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The Effect of Cow Dung Manure Fertilizer on The Growth and Production of Cayenne pepper (*Capsicum annuum* var. cayenne)

Sudirman[1,*], Dini Hariyati Adam[1], Khairul Rizal[1]

Abstract

Cayenne pepper is a shrub that grows to a height of approximately 50–135 cm. This plant has an upright growth habit. Cayenne pepper has a primary taproot with lateral roots. Manure is decomposed animal waste, primarily from livestock, that is applied to agricultural land to enhance soil fertility and structure. The nutrient content of manure depends on its source material. This study aims to determine the effect of cow dung fertilizer on the growth and yield of cayenne pepper (Capsicum annuum var. cayenne). This study employs an experimental approach using a Completely Randomized Design (CRD). The collected data were statistically analyzed using the Kruskal-Wallis test. The results showed that cow dung fertilizer had a significant effect on plant height, number of fruits per plant, and fruit weight. However, the number of leaves showed significant differences among treatments, indicating that cow dung fertilizer influenced plant height, number of fruits, and fruit weight but had no effect on leaf count. The P4 treatment (150 g/polybag) was the most effective in promoting cayenne pepper growth.

Keywords: Cayenne Pepper, Manure, Cow Dung

1. Introduction

Cayenne pepper is a shrub that is only about 50-135 cm tall. This plant grows straight up. The roots of cayenne pepper are taproots. The roots of this plant are generally close to the surface of the soil and extend 30-50 cm vertically, cayenne pepper roots can penetrate the soil to a depth of 30-60 cm. The stem is stiff and does not have trichomes. The leaves are single leaves with stalks. The leaves are oval or oval-lanceolate in shape, with a pointed base and a narrowed tip. They are alternately located on the stem and form a spiral pattern (Christy et al., 2023).

(Alif, 2017) The cayenne pepper flowers are located at the tip or appear in the axils, with upright stalks. The cayenne pepper flowers emerge from the leaf axils. The color is white or greenish white, some are also purple. The flower crown consists of 4-7 strands and is star-shaped. Flowers can be single flowers or 2-3 located close together. This cayenne pepper flower is hermaphroditic (bisexual). The fruit is oval-elongated, the fruit is red, it tastes very spicy, with a tip that nods 1.5-2.5 cm. The cayenne pepper fruit grows upright pointing upwards. The young fruit is greenish white or dark green. When it is old it becomes yellowish green, orange, or bright red (Paulus A & Ellen G, 2016).

Chili pepper plants (Capsicum frutescens L.) are one of the plants that grow and develop in tropical and subtropical areas. Chili peppers are very suitable for planting in lowlands with an altitude of 200-500 meters above sea level (asl) (Zamrodah & Pintakami, 2020). According to (Prasetyo et al., 2024) based on the altitude, chili pepper plants can be cultivated in Indonesia in three areas, namely lowlands (0 - 200 m), middle plains (201-700 m) and highlands (≥ 700 m).

(Roidah, 2013) Organic fertilizers are manure and compost (green plants). Organic fertilizers are formed through cooperation between decomposing microorganisms and the weather and human treatment. The activities of soil organisms in the decomposition process are very important in the formation of organic fertilizers. Plant remains are destroyed by organisms and the elements that have been decomposed are bound into compounds. These compounds must of course be soluble in water so that they are easily absorbed by plant roots. The forms of these compounds include ammonium and nitrate. Some important microorganisms include: algae (chlorophyll microorganisms), fungi (non-chlorophyll microorganisms

*Correspondence: sdirman2181@gmail.com
1) Universitas LAbuhanbatu - Jl. SM. Raja Aek Tapa No.126 A KM 3.5, Bakaran Batu, Kec. Rantau Sel., Kab. Labuhanbatu, Sumatera Utara 21418, Indonesia

that obtain energy and carbon from organic materials), and bacteria. Bacteria play an important role in the decomposition process such as nitrification, sulfur oxidation, and nitrogen fixation (Musnamar, 2009).

(Sentana, 2010) The provision of organic fertilizers serves to increase the content of organic matter in the soil. Organic matter during decomposition by soil microorganisms forms products that function as binders of soil grains or granulation, soil grains so that the soil becomes looser. Organic matter functions as a source of nutrients.

