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The Study of Biodive and Cow Fertilizer Composition on Bean Growth and Production (*Phaseolus Vulgaris* L.)

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ABSTRACT

In agricultural cultivation technology, there are very influential limiting factors on plant growth and yield, one of which is the presence of fertilization. This research aims to study the composition of Bio fertilizer and Cow manure fertilizer application bean's growth and yield. This research was conducted from February 25th, 2022 to May 22th, 2022 at Seed Garden of Food Crops and Horticulture Tawangmangu (TPH) Tawangmangu, Karangpandan District, Karanganyar Regency with an altitude place of 1100 meters above sea level and Latosol soil. This research method uses a single factor randomized complete block design (RCBD) consisting of 6 kinds of experiments and each was repeated 4 times in order to obtain 24 kinds trial. The variables used are length of plant, number of leaves, length of root, fresh weight of biomass, dry weight of biomass, the number and weight of pods. The results of this research showed that the composition of biofertilizer and cow fertilizer application has no effect on bean's growth and yield.

Keywords: Beans, Composition, Fertilizer, Growth, Yield

INTRODUCTION

Beans are one type of plant that has many benefits. As a vegetable ingredient, the chickpea pods can also be consumed as it young or as seeds. Beans are not originally from Indonesia, it come from South Mexico and Central America. Beans that are cultivated by people in Indonesia have many types. Among of these, the chickpea plant is broadly divided into two types, called the vine chickpea type and the upright chickpea (Rindiani & Murtalaksono, 2019). The leguminaceae family is a family of legumes that has many species, one of these is chickpea which is categorized as a type of fruit-shaped vegetable (Supandji et al., 2020).

Along with the increasing public demand for beans, the production of beans in Indonesia is still lacking. This condition requires efforts to increase the beans' productivity, one of which is through fertilization. According to Kusumiyati (2016), fertilization is one of the efforts to increase the supply of nutrients needed by plants for boosting the yields' production and quality.

The cultivation of chickpeas would be better when using organic fertilizers as an alternative to inorganic fertilizers through the use of biological and organic fertilizers. By using biological fertilizers, it is expected to reduce the use of inorganic fertilizers and increase the beans' production every year in maintaining the community's needs for beans.

Two types of fertilizers that can be used are biological and organic fertilizers. Biological fertilizers are inoculants made from active living organisms that has a function to bind certain nutrients or facilitate the availability of nutrients in the soil for plants. The microorganisms in biological fertilizers, especially those related to N and P nutrients are two main nutrients that are needed by plants. The use of biological fertilizers are able to increase the efficiency of organic fertilizers that are needed by plants through the use of N fixing bacteria and P solubilizing bacteria. These biological fertilizers are able to boost the fertilization, fertility and soil health efficiency (Setiawati et al., 2017). The organic fertilizers have advantages when compared to inorganic fertilizers. The use of organic fertilizers in soil will improve the environment for plant growth through cultivated aggregates, water, aeration, temperature and root penetration. Through these improvements, the water and soil air system can be maintained in a balanced manner (Kusumiyati et al., 2016).

Manure is fertilizer that comes from livestock cages, either in the form of solid manure (faeces) mixed with food waste and urine (urine) such as cows, pigs, goats and chickens. Manure is one of the fertilizers that can maintain the soil moisture for a long time period, even though the nutrients contained in manure are lacking.

Cow manure is a solid fertilizer which contains a lot of water and mucus. This fertilizer is a cold type of fertilizer that the decomposition process is very slowly that caused no heat is formed. This happens because cow manure hardens quickly and is difficult for water and air to penetrate. Cow manure has a low C/N ratio of

11. This means that cow manure contains a lot of nitrogen that very useful for fertilize the soil. The nitrogen reduction in soil is a problem in maize cultivation that can cause production decrease (Aulianta et al., 2022). In 1 ton of cow manure there is 1.5 kg of N; 2.0 kg P₂O₅; 4.0 k K₂O and 0.8 kg Mg. Adriani and Syahfari (2017) stated that giving cow compost at a 15 tons/ha dose gave the best effect on the growth and production of mustard greens at 28.72 tons/ha.

