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Combination of Cow Feases Compost with Tofu Waste on Growth and Yield in Long Beans Vegetable

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Abstract
Long beans are kind of the vegetable crops as a source of vitamins and minerals. The functions of this vegetable is a regulator of body metabolism, increasing intelligence and body resistance, and also facilitate the digestive process due to its high fiber content. The aim of this study was determined the effect of cow manure and tofu waste includes interaction both of them on the growth and yield of long bean crops. This research was used a Randomized Complete Block Design (RCBD) with two factors and 3 replicated, which in the first factor was used the Tofu waste, namely: T1 = 1 kg/plot, T2 = 2 kg/plot and T3 = 3 kg/plot,and the second factor was used cow manure (S) consisted of 4 levels, namely: K_0 = 0 (control), K1 = 2 kg/plot, K2 = 4kg/plot and K3 = 6 kg/plot. The parameters were measured plant length growth (cm), number of productivity branches, number of pods/sample, pod/sample weigh and pod/plot weigh. Based on DMRT analysis, the results were showed that the use of cow manure and tofu waste fertilizer was significantly different effects ($p < 0.05$) on plant length, production/sample and yield, unlike number of main branches and the number of pods/sample were no significantly different ($p > 0.05$) as compare untreated plant.

Key Words: ***long bean, tofu waste, cow compost***

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I. Introduction

Vegetables are not a staple food, only as a complement in your diet, but as a source of vitamins and protein as well as good in stomact due to their high fiber. Although vegetables have been growing in Indonesia, most of them are highland vegetables such as cabbage, cauliflower, carrots. Vegetables that grow in the lowlands are less in number. It is not surprising that any area has abundant in vegetables, while some urban areas such as in Kalimantan, Sulawesi and Papua lack vegetables for consumption (Anto, 2011). Unlike Long bean crops come from the tropical regions of India and Africa, especially Abissinia or Ethiopia (Ashari, 2013; Syahputra, 2022).

Long bean is one of legumenous that has famous cultivated by farmers, both in monoculture and intercropping. This crop is easily planted in the lowlands and highlands, both in rice fields, dry fields and yards. The most important influencing factor for the growth of long beans is the availability of sufficient water (Arinong et al, 2014). Factor the availability of water, other influencing factors are the spacing and intercropping factors (Zuhroh and Agustin 2017). This vegetable is multipurpose, an important leguminous vegetable and fertilizer in soil because the roots of this crop has contain Rhyzobium nodules. These bacteria function has tie up free nitrogen from the air, which is also the reason why many farmers plant rice fields in bunds (Sunarjono, 2003; Barus et al, 2013; Syahputra et al, 2016).

One of the interesting in agribusines of this vegetable is the market demand which is quite high. The market is able to absorb it, even though production increases during harvest. From an economic point of view, this commodity still has considerable market power. In addition, there are also opportunities for local and export markets. Thus, long beans have good prospects in the future to be cultivated by farmers (Haryanto, et al, 1994). The aims of this study was to see how much influence organic fertilizer made from cow feses and tofu waste and the interaction of the two organic fertilizers had on the growth and yield of long beans.

Cow feses compost

Manure or faeses animal husbundry is organic fertilizer that comes from cattle pens, either in the form of solid manure (faeces) mixed with food scraps and urine (urine), so the quality of manure varies depending on the type, age and health of the livestock, the type and level of its content the nutrient. Manure usually consists of a mixture of 0.5% N; 0.25 P2O5 and 0.5 K2O. Solid cow manure with a moisture content of 85% contains 0.4%

N; 0.2% P2O5 and 0.5% K2O and a liquid with a concentration of 95% contains 1% N; 0.2% P2O5 and 0.1% K2O. (Allison, 1973).

Tofu Waste

Tofu waste is a solid waste produced by the soybean industry to become tofu which not utilized, so far, it can be environmental pollution. One the other way, this waste to be valuable is used to organic fertilizer. Tofu waste has suspended content (TSS) which can be reduced using the phytoremediation method (Ruhmawati et al, 2017). The advantage of using tofu waste as organic fertilizer always available and have protein content. According to Anggoro (1985) tofu waste contains 43.8% protein, 0.9% fat, 6% crude fiber, 0.32% calcium, 0.76% phosphorus, 32.3 mg/kg magnesium and other ingredients. Tilman (1998) states that tofu waste contains N on average 16% of the protein. Organic fertilizers are fertilizers derived from natural such as feases, garbages and others. One of the materials that can be used as a raw material for making organic fertilizer is tofu waste, both solid and liquid waste (Barus et al, 20 19; Yama et al, 2021).