Manure is processed animal waste, usually livestock, which is given to agricultural land to improve soil fertility and structure. The nutrients contained in manure depend on the source of the raw material manure (Prasetya, 2014). Livestock manure is rich in nitrogen and metal minerals such as magnesium, potassium, and calcium. However, the main benefit of manure is to maintain the physical structure of the soil so that the roots can grow well. Therefore, manure is very good for use in cultivating cayenne pepper plants. Cow manure is relatively cheaper compared to the price of inorganic fertilizers on the market. Organic fertilizer is the main priority in plant cultivation. Organic fertilizer occurs due to the decomposition process or the decomposition of complex compounds into simple ones by microbes. In the long term, organic fertilizer can increase the humus content in the soil. The soil structure that is given organic fertilizer becomes looser and more fertile and stores more water to overcome drought (Sentana, 2010).

The nutrient content in cow dung is very beneficial, namely as a plant nutrient so that its growth is better. Among the types of manure, cow dung manure has a high fiber content such as cellulose, this is proven by the results of measuring the C/N ratio parameter which is quite high > 40. Cow dung manure is beneficial for plants, namely providing macro- and micro-nutrients to plants and increasing plant growth. In addition, cow dung manure is easily obtained by farmers Sutedjo in (Ramadani et al., 2024). Cow dung manure is one of the organic materials that can be used as fertilizer and a mixture of planting media. Cow dung manure contains a number of nutrients that can improve the physical, chemical and biological properties of the soil. In addition to contributing nutrients and increasing the efficiency of fertilization and nutrient absorption for plant production. The availability of nutrients is very important in the process of plant metabolism. The effect of adding cow dung manure to the planting medium will increase soil porosity which is related to soil aeration and water content in the planting medium. Nutrients in the planting medium will dissolve in water and then be absorbed by the plant roots (Suwahyono, 2011).

(Pangaribuan et al., 2022) Cow dung is livestock waste that is processed into manure. Organic matter in cow dung can be decomposed by bacteria into inorganic compounds. Cow dung is called cold manure, the process of change is slow. The slow decomposition process is caused by physical properties that contain a lot of water and mucus. Mucus when exposed to air will become crusty and the outside will dry out, this causes the oxidation process to run slowly because air and water have difficulty entering it (Hartatik & Widowati, 2006).

According to (Arifah, 2013) manure can add nutrients to the soil and encourage the life of soil microorganisms. Nutrients are divided into two, including macro nutrients needed by plants in large quantities, including Nitrogen which functions as a synthetic material for chlorophyll, protein and amino acids, Phosphorus which functions to regulate overall plant growth and Potassium which functions as a photosynthesis process, translocation and carbohydrate transportation. Micro elements are needed by plants in relatively small amounts, including Iron (Fe) which functions to form chlorophyll, Manganese (Mg) which functions to form protein and vitamin C, Zinc (Zn) which functions to form vegetative growth and seed or fruit growth (Jannah et al., 2012).

The formulation of the problem in this study is how does the provision of cow dung fertilizer affect the growth and production of cayenne pepper plants (Capsicum annuum var. cayenne.)? The purpose of this study is to determine the effect of providing cow dung fertilizer on the growth of cayenne pepper plants (Capsicum annuum var. cayenne.) and to determine the effect of providing cow dung fertilizer on the production of cayenne pepper plants (Capsicum annuum var. cayenne.). Based on the background above, this study is entitled The Effect of Providing Cow Dung Fertilizer on the Growth and Production of Cayenne Pepper".

2. Material and Methods

This research was conducted on Jl. Padang Maninjau, Kampung Pajak Village, Na IX-X District, North Labuhanbatu Regency. Coordinate point: 2 degrees 31 minutes 87000 second north, longitude 99 degress 25 minutes 46.500 second east/3,6600000 degress north 99,764863 degress east.

Figure 1. Location of sampling area of Cayyenes in Padang Maninjau

Cow dung manure is one of the organic materials that can be used as fertilizer and a mixture of planting media. Cow dung manure contains a number of nutrients that can improve the physical, chemical and biological properties of the soil. In addition to contributing nutrients and increasing the efficiency of fertilization and nutrient absorption for plant production. The availability of nutrients is very important in the process of plant metabolism. The effect of adding cow dung manure to the planting media will increase soil porosity related to soil aeration and water content in the planting media. The nutrients in the planting media will dissolve in water and then be absorbed by the roots of the plant. The research flow diagram can be seen in figure 2.