It is necessary to conduct the research on the composition of biological fertilizer and cow manure on beans growth and yield of beans (*Phaseolus vulgaris* L). This research aims to know whether the additional of biological and cow manure has the impact on beans grows and its weight, number of leaves, root height when harvest time.

RESEARCH METHODOLOGY

This research used a single factor Completely Randomized Block Design which consisted of 6 kinds of experiments and each was repeated 4 times. Then, the 24 kinds of experiments were obtained. One of the advantages of the completely randomized block design is that the experimental units available for use are as homogeneous as possible in each block. In other words, there is no source of variation that can be recognized among the experimental units under any grouping or arrangement (Suparman et al., 2020)

A: Control

B: PH Bioboost 100% (20 ml/l water), 0% cow manure (0 cow manure per plot)

C: PH Bioboost 75% (15 ml/l water), 25% cow manure (0.375 kg cow manure per plot)

D: PH Bioboost 50% (10 ml/l water), 50% cow manure (0.750 kg cow manure per plot)

E: PH Bioboost 25% (5 ml/l water), 75% cow manure (1,125 kg cow manure per plot)

F: PH Bioboost 0% (0 ml/l water), 100% cow manure (1,500 kg cow manure per plot)

The data obtained were analyzed by analysis of variance analysis , when there is a treatment that shows a significant difference, it will be tested through Duncan's Multiple Distance Test

Research Materials and Tools

Research Materials: Bean Seeds, Bioboost Biological Fertilizer, cow manure, dolomite. The research tool used in land management is a hoe, while the tools used for research are rulers, stationery, meters and scales.

The research was conducted from February 25th, 2022 to May 22th, 2022 at Tawangmangu Food and Horticultural Seed Garden (TPH), Tawangmangu District, Karanganyar Regency with an altitude of 110 m above sea level and Latosol soil.

The variables used are:

1. Plant length (cm), through a measuring device (ruler or tape measure). The method of measurement is from the stem base to the stem tip and the observations are made in every 14 days
2. The number of leaves (strands), was calculated from the 2nd, 4th and 6th weeks after planting by counting the leaves of each sample.
3. Root length (cm) was measured using a ruler or a tape measure from the root base to the root tip. The measurements were made when the plants were harvested.
4. The number of pods per plant is conducted after harvesting by counting the number of pods for each plant samples.
5. The weight of pods per plant is conducted after harvesting by weighing all the production of plant samples.
6. Plant dry weight (g), was measured by oven-baking all plant organs (roots, stems and leaves) at 60°C for 48 hours, then counting them on an analytical balance to a constant weight.
7. Plant fresh weight (g), was measured by weighing the whole plant on an analytical balance.

RESULT AND DISCUSSION**Bean Plant Growth****Table 1.** Bean Plant Growth

Treatment	Plant length	Number of Leaves	Root length	Fresh weight of the plant	Dry weight of the plant
A	186.67	43.50	41,575	56.75	14,445
B	191.17	49.00	41,875	54.65	14,930
C	164.00	46.50	41,500	59.37	11,537
D	174.83	37.50	42,550	46.32	13,925
E	159.83	49.25	41,950	59.23	12,985
F	210.50	47,00	41,800	38.77	11,810

Plants can absorb nutrients through the roots or through the leaves. Most of the nutrients are absorbed from the soil. These nutrients can be available around plant roots through mass flow, diffusion and root interception. Upadhyay (2022) stated that the growth and yield of a plant is influenced by its environment. One of the important growing environmental factors for plant growth is the availability of nutrients.

Plant growth is influenced by two important factors, called genetic factors and environmental factors. Environmental factors are defined as a combination of

all external conditions and influences that affect the life and organism development. The environmental factors that affect plant life and development, such as temperature, humidity, radiation energy (sunlight), atmospheric composition, soil structure and soil air composition, soil reaction (pH), biotic factors, nutrient supply (Damanik et al., 2011).

