manure provided is able to improve the physical, chemical, and biological properties of the soil. According to Hinarti et al (2012), organic matter contains several growth substances and vitamins that can be directly absorbed and stimulate plant growth.

The BNJ test results show that the treatment of cow manure provides better stem diameter and plant height growth compared to chicken manure and goat manure. According to Harsono (2009) in A. Malik, et al., 2021, the nutrient content in manure varies depending on its production level, type, the amount of food consumed, and the individual livestock. It is suspected that the application of cow manure is able to provide sufficient and balanced nutrients for the growth of green bean plants compared to chicken manure and goat manure. The nutrients absorbed by the plants are used for cell division and the formation of new cells to form plant organs such as leaves, stems, and roots, thereby facilitating the photosynthesis process. Additionally, it is suspected that the N, P, and K content in cow manure can meet the nutrient requirements needed by green bean plants, resulting in better growth. Hafizah and Fathnur et al (2022), stated that cow manure contains N, P, K, and organic C elements obtained from the mineralization of organic matter, which function in forming plant body tissues and carbohydrates. N nutrients are useful for forming proteins and chlorophyll, P as an energy source, K for protein and carbohydrate formation, and the micronutrients Fe and Zn to help with metabolism and vegetative growth of plants (Kurniastuti & Faustina, 2019).

3.3. Number of Pods per Plant

The analysis of variance on the number of pods per mung bean plant shows that the application of different types of manure has a highly significant effect on the number of pods per plant. The results of the BNJ 0.05 test on the effect of different types of manure on the number of pods per mung bean plant are presented in Table 4, as follows:

Table 4. Average Number of Pods per Plant (Pods Plant^{-1}) Under Different Manure treatments

Type of Manure	Number of Pods per Plant (Pods Plant^{-1})
P0 (No Manure)	38,20±4,84a
Chicken Manure)	52,93±4,84ab
P2 (Cow Manure)	60,93±2,21b
P3 (Goat Manure)	43,47±2,60a
BNJ 0,05	14,77

Note: Numbers followed by different letters indicate significant differences based on the BNJ test at a 95% confidence level.

Table 4 shows that the average number of pods per green bean plant was highest with the application of cow manure fertilizer, which was 60.93 pods, significantly different from the treatment without manure fertilizer and goat manure fertilizer, but not significantly different from the chicken manure fertilizer treatment. Meanwhile, the lowest number of pods per green bean plant was obtained in the treatment without manure fertilizer, which was 38.20 pods, significantly different from the cow manure fertilizer treatment but not significantly different from the chicken and goat manure fertilizer treatments. This is suspected to be due to the positive role of manure fertilizer in providing nutrients for the plants.

The availability of nutrients in the soil allows for proper plant growth and production. With better plant growth and development, more auxin growth hormones are produced, as auxin is formed from the amino acid tryptophan, which is also a product of photosynthesis. Plants with better growth and development can produce more flowers, which can result in more well-filled pods.

The application of manure fertilizer is also suspected to provide essential nutrients such as N and P, which play a role in pod formation. The availability of P helps facilitate the photosynthesis process, allowing the fertilizer to be absorbed by the plants for photosynthesis, leading to well-filled pods. Phosphorus is a key component for ATP formation, which is crucial in the photosynthesis process. This is consistent with the opinion of Fitter and Arista et al (2015) that adequate ATP will increase nutrient absorption by plants, thereby increasing pod yield.

3.4. Weight of 100 Seeds

The analysis of variance on the weight of 100 mung bean seeds shows that the application of different types of manure has a highly significant effect on the weight of 100 seeds. The results of the BNJ 0.05 test on the effect of different types of manure on the weight of 100 mung bean seeds are presented in Table 5, as follows:

Table 5. Average Weight of 100 Seeds (Grams) of Mung Bean Under Different Manure Treatments

Type of Manure	Weight of 100 Seeds (gram)
No Manure	4,33±0,33a
Chicken Manure	6,67±0,33b
Cow Manure	8,33±0,33c
Goat Manure	6,00±0,00b
BNJ 0,05	1,56

Note: Numbers followed by different letters indicate significant differences based on the BNJ test at a 95% confidence level

Table 5 shows that the average weight of 100 mung bean seeds was highest in the treatment with cow manure, which was 8.33 grams, significantly different from the treatments without manure, chicken manure, and goat manure. Meanwhile, the lowest weight of 100 mung bean seeds was found in the treatment without manure, which was 4.33 grams, significantly different from the treatments with chicken manure, cow manure, and goat manure. This is suspected to be due to the plants' ability to optimize the use of nutrients, water, growing space, and environmental conditions. Plant growth and production are determined by the rate of photosynthesis, which is controlled by the availability of nutrients and water. This condition causes the produced photosynthates to be focused on being transferred to the pods for their development and filling. Hinarti (2011) stated that the increase in seed weight in plants is in line with the improvement in photosynthesis efficiency and the rate of photosynthate translocation.

Growth data (Tables 1 and 2) show that the vegetative growth in the cow manure treatment was the best, resulting in a higher production of assimilates, and thus the weight of 100 seeds was the highest compared to the other treatments. Additionally, the energy generated from respiration during the generative phase was largely utilized for the improvement of pod and seed formation.

3.5. Dry Seed Weight Per Plot and Plant Productivity

The results of the BNJ 0.05 test on the effect of different types of manure on dry seed weight per plot and the productivity of mung bean plants are presented in Table 6, as follows.