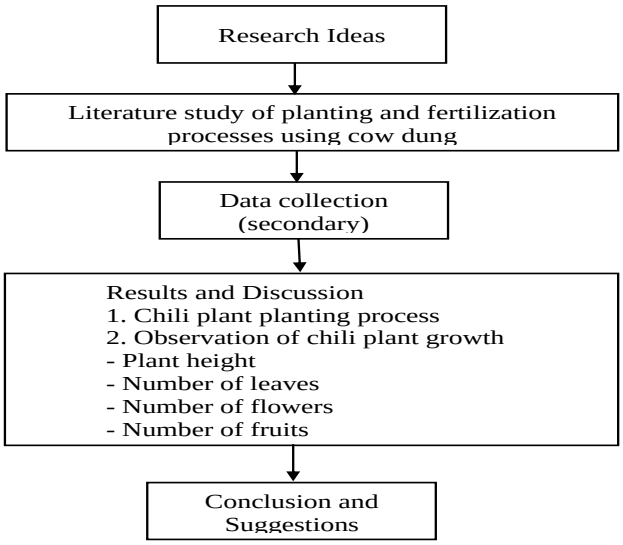

Figure 2. Research Flow Diagram

This research was conducted from December 2024 to April 2025. The tools used in this study are as follows: polybags (35x35), rulers, buckets, hoes, scales, bamboo and nails. The materials used in this study are as follows: cayenne pepper seedlings, soil, 90% paranet, cow dung manure This study used a single factor Randomized Block Design (RAK), grouping based on seedling height. The factors studied were the doses of cow dung fertilizer at 6 levels, namely:

p0 = 0 g/polybag
p1 = 40 g/polybag
p2 = 80 g/polybag
p3 = 100 g/polybag
p4 = 150 g/polybag
p5 = 200 g/polybag

Each treatment was repeated 4 times, so that there were 24 experimental units and each experimental unit consisted of 4 sample plants. Observations were made on plant height, number of leaves, number of fruits per plant, and weight of fruit per plant.

3. Results and Discussion

3.1. Chili Pepper Growth

3.1.1. Plant Height

Chili pepper plant height was measured with a ruler or ruler starting from the base of the stem (± 1 above the planting medium) to the apical shoot growth point. Plant height measurements were carried out once a week. Based on the results of the analysis, it showed that the application of cow dung fertilizer affected the height of chili pepper plants. The results of observations showed that there was an increase in the average plant height in each treatment, especially the P4 treatment which had a significant difference compared to other treatments. The results of observations of the average plant height are presented in Table 1.

Table 1. Average Plant Height

Treatment	Plant height cm				Average
	14hst	21hst	28hst	35hst	
P0	7,12	9,62	13,38	16,40	11,33
P1	8,21	10,63	15,28	20,65	13,69
P2	8,63	11.82	17,54	21,23	14,80
P3	10,25	12,62	19,63	23,21	16,42
P4	12,63	14,60	20,54	24,51	18,07
P5	10,45	12,52	18,62	21,82	15,85

Description: Numbers followed by the same letter in a column are not significantly different at the 5% level in the Duncan test.

Table 1 shows the results of the height of cayenne pepper plants that differ for each treatment. The increase in plant height shows that cayenne pepper plants always experience growth every time an observation is made. The data was analyzed using the Kruskal Wallis test with a significance level (α) of 0.05 using the following version of SPSS (Table 2).

Based on the analysis results obtained with a significant value of 2.724> p (0.05), which means that cow dung fertilizer influences plant height (cm).

Table 2. Results of the Kruskal Wallis Test for Plant Height

	Plant height
Chi-Square	2.375
Df	23
Asymp. Sig.	2.724

Source: Research Results, 2025

Table 3. Effect of cow dung fertilizer dosage on cayenne pepper plant height (cm) based on weekly observations

Treatment	Week								
	I	II	III	IV	V	VI	VII	VIII	IX
P1	15.67± 4.20	17.17± 3.50	19.00± 3.80	20.5± 4.10	21.63± 5.30	24.93± 4.40	30.00± 5.20	33.03± 3.90	35.83± 3.30
P2	15.60± 0.40	16.37± 0.70	17.57± 1.40	20.83± 1.30	23.90± 2.10	28.50± 3.10	33.67± 3.80	39.67± 4.40	45.83± 2.80
P3	15.40± 1.90	17.13± 1.80	19.23± 1.30	21.20± 2.30	21.67± 3.50	24.43± 5.90	30.33± 8.60	35.30± 10.70	40.00± 11.10
P4	18.23± 1.60	19.60± 1.40	21.50± 1.30	24.43± 2.90	25.67± 5.10	29.67± 7.50	34.50± 8.50	39.30± 10.80	44.00± 10.90
P5	15.73± 2.90	17.97± 2.50	21.03± 2.30	25.40± 2.00	28.17± 1.90	33.07± 6.20	39.87± 5.10	44.37± 5.30	47.50± 5.00

Description: The average value followed by different letters indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

3.1.2. Number of leaves

The results of the observation showed that there was an increase in the average number of leaves in each treatment. The increase that occurred did not experience a significant difference for each treatment. The results of the observation of the average number of leaves are presented in Table 4.