Table 1 shows that the composition of biological fertilizer and cow manure application did not give a significant difference to bean plants growth in plant length, number of leaves, root length, fresh weight of plant and dry weight of plant. This is presumably since the nutrients in soil are already high and the pH is neutral, then it can be concluded that the addition of additional nutrients in biological fertilizers and cow manure has no effect. The application of biological fertilizers and cow manure can improve the chemical properties of the soil and the availability of N, P in soil and the availability of nutrients for plants. However, because the soil condition is considered to have sufficient nutrients for plant growth, then with the addition of nutrients from biological fertilizers and cow manure, the treatment does not contribute to plant growth.

The parameters of plant length in the treatment without biological fertilizer and cow manure with biological fertilizer and cow manure composition showed no significant difference. This indicates that the nutrient content of each fertilizer does not affect the bean plants growth and indicates that the growth of each plant with different treatments is produces the same plant length.

The parameter of number of leaves in the treatment without biological fertilizer and cow manure with biological fertilizer and cow manure composition showed no significant difference. This is because the N element contained in the fertilizer can help in the growth of the number of leaves. Since the nutrients contained in soil are already high, then the application of biological fertilizers and cow manure cannot be absorbed optimally by plants.

The root length parameters when compared with the treatment without biological fertilizer and cow manure and the ones with biological fertilizer and cow manure composition showed no significant difference. This is because the addition of additional nutrients given to soil are already has a high nutrient content that cannot be utilized by plant roots, then there is no effort from plant roots to utilize more nutrients to meet the plant needs.

The comparison of plants' weight parameters in the treatment without biological fertilizer and cow manure and the ones with the composition of biological fertilizer and cow manure showed no significant difference. The availability of nutrients for plants is one of the important factors to support the plant growth and its development since these nutrients have an important role as an energy source and structural constituent for plants. Then, the level of nutrient plays a role in influencing the plants' weight (Razaq et al., 2017).

The fresh weight of the plant is influenced by its length, the number of leaves and the length of roots, the longer the plant is and the more leaves and long roots,

the higher of fresh weight of the plant it is.

The dry weight of the plant is influenced by its number of leaves and the intensity of the sun. The plants that have many leaves and absorb effective sunlight can produce more photosynthate since they can conduct the photosynthesis well. The plant dry weight is a combination of all plant physiological events (Cahyani et al., 2022). The application of biological fertilizers and cow manure composition tends to reduce the dry weight of the plant, then it cannot increase the plant growth.

The addition of biological fertilizers and cow manure will only increase the yield to optimal point. The application of fertilizers with large doses will cause the soil solution become concentrated and will not be able to be absorbed by plants. The excess in fertilizers application will result in plant growth, even the nutrients contained in fertilizers cannot be utilized by plants since the soil solution becomes concentrated.

