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The Effect of Using Various Doses of Organic Cow Manure Fertilizer on the Growth and Production of Green Bean Plants

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A B S T R A C T

This research is in the form of an experiment that aims to determine the effect of using various organic fertilizers of cow dung on the growth and production of green bean plants carried out in Kanco Village, Cina District, Bone Regency and its implementation began in March to May 2023. This experiment was arranged based on a Randomized Block Design (RAK) consisting of 4 treatments, each repeated 3 times, in 1 plot there were 96 plants. Sampling was taken from 30% of the middle plants, so there were 5 plants. In this experiment there were 12 plots, so that 60 plants would be studied. The results of the experiment showed that the effect of using various doses of organic fertilizers of cow dung on fertilizer treatment with a dose of 5 tons/Ha or 3000 grams/plot showed the highest results of all parameters observed and for the production of sample plants was 15.54 grams and production per plot 1.49 kg

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INTRODUCTION

Green beans are one of the short-lived seasonal plants of approximately 60 days. This plant is also called mungbean, green gram, or golden gram. According to Atman (2013) in the world of plants this plant is classified as follows:

Kingdom : Plantae
Division : Spermathophyta
Subdivision : Angiospermae
Class : Dicotyldonae
Family : Papilionaceae
Genus : Vigna
Species : Vigna radiata L or Phaseolus radiatus L.

Green Bean Plant Morphology

Green bean plants have upright stems with varying heights, between 30-60 cm, depending on the variety. The branches are sideways on the main stem, round, and hairy. The color of the stem and branches is green and purple (Atman, 2013).

The leaves are trifoliate (consisting of three strands) and are alternately arranged. The leaf stalks are quite long, longer than the leaves. The color of the leaves is light green to dark green. Green bean flowers are yellow, arranged in bunches, emerging on branches and stems, and can self-pollinate (Atman, 2013). Green bean pods are cylindrical with a length of between 6-15 cm and usually have short hairs. When young, the pods are green and when old they are black or brown. Each pod contains 10-15 seeds (Atman, 2013).

Green bean seeds are smaller than other legume seeds. The color of the seeds is mostly dull green or shiny green, some are yellow, brown, and black. Mung bean plants have tap roots with branch roots on the surface (Atman, 2013).

Growth Requirements

Soil

The soil texture that is suitable for mung bean plants is loamy clay containing lots of organic matter, good aeration and drainage. Loose soil structure and pH 5.8 - 6.5 (Atman, 2013).

Climate

The optimal rainfall for mung bean plants is 50-200 mm/month. Temperature 25-27 0C with air humidity of 50-80% and sufficient sunlight (Atman, 2013).

Organic Fertilizer

The action of giving fertilizer aims to maintain the availability of nutrients. Organic fertilizer is a fertilizer that is mostly or entirely composed of organic materials derived from plants and/or animals that have gone through an engineering process, can be in solid or liquid form which is used to supply organic soil materials, improve the physical, chemical, and biological properties of the soil (Faisal Matenggomena, 2013).

Balanced fertilization is a combination of inorganic fertilizers and organic fertilizers. The practical meaning is fertilization by considering the type,

amount, method, and time. Fertilization, according to soil fertility and plant needs to obtain optimal harvest results (Faisal Matenggomena, 2013).

By using organic fertilizers or returning organic materials to the soil will affect soil fertility so that there is an increase in agricultural production, efficiency of fertilizer use and maintaining environmental sustainability (Faisal Matenggomena, 2013).

The raw materials for organic cow dung fertilizer consist of cow dung, urea, sawdust, rice dregs in the form of ash, agricultural lime and nutrients in the form of Stardec bacteria. Then the ingredients are mixed together and covered for 4 weeks, occasionally the mixture is turned over to be aired (Faisal Matenggomena, 2013).

The benefits of organic cow dung fertilizer are that it can replace the use of chemical fertilizers or reduce production costs, is free from wild plant seeds (weeds), is odorless and easy to use, provides balanced nutrients in the soil, increases the population of soil microbes so that the soil structure remains loose, improves soil pH, and increases the production of various plants between 10-30% (Faisal Matenggomena, 2013).

The benefits of Stardec are to change livestock waste into high-quality organic fertilizer at a low cost. Stardec is a decomposer for making compost, where these microbes as workers are used to process livestock waste into super quality fertilizer. The main function of Stardec, the content contained in Stardec products for biocompost is thermophilic microbes, thermophilic microbes in stardec are useful as converters or decompose livestock waste into compost at high temperatures. Another advantage of Stardec is that it can compost in an aerobic environment and does not require sugar to awaken its microbes from normal conditions (Sandi Maulana, 2013).