Tofu waste has contains N, P, K, Ca, Mg, and C which the potential to increase soil fertility. Based on the analysis, the dry matter of tofu waste has contains 2.69% water, 27.09% protein, 22.85% fiber, 7.37% fat, 35.02% ash, 6.87% nitrogen, calcium 0.5%, and phosphorus 0.2%. These ingredients have the potential to increase soil fertility and crops growth (Anonymous, 2010). According to Desiana et al (2013) and Gashua et al (2022) that tofu waste contains a lot of organic matter compared to inorganic matter. The protein content of tofu waste reaches 40-60%, carbohydrates 25-50% and fat 10%. These organic materials affect the high content of phosphorus, nitrogen and sulfur in the water. Prasetya (2009) also stated that the nutrient content of tofu waste could be increased by composting using the bioactivator Stardec (Ali et al, 2008; Hardarani et al, 2022).

II. Materials & Methods

Field experiment was conducted at Pinang Dua street, Sei Dendang Village, Stabat District, Langkat Regency. With an altitude of ± 25 m above sea level. The implementation of this research started from May to August 2022. This research was used Complete Randomized Block Design (CRBD) consisting of 2 treatments with 12 combinations and 3 replicates so that a total of 36 plots were obtained. Factor I of Tofu waste ("T") consisted of 3 levels, namely: T1 = 1 kg/plot, T2 = 2 kg/plot, T3 = 3 kg/plot, and cattle manure (K) consisted of 4 levels, namely: K0 = control (without treatment), K1 = 2 kg/plot, K2 = 4 kg/plot, S3 = 6 kg/plot as the second factor. Parameters was measured Plant length (cm), number of productive branches, number of pods/sample, fruit yield/sample (g), fruit yield/plot (kg). Data analysis using R-software 3.5.1, if there was a significant difference in treatment, then continues proceed with the DMRT test at 5% level.

III. Results & Discussions

Plant Length

The results of plant length growth was shown in Table 1, the effect of tofu waste on 6 WAP was showed a significant difference. It can be seen that the longest plant length using a dose of 3 kg/plot (T3) with an average plant length of 174.10 cm was significantly different with dose 1 kg/plot (T1) with an average plant length of 152.60 cm, but not significantly different with dose 2 kg/plot (T2) with an average of 162.36 cm. From the results (Table 1) that the use of fertilizer from tofu waste at a dose of 2 kg/plot (T2) was used suitable in this study and can be recommendations for cultivated long beans in the field.

Tabel 1. Average plant heigh growth and total branches productive in long bean after application tofu waste and cow manure at different doses in 6 weeks after planting (WAP)

Perlakuan	plant heigh	total branches
	6 WAP	6 WAP
Tofu waste (/plot)		
T1 (1 kg)	152.60b	1,81 a
T2 (2 kg)	162.36ab	1,95 a
T3 (3 kg)	174.10a	2,08 a
Cow manure (/plot)		
Ko (0 kg)	140.82c	1,82 a
K1 (2 kg)	158.43b	189 a
K2 (4 kg)	169.00ab	2,00 a
K3 (6 kg)	16.16a	183.83a

Note: The different letters in the same colomn, to show significantly at $p<0.05$

The use of cow manure with different doses on the growth in length of long bean crops was observed at 6 WAP and a significantly different effect ($p < 0.05$) was shown in Table 1. The analysis for the growth of plant length in 6 weeks after planting (wap) it was found that the effect of the dose of cow manure was seen on the longest plants using a dose at 6 kg//plot (K3) with an average plant length of 183.83 cm, and a significant difference ($p < 0.05$) as compared to untreated crops (Ko) with the shortest plant (140.82 cm), but K3 compare to K2 (4 kg/plot) was not significantly different, with an average plant length of 169.00 cm. From the results (Table 1) that the use of cow manure at 4 kg/plot (K2) in long bean has effect on growth and K2 was a recommended use in long bean planting in the field.