Figure 1. The statistic of bean's high per week

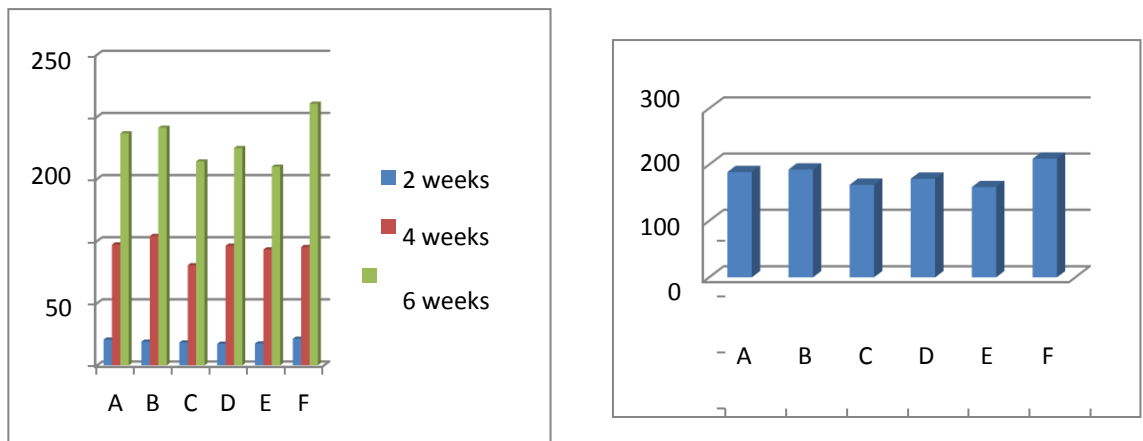


Figure 2. Number of leaves of beans

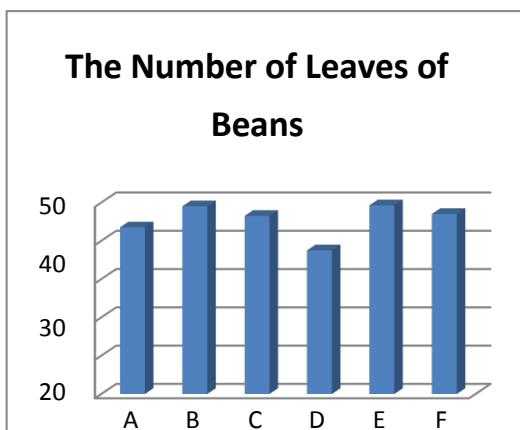


Figure 3. The statistic of bean’s root length

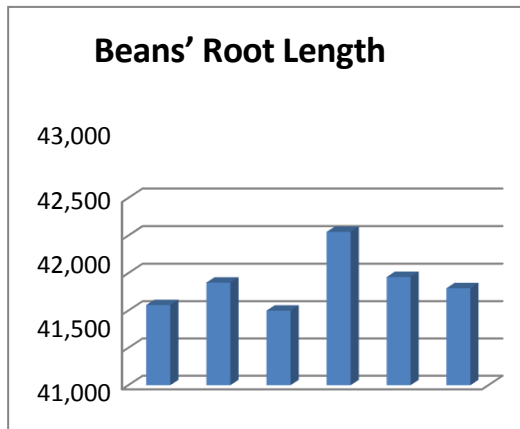
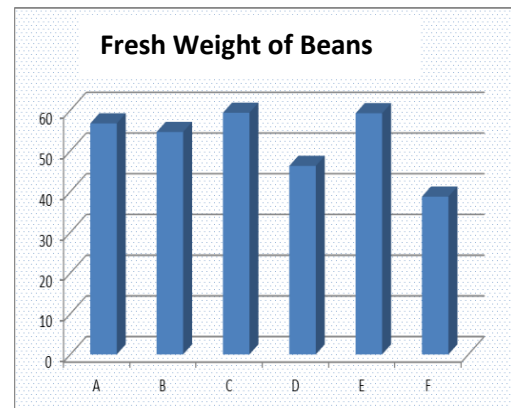
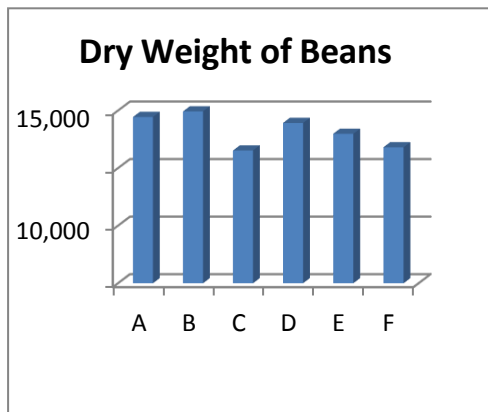