LITERATURE REVIEW

Land Preparation

A week before, a plot is made for the plants, then the soil is mixed with fertilizer according to the specified dosage. The area of each plot is 2 meters x 3 meters and is given a label that has been previously determined.

Planting

After land preparation is complete, planting is carried out using a 3-4 cm deep digger and each hole is filled with 2 seeds with a distance of 25 cm x 25 cm.

Maintenance

a. Watering and Replanting

Watering is carried out in the morning and evening depending on the weather. Replanting is carried out one week after planting, and if there are plants that die, they are replaced using reserve seeds that have been prepared.

b. **Fertilization**

Basic fertilizer is given two days after planting with a dose of ZA = 50 Kg/ha = 0.31 grams/planting x 96 = 29.76 grams/plot, SP-36 = 75 Kg/ha = 0.46 grams/planting x 96 = 44.16 grams/plot, and Kcl = 75 Kg/ha = 0.46 grams/planting x 96 = 44.16 grams/plot. Then organic fertilizer is given before

planting, given according to the treatment while basic fertilizer (not treatment) is given at planting time, together with planting by digging.

c. Pest and Disease Control

The main green bean diseases include powdery mildew (Erysiphe polygoni), leaf spots (Cercospora canescens), and pustule disease (Elsinoe glycines).

The main pests of green beans are: brown ladybugs (Riptortus lineari), green bean flies (Agromyza phaseoli), green ladybugs (Nezara viridula), caterpillars (Plusia chalcites), pod borers (Maruca testutalis), and (Etiella zinckenella).

Diseases and pests, control should be carried out by referring to the principles of Integrated Pest Management (IPM), namely the use of pesticides is carried out as a last step when other IPM actions do not provide good results.

Observations

The parameters observed include:

a. Plant height (cm) measured 14 days after planting and 28 days after planting

b. The number of pods is calculated each time a crop is harvested.

c. Dry seed weight per sample plant.

d. Dry seed weight per plot.

METHODS

This experiment was arranged based on a Randomized Block Design (RAK) consisting of 4 treatments, each repeated 3 times, in 1 plot there were 96 plants. Sampling was taken from 30% of the middle plants, so there were 5 plants. In this study there were 12 plots, so that 60 plants would be studied. The treatments studied were as follows:

P_0: Without fertilizer use

P_1: Dosage of cow dung fertilizer 3 tons/Ha or 1800 grams/plot

P_2: Dosage of cow dung fertilizer 4 tons/Ha or 2400 grams/plot

P_3: Dosage of cow dung fertilizer 5 tons/Ha or 3000 grams/plot

Each treatment was placed in each plot that had been provided.

RESULTS

Plant height 14 days after planting

The average plant height and its variance are presented in Appendix Tables 1a and 1b. The variance analysis shows that the effect of using various doses of organic cow dung fertilizer showed a very significant effect on the parameters of the height of green bean plants at the age of 14 days after planting.

The BNT test in the Table shows that the fertilizer treatment of 5 tons/Ha or 3000 grams/plot gave the highest plant height (34.79). While the treatment without treatment (0 tons/ha) gave the lowest plant height (30.51).

Table 1. Average Plant Height (cm) at the Age of 14 Days After Planting

Treatment	Average	NPBNT (0,05)
Without Treatment (P0)	30.51 b	1.35
3 ton/Ha (P1)	33.76 b	
4 ton/Ha (P2)	34.10 a	
5 ton/Ha (P3)	34.79 a	

Description: Numbers followed by the same letter are not significantly different at the 0.05 test level.

Plant height at 28 days after planting

The average plant height and its variance are presented in Appendix Tables 2a and 2b. The variance analysis shows that the effect of using various doses of organic cow dung fertilizer shows a very significant effect on the height of green bean plants 28 days after planting.

The BNT test in Table 2 shows that the treatment of fertilizer doses of 5 tons/Ha or 3000 grams/plot gives a plant height of (61.08). While the treatment without treatment (0 tons/ha) gives the lowest plant height (53.82).

Table 2. Average Plant Height (cm) at 28 Days After Planting

treatment	Average	NPBNT (0,05)
Without Treatment (P0)	53.82 b	1.93
3 ton/Ha (P1)	56.52 b	
4 ton/Ha (P2)	58.76 b	
5 ton/Ha (P3)	61.08 a	

Description: Numbers Followed by the Same Letter are not Significantly Different at the 0.05 Test Level

Number of Pods Per Plant

The average number of pods per plant and its variance are presented in Appendix Tables 3a and 3b. The variance analysis shows that the effect of using various doses of organic cow dung fertilizer shows a very significant effect on the growth and production of green bean plants.

The BNT test in Table 3 shows that the treatment of a fertilizer dose of 5 tons/Ha or 3000 grams/plot gave the highest number of pods (28.87). While the treatment without treatment (0 tons/ha) gave the lowest number of pods (23.40).