Table 4. Average Number of Leaves

Treatment	Number of Leaves (Shells)				Average
	14hst	21hst	28hst	35hst	
P0	4	4	4	4	4
P1	4	4	5	5	4,5
P2	4	4	4	5	4,25
P3	4	4	4	4	4
P4	5	5	5	5	5
P5	4	4	4	5	4,25

Description: Numbers followed by the same letter in a column are not significantly different at the 5% level in the Duncan test.

Table 4 shows the results of the number of cayenne pepper leaves that vary for each treatment. The increase in the number of leaves indicates that cayenne pepper plants experience slow growth each time an observation is made. The data were analyzed using the Kruskal Wallis test with a significance level (α) of 0.05 using the following version of SPSS (Table 5).

Based on the analysis results obtained with a significant value of 0.921 < p (0.05) which means that cow dung fertilizer does not have a significant effect on the number of leaves (strands).

Table 5. Results of the Kruskal Wallis Test Number of Leaves

	Number of Leaves
Chi-Square	5.825
Df	23
Asymp. Sig.	0.921

Source: Research Results, 2025

Table 6. Effect of cow manure dose on the number of leaves (strands) of cayenne pepper in weekly observations

Treatment	Week								
	I	II	III	IV	V	VI	VII	VIII	IX
P1	7±0.60	9±1.00	11±2.30	11±2.30	11±2.10	50±2.70	76±1.00	100±10.00	105±15.00
P2	8±1.70	9±1.70	10±1.50	13±1.50	18±5.80	26±5.70	44±11.00	66±21.50	81±25.40
P3	8±0.60	9±1.00	10±1.70	10±2.00	10±2.00	30±16.00	44±19.70	60±33.40	66±40.10
P4	7±0.60	9±1.50	11±2.90	13±4.60	15±6.10	24±8.60	33±13.70	42±11.00	50±7.60
P5	8±0.60	9±1.50	11±1.50	12±1.70	13±2.00	39±16.10	56±23.00	60±22.50	68±27.70

Description: The average value followed by different letters indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

3.2. Chili Pepper Production

The parameters of chili pepper plant production in this study were the number of fruits per plant, and the weight of the fruit per plant.

3.2.1. Number of Fruits Per Plant

Observation data on the number of fruits showed that the application of cow dung fertilizer had a significant effect on the number of fruits per plant. The average when the number of fruits per plant is presented in Table 7.

The calculation of the number of fruits was carried out after the chili fruit grew. It can be seen in table 5 that the growth of the number of fruits on cayenne pepper plants increased every time the calculation was carried out. After obtaining the results of the calculation of the number of fruits, the data was analyzed by the Kruskal Wallis test as follows (Table 8).

Based on the analysis results obtained with a significant value of 5.342 < p (0.05) which means that cow dung fertilizer has an effect on the number of cayenne

peppers (Table 9).

Table 7. Results of the Average Difference Test for the Number of Chili Pepper Fruits Per Plant

Treatment	Average Number of Fruits Per Plant
P0	7,85 [a]
P1	8,05 [a]
P2	15,63 [b]
P3	16,17 [b]
P4	18,72 [c]
P5	8,95 [a]

Description: The average value followed by different letters indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

Table 8. Results of the Kruskal Wallis Test Number of Fruits

	Average Number of Fruits
Chi-Square	8.006
Df	23
Asymp. Sig.	5.342

Source: Research Results, 2025

Table 9. Effect of cow dung fertilizer on the number of cayenne pepper fruits

Treatment	Number cayenne pepper fruits	Average
P1	7±2.50	7±4.25
P2	16±9.20	13±11.25
P3	5±7.20	4±5.05
P4	12±11.00	13±13.00
P5	11±8.30	11±8.05
Average	10±7.64	

Description: The average value followed by different letters indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

3.2.2. Plant Fruit Weight

Observation data on fruit weight per plant and analysis results show that the application of cow dung fertilizer has a significant effect on fruit weight per plant. The average fruit weight per plant is presented in Table 10

Table 10. Results of the Average Difference Test for Fruit Weight Per Plant

Treatment	Average Amount of Fruit Weight Per Plantation
P0	11,52 [a]
P1	12,53 [a]
P2	22,63 [b]
P3	23,45 [b]
P4	28,72 [c]
P5	12,95 [a]