The combination treatment between the use of tofu waste and cow manure based on analysis of variance has no significant effect ($p > 0.05$). but the combine of tofu waste at 3 kg/plot and cow manure at 6 kg/plot (T3K3) was the longest length of the long bean crop. Unlike, the lower of organic fertilizer, both tofu waste and cow manure, the resulting shorter the plant length. The number of productive branches was observed on long bean crops when they started to flower, and the resulting data were analyzed in statistically using DMRT which was showed no significant difference ($p > 0.05$). The use of tofu waste was showed the highest number of long bean branches, but the lower the dose would be the fewer the branches, although the difference was very low in tofu waste at 3 kg/plot (T3) with an average main branch of 2, 08 and at least produced in the treatment without organic fertilizer 1 kg/plot (T1) with an average of 1.81.

The resulting in Table 2 was shown the effect of using cow manure (K) in several insignificantly different effect ($p > 0.05$) on the number of productive branches in long bean crops. However, it is slightly apparent that the number of productive branches was more produced when the use of cow manure at 6 kg/plot (K3) with an average of 2.08 and the lower the dose was used would be the fewer the number of branches. This can be showed untreated of cow manure (Ko) with an average of 1.82.

Data from the field and after statistical analysis was showed that the effect of using tofu waste as a fertilizing agent for long bean crops had a significantly different effect ($p < 0.05$) on plant length growth (cm), pod/sample (pod) production, pods per plot (kg), but had no significant effect on the growth of the number of productive branches and the number of pods/sample. Unlike the case with tomato plants was used organic and inorganic fertilizers (Kartika et al, 2013; Colak and Karaca, 2021).

The effect of tofu waste as organic fertilizer was showed the higher of dose can increase growth and yield. Growth and yield are strongly influenced by the nutrients intake from the soil including the addition of fertilizer by application. Due to the high dose of tofu waste in this study with 3 kg/plot (T3) which more growth and yield, but with the use at 2 kg /plot (T2) with slightly lower and not significantly different ($p > 0.05$). Based on these results, the treatment of using 2 kg/plot (T2) was recommended dose for planting long beans in the field. This is in accordance with the results of research by Lestari, (2016) in the use of tofu waste was good for the growth of red spinach. Oil palm seedlings also using tofu waste and suitable for growth (Tua, et al, 2014) and also for Celery vegetables (Trianti and Lesti, 2017), Petsai plants (Brassica chinensis) by Asmoro et al, (2008), Leeks (Allium fistulosum L.) by Rahmisari and Rizali (2022 and soybeans (Wan et al, 2019).

Yield and Yield Component

The number of pods/samples that can be increase produced from the effect of using tofu waste fertilizer (T) and cow manure (K) doses in long bean crops was carried out at harvest time, respectively the number of pods that can be produced can showed in Table 2 below. The number of pods/samples at harvest observed with the highest number of pods produced was using tofu waste at dose 3 kg/plot (T3) with the highest number of pods in average of 8.25 pods/sample with no significant difference as compared to using tofu waste fertilizer at lower doses of up to 1 kg/plot (T1) with an average number of pods of only 7.11 pods/sample.

The yield for the number of pods/sample using cow manure with dose 6 kg/plot (K3) averaged 8.55 pods/sample, as compared to the use of a lower dose at 4 kg/plot (K2) with an average 8.00 pods/sample and without the use of cow manure (Ko) with the least number of pods on average 6.89 pods/sample. From the results of the analysis, it was founded that all treatments had no significant ($p > 0.05$) effect on the number of pods/samples. The results of harvest/sample, weighing and production/plot from the effect of tofu waste fertilizer (T) and cow manure (K) doses in long bean crops at harvest that the yield of long bean pods from the influence of tofu waste fertilizer and cow manure doses as in Table 2.

Tabel 2. Average of pods/sample, total pods/sample and weigh of pods/plot in long bean after application tofu waste and cow feses compost at harvesting.

Treatment Organic fertilizers	total pods/plot	Weigh of pods/sample	Weigh of pods/plot
Tofu Waste (T)			
T1 = 1 kg/plot	7,11 a	229,79 b	1,66 b
T2 = 2 kg/plot	7,78 a	246,79 ab	1,85 ab
T3 = 3 kg/plot	8,25 a	260,79 a	1,96 a
Cow manure (K)			
K0 = control	6,89 a	211,16 c	1,56 c
K1 = 2 kg/plot	7,41 a	140,81 bc	1,76 bc
K2 = 4 kg/plot	8,00 a	256,89 ab	1,85 ab
K3 = 6 kg/plot	8,55 a	274,30 a	2,10 a