Table 3. Average Number of Pods Per Plant (pods).

Treatment	Average	NPBNT (0,05)
Withour Treatment (P0)	23.40 b	1.79
3 ton/Ha (P1)	25.07 b	
4 ton/Ha (P2)	27.07 a	
5 ton/Ha (P3)	28.87 a	

Description: Numbers Followed by the Same Letter are not Significantly Different at the 0.05 Test Level

Dry Seed Production Per Sample Plant

The average dry seed production results per sample plant and its variance analysis are presented in Appendix Tables 4a and 4b. The variance analysis shows that the effect of various doses of organic cow dung fertilizer shows a very significant effect on dry seed production per sample plant.

The BNT test in Table 4 shows that the treatment of fertilizer doses of 5 tons/Ha or 3000 grams/plot gave the highest amount of dry seed production (15.54). While the treatment without treatment (0 tons/ha) gave the lowest amount of dry seed production (23.40).

Table 4. Average Seed Weight Production Per Sample Plant (grams)

treatment	Average	NPBNT (0,05)
P0	13.34 b	0.71
P1	13.94 b	
P2	15.07 a	
P3	15.54 a	

Description: Numbers Followed by the Same Letter are not Significantly Different at the 0.05 Test Level

Dry Seed Production Per Plot

The average results of observations of green bean seed weight production per plot and its variance analysis are presented in Appendix Tables 5a and 5b. The variance analysis shows that the effect of various doses of organic cow dung fertilizer shows a significant effect on dry seed production per plot.

The results of the BNT test at the 0.05 level show that the effect of various doses of organic cow dung fertilizer shows that treatments P0 and P1 are significantly different from treatments P2 and P3 on the parameters of green bean seed weight production per plot.

Table 5. Average Seed Weight Production Per Plot (kg)

treatment	Average	NPBNT (0,05)
P0	1.28 b	0.13
P1	1.34 b	
P2	1.45 b	
P3	1.49 a	

Description: Numbers Followed by the Same Letter are not Significantly Different at the 0.05 Test Level

DISCUSSION

Based on the results of the research that has been carried out, it shows that the use of various doses of organic cow dung fertilizer has a very significant effect on plant height 14 and 28 days after planting, the number of pods, production per sample plant and production per plot (Tables Appendix 1,2,3,4 and 5).

The BNT results at the 0.05 level show that the treatment of organic cow dung fertilizer doses of 5 tons/Ha or 3000 grams/plot has a very good effect on all observed parameters. Organic cow dung fertilizer is one of the solid organic fertilizers circulating in the community, because its existence is so widespread in the community. Organic cow dung fertilizer contains various types of nutrients, both macro and micro, which come from organic materials that can improve the physical, chemical, and biological properties of the soil and are environmentally friendly. This is in line with the opinion of Setyamadjaja (2010), organic materials (organic fertilizers) function to improve the physical properties of the soil, improve soil structure, the ability to absorb rainwater, the ability to bind water, the air system of the soil against erosion.

The dose of organic fertilizer of cow dung in the treatment of 5 tons/Ha or 3000 grams/plot gave the best results. This is suspected with a dose of organic fertilizer of cow dung of 5 tons/Ha or 3000 grams/plot is able to meet the nutrient needs of green bean plants to stimulate growth and production because sufficient and balanced nutrients are available. In addition, the provision of solid organic fertilizer with a higher dose contains a high amount of nutrients, so it will increase plant photosynthesis to form plant organs. This is in line with the opinion of AAK (2010), that the availability of nutrients affects plant growth. The provision of organic fertilizer of cow dung in the P0 treatment showed the lowest results of all treatments. This is because the nutrients needed by plants to produce optimally are not available in sufficient quantities, thus affecting plant growth. According to Goeswono Soepardi (2011), for normal growth a plant requires nutrients and if these components are in sufficient and balanced condition, the cell division process will take place quickly. This is in line with Sri Setyati's opinion (2011) that nutrients are used by plants for their growth and development. Plant physiological processes require the availability of nutrients to provide high yields. Nutrients that are less available can inhibit plant growth and production.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the results obtained, it can be concluded that, the treatment of 5 tons/Ha or 3000 grams/plot showed the highest results of all observed parameters. The highest dry seed production per sample plant was 15.54 grams and dry seed production per plot was 1.49 kg.

Suggestions

1. To obtain the best and environmentally friendly growth and production, it is expected to use organic fertilizer.
2. To obtain high production, a dose of 5 tons/Ha or 3000 grams/plot is used.
3. It is also expected to be used as information material to be used as a reference in further experiments.

FURTHER STUDY

Every research is subject to limitations; thus, you can explain them here and briefly provide suggestions to further investigations.

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