Note: The average value followed by a different letter indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

The calculation of fruit weight per plant was carried out after the chili fruit grew. It can be seen in table 10 that the growth of fruit weight in cayenne pepper plants increased every time the calculation was carried out. After obtaining the results of the fruit weight calculation, the data was analyzed using the Kruskal Wallis test as follows

Table 11. Results of the Kruskal Wallis Test Fruit Weight

	Fruit Weight
Chi-Square	3.035
Df	23
Asymp. Sig.	7.825

Source: Research Results, 2025

Based on the results of the analysis obtained with a significant value of 7.825 < p (0.05) which means that cow dung fertilizer has a significant effect on the weight of cayenne pepper fruit.

Table 12. Effect of cow dung fertilizer on the number of cayenne pepper fruits

Treatment	Weight cayenne pepper fruits	Average
P1	4.75±2.30	3.58±2.25
P2	6.84±4.00	5.89±5.85
P3	2.43±3.80	1.56±2.50
P4	5.13±4.50	6.39±6.40
P5	7.54±6.20	5.58±4.60
Average	5.34±4.16	

Description: The average value followed by different letters indicates that the treatment is significantly different based on the Duncan Test at the 5% level.

3.3. Discussion

3.3.1. Plant Height

In this study, the growth variables are plant height and number of leaves, while the results are the number of fruits per plant and the weight of fruit per plant. For the observation parameter of plant height, the results were not influential. This is related to the results of the analysis of cow dung fertilizer where the N content is low, namely 0.84% (Balitra, 2013), while the N element is very much needed by plants, especially during the vegetative period because it stimulates plant growth.

3.3.2. Number of Leaves

Based on the results of the analysis of the number of cayenne pepper leaves aged 5,6,7,8 weeks did not show a response to the provision of cow dung fertilizer because the roots of the cayenne pepper are still shallow and have not been able to absorb nutrients optimally, so that the nutrients contained in cow dung cannot be utilized by plants. P plays a role in improving plant root growth. Root density can be stimulated by P although not as good as nitrate. However, in terms of stimulating the growth of lateral root elongation, P plays a bigger role than N.

3.3.3. Number of Fruit and Fruit Weight

The results of the analysis showed that the provision of cow dung fertilizer on the number of fruits and fruit weight per cayenne pepper plant had a significant effect. Based on further tests for these variables, the best treatment was also obtained with a dose of P4 = 150 g/polybag. In the plant

body, P plays a role in almost all biochemical reaction processes. The role of P is in the process of capturing sunlight and then converting it into biochemical energy. P is a component of plant cell membranes, a component of enzymes, nucleotides (components of nucleic acids), P also functions in the process of protein synthesis, especially those found in green tissue, carbohydrate synthesis, and stimulating flower formation (Wijaya, 2008). The process of fruit formation is influenced by the pollination process as well as sufficient nutrients. The number of fruits is influenced by the provision of cow dung fertilizer. Photosynthate produced through the process of photosynthesis is translocated to the fruit. In addition to phosphate, the availability of sufficient nitrogen is very necessary for the formation of flowers, fruits and improving fruit quality. In cow dung manure, the content of organic N, P, K and C elements obtained from the mineralization process of organic materials functions as the formation of plant body tissue and carbohydrates. This element is absorbed by plant roots (HPO4 2- or H2PO4 - ions mainly move towards the roots due to diffusion) then transported throughout the plant, especially the stem for the formation of branches, flowers and fruits. After the fruit is formed, this element also plays a role in the weight of the fruit to form proteins, minerals and carbohydrates in the fruit, the weight of the fruit is an indication of the results of photosynthesis stored in the fruit flesh and other parts of the fruit.

4. Conclusion

The research results indicate that the application of cow dung fertilizer has a significant effect on plant height, number of fruits per plant, and fruit weight per cayenne pepper plant. Leaf count measurements show significant differences among treatments. The optimal dose of cow dung fertilizer for cayenne pepper growth and yield was found at 150 g/polybag. In plants, phosphorus (P) plays a role in nearly all biochemical reactions. It is essential for capturing sunlight and converting it into chemical energy. Phosphorus (P) is a key component of plant cell membranes, enzymes, and nucleotides (which are components of nucleic acids). Additionally, P plays a crucial role in protein synthesis, particularly in green tissue, carbohydrate synthesis, and flower formation.

Based on the conclusion above, applying 150 g/polybag of cow dung fertilizer is recommended for cayenne pepper cultivation.

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