Note: The different letters in the same colomn, to show significantly at $p<0.05$

Measuring of yield in pods/samples and yield/plots on long bean crops after harvest was showed that the weight of the pods produced significantly different effect ($p <0.05$) from the effect of the dose of tofu waste fertilizer (T). The highest yield in pods/sample (g) was obtained using a dose of tofu waste in 3 kg/plot (T3) with average of 260.79 g/ampel (1.96 kg/plot), followed by a dose in 2 kg/plot (T2) an average of 246.79 g/sample (1.85 kg/plot) and with no significant difference between T3 using 1 kg/plot (T1) with average of 229.79 g/sample (1.66 kg/plot) shows significantly different. Based on the results of the analysis that the use of higher doses results in higher yield/plots, increased yield is based on the linear equation $Y = 0.1149\ T + 1.522$ and $r = 0.97$ as shown in Figure 1.

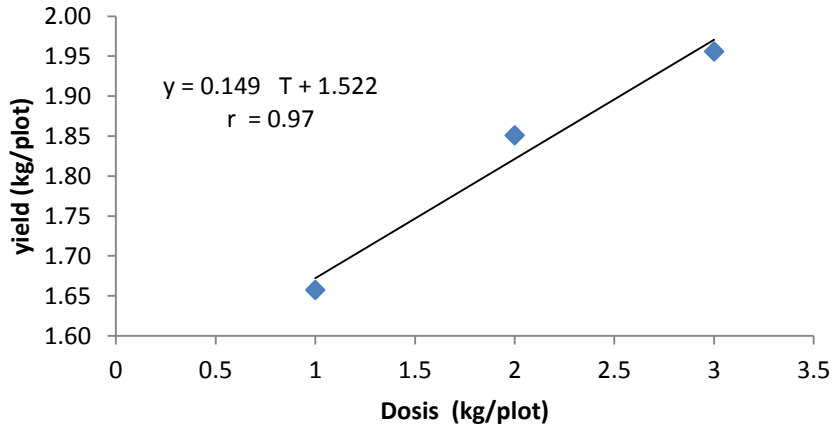

Figure 1. Effect of tofu waste in yiled of long bean (kg/plot)

One of technique planting vegetables is by applying fertilizer with various types of fertilizer. One type of fertilizer that has the potential to add nutrients in soil is tofu waste. The amount of provision in broad unity describes the amount available in adding nutrients in soil. Tofu waste fertilizer will affect the effectiveness of absorption of nutrients by plant roots. The higher of dose given tofu waste fertilizer the more nutrients that can be absorbed by plant roots. As a result, the growth and yield per plant will increase (Rahayu et al, 2021; Budiono, 2017). The effect of tofu waste fertilizer on significantly different parameters was suspected that the role apart from the factor of providing fertilization as well as light greatly influences it in the growth survival of these plants (Hakim, 1986).

Every crop needed in solar, especially for young plants, in fact specific according to the type and age crops. Therefore, the introduction of the nature of the light requirements for plants at each stage of their growth is very important information in the management of natural regeneration and in the maintenance of seedlings in nurseries (Curry, 1969). The application of fertilizers at lower doses causes nutrients in the soil to be absorbed less by plants and moreover, some of them can be leached into the soil by the flow of groundwater and do not have time to be absorbed by plant roots. On the other hand, the higher fertilizer, the more nutrients in the soil for

plants are still available, although some of the nutrients are leached by groundwater, but in relatively small amounts.

Fertilization is able to maintain the availability of nutrients, to care the solution by water (washed). Availability of specific nutrients in the soil is determined by soil pH, aeration, temperature, organic matter and micronutrients, especially phosphorus (Novizan 2003). Fertilizer shows a significant effect due to the ability of the soil to meet the nutrient needs in the soil. Apart from getting additional nutrients, and has other properties that are beneficial to plants. Decomposition of soil organic matter by microorganisms (decomposition), resulting in the presence of dissolved potassium re-entering the soil (Nyakpa, et al 1986).

Reported by Setiadi (2000), one of the limiting factors in plant growth and development is the absorption of essential (essential) nutrients. In the process of plant growth at absorbing nutrients in metabolic processes, including cell growth that can be fulfilled, it means, availability of food for growth is increasing. Fertilization plays a role in solar intensity which is very important for the survival of plant growth. Curry (1969) stated that the role of solar system is very important in the survival of plant growth, also the need for solar, especially for young plants, is infact specific according to type and age of crops. Therefore, the identification of the nature of the solat system requirements for trees at each stage of their growth is very important information in management and maintenance. Apart from that, the growing season also determines the growth and yield of long bean plants (Marmadion, et al, 2014). It also influences the inorganic fertilizers (Zaevie et al, 2014).