Figure 4. The dry and fresh weight of beans



Bean Yield

Table 2. Beans Yield

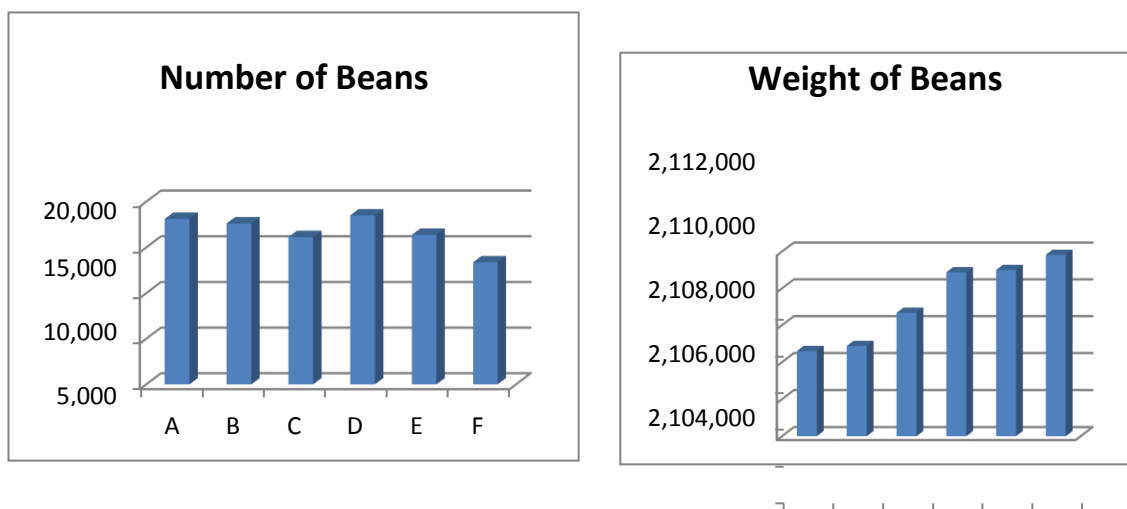
Treatment	Number of Peas	Weight of Peas
A	18,125	210,6600
B	17,625	210,6875
C	16,125	210,8675
D	18,500	211,0875
E	16,375	211,1000
F	13,375	211,1825

The providing of fertilizers that are in accordance with the dosage and needs for the plants can increase the plants’ yields. On the contrary, the excessive application will reduce the plants’ yields. The increasing the fertilizer dose will not

increase the beans' yields after reaching the optimal point. The plant growth and production will reach optimum with the supporting factors that supporting the plants' growth in optimal condition, balanced elements, the right dose of fertilizer and the nutrients needed are available for plants (Bustami, et al., 2012). The availability of nutrients and good external factors will greatly affect the plant metabolites. This metabolite process not only does the plants' formation, but also changes the organic compounds elements in plants which will greatly affect the productivity of the plant itself.

Table 2 shows that the application of biological fertilizers and cow manure composition did not give a significant difference to the beans' yield in the number of beans and its weight. Plants that were not treated with biofertilizers produced the same number of beans compared to plants that were treated with biofertilizers. This is presumably due to the influence of the weather, which often rain that caused the given fertilizer to have no effect or washed away by the rain. According to Khotimah et al (2022) the environment factors will affect the physiological process of the plant, all processes in plant physiology will be affected by temperature and some processes will depend on the light. This is line with research conducted by Sitinjak (2018) that stated chicken manure and plant spacing affected the number of branches on green bean plants. The emergence of flowers that will later develop into a pod that will contain green bean seeds. In this research, it is suspected that flower growth is disturbed by environmental factors such as rain and wind. The flowers that blooms will produce more beans, and the presence of more beans will increase the number of bean pods per plant.

Figure 5. Number of beans and its weight during harvest time



CONCLUSION

Based on the research results and discussion regarding the biological fertilizer and cow manure composition on chickpeas (*Phaseolus vulgaris* L.) it can be concluded that the application of various types of biological fertilizers and cow manure did not significantly affect the growth and yield of chickpeas. Also, the environmental factors are play an important role in the growth and yield of chickpeas.

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