Table 6. Average Dry Seed Weight Per Plot (Gram Plot^{-1}) and Productivity (Ton Ha^{-1}) of Mung Beans Under Various Manure Treatments

Type of Manure	Dry Seed Weight per Plot (Grams Plot^{-1})	Plant Productivity (Ton ha^{-1})
No Manure	149,22±12.13a	0,62±0.05a
Chicken Manure	216,78±3.04b	0,90±0.01b
Cow Manure	249,33±4.02b	1,04±0.017b
Goat Manure	194,11±5.91b	0,81±0.02b
BNJ 0,05	38,98	0,16

Note: Numbers followed by different letters indicate significant differences based on the BNJ test at a 95% confidence level.

Table 6 shows that the highest average dry seed weight per plot and mung bean plant productivity were obtained with the application of cow manure, amounting to 249.33 grams and 1.04 tons ha^{-1}. This was significantly different from the treatment without manure but not significantly different from the treatments with chicken manure and goat manure. Meanwhile, the lowest dry seed weight per plot and mung bean plant productivity were observed in the treatment without manure, with values of 149.22 grams and 0.62 tons ha^{-1}, which were significantly different from the treatments with chicken manure, cow manure, and goat manure. Good vegetative growth during the early phase continues into the generative phase.

The BNJ 0.05 test results indicated that the best effect on mung bean production components was observed with cow manure application, although it was not significantly different from chicken manure and goat manure. The application of organic materials through different manure types has varying effects on soil and plants. The production component observations showed that cattle manure application had the best effect. This is likely because cattle manure provided a nutrient supply that was more readily available and efficiently absorbed by the plants. According to Hakim, N. et al (1986) in (Amri et al., 2018), nutrients in manure become available through mineralization, increasing N, P, and K availability for plants. With sufficient N availability, plant organ growth is optimal, photosynthate production increases, and ultimately, plant productivity improves. Gardner & Pearce (1991) in Jakunda et al (2020) stated that nitrogen is a primary nutrient for plant organ growth as it is a component of amino acids, amides, and nucleoproteins, which are essential for cell division. Proper cell division supports plant growth since growth is characterized by an increase in size, volume, weight, and cell number.

Nitrogen plays a crucial role in plant growth, particularly as a chlorophyll precursor, amino acid component, and protein and enzyme producer. Additionally, a high nitrogen content accelerates assimilate translocation to the seed organs. The translocation of dry matter is highly influenced by the seed's ability to store assimilates. Sufficient assimilate availability in plants increases seed weight (Murbandono, 2000 in Syamsuwirman, et.al. 2023).

Potassium (K) is an essential nutrient needed after nitrogen in plant metabolism. Potassium acts as a catalyst in protein conversion into amino acids, is a carbohydrate precursor, regulates carbohydrate accumulation and translocation, and activates enzymes in photosynthesis. It increases seed size and fruit quality (Sumiati & Gunawan, 2007 in Rahim, 2012). Furthermore, potassium in soil plays a critical role in starch translocation, protein synthesis, and tissue development, strengthening plant structure to prevent leaf, flower, and fruit drop. Potassium deficiency leads to imperfect fruit growth, lower yields, and reduced storage durability. Potassium also regulates water status, turgor pressure, stomatal function, and carbohydrate translocation Akhtar et al (2002).

Phosphorus (P) is an essential nutrient that supports protein formation, mineral absorption, energy transport, root growth, flowering stimulation, and seed/fruit formation. The availability of phosphorus within plant organs enhances metabolism, especially during the seed-filling phase, increasing seed weight. Phosphorus is a key component of energy transfer molecules (ATP, nucleoproteins), genetic information carriers (DNA, RNA), cell membranes (phospholipids), and phosphoproteins (Lambers et al., 2008).

The availability of N, P, and K is crucial for increasing seed weight, as N forms proteins, which are essential for mung beans due to their high protein content. Sufficient nitrogen supply throughout growth is vital for optimal yield, especially during seed-filling, where N translocation to seeds occurs rapidly. According to Simanungkalit et al (2006), N, P, and K are required for pod development and filling, as N forms proteins, P supports seed formation, and K regulates carbohydrate growth, all contributing to increased seed weight.

The transition from vegetative to generative growth is partly determined by genetic traits and environmental factors such as temperature, light, water, and fertilizer. The addition of organic matter through manure application increases available nutrients, enhancing the photosynthesis process. A well-functioning photosynthesis system ensures that the photosynthates produced contribute to higher dry weight accumulation. Observations of mung bean dry weight showed that the highest productivity was obtained with cattle manure application, yielding 1.04 tons per hectare. Dry weight represents the accumulation of photosynthates from plant photosynthesis. To conduct effective photosynthesis, plants require sufficient nutrients. Prawiranata et al (1995) stated that dry weight reflects plant nutritional status. Higher nutrient absorption leads to improved plant physiology. Plant biomass includes photosynthesis products, nutrient uptake, and water absorption. Dry weight is an indicator of plant productivity, as 90% of photosynthesis products contribute to plant dry weight.

4. Conclusion

Based on the results and discussion of the research conducted, the following conclusions can be drawn:

1. The application of various types of manure has a significant effect on the growth and yield of mung bean plants.
2. The application of cow manure (P2) provides the best growth and yield of mung bean plants, with an average productivity of 1.04 tons ha^{-1}.

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