Pod yield (g/sample) from the effect of cow manure (K) was higher with dose 6 kg/plot (K3) which average of 274.30 g/sample (2.10 kg/plot) with insignificantly difference ($p > 0.05$) with dose 4 kg/plot (K2) and average of 256.89 g/sample (1.85 kg/plot), but significantly different to K1 and Ko (control). The least yield was found in untreated plants (Ko) with average of 211.16 g/sample (1.58 kg/plot) with no significant difference as compared to K1 dose (1 kg/plot) but very significantly different ($p < 0.01$) against with K2 and K3. Based on statistical analysis that the increasing use of cow manure doses has an effect on yield/plot which is higher up to a certain dose, the increase in yield (kg/plot) from the effect of using cow manure at different doses was determined based on the analysis of the equation $Y = 0.085\ K + 1.586$ and $r = 0.99$ as showed in Figure 2.

Results of study with analysis all parameters, it showed that the use of organic cow manure with high doses on the growth and yield of long bean crops in the field showed a very significant difference ($p < 0.01$). Based on statistical analysis using DMRT, the dosage of organic cow manure showed a very significant difference ($p < 0.01$) in plant length (cm), yield/sample (g), pod yield/plot (kg). However, it did not show a significant difference in the number of productive branches and the number of pods/samples (pods) in long bean crops. This is in accordance with the results of research (Setiyono, 2015) that manure affects long bean yield.

Combined of treatment tofu waste with cow manure on yield (g/sample and yiled kg/plot) of each treatment did not significantly different effect ($p > 0.05$). Yield for the most weight/sample produced with 3 kg/plot (T3) tofu waste and combined with 6 kg/plot cow manure (K3T3) obtained the highest yield, if one of the factors is reduced the dose will reduce production/sample and kg/plot. In accordance with the results of Budiono's research (2017) on peanut plants (Arachis hypogea).

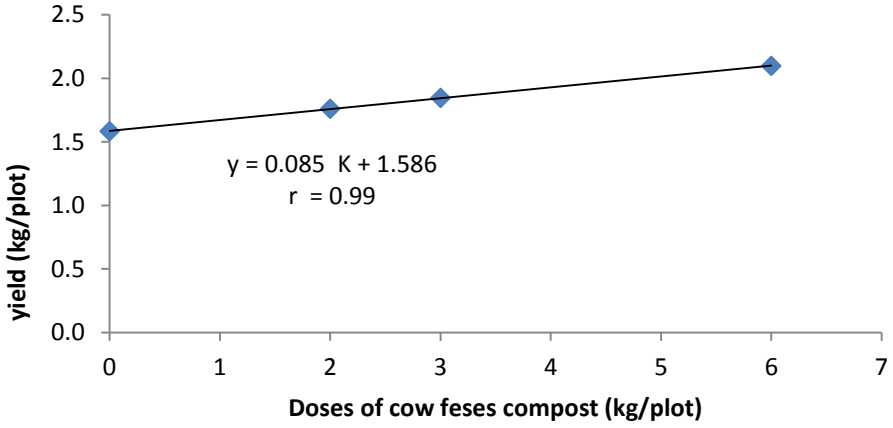

Figure 2. Effect of cow feses compost in yield of long bean (kg/plot)

Giving cow manure which rich in elements has needed by plants, it is one of the factors in providing nutrients to stimulate plant growth and increase yield by means of providing nutrients carried by cow manure, which is a supplier in essential nutrients which needed plants while growing in the field. Availability of higher

nutrients can be increased development of crops and increase the yield that can be high productivity (Lingga, 2003).

Availability of nutrients to responds absorption of nutrients by plant roots thereby increasing growth and yield. The low dose of fertilizer has given at plants causes nutrients in the soil to lower which result in decreased of growth and reduced the level of yield, this can be seen by a decrease in higher fertilizer doses (Sitorus, 2008). According to Sutejo (2002), when plants a deficiency of elements it result in inhibited root formation. The use of fertilizer as an effort to increase crop yield and farmers have considered that fertilizer and the method of fertilization as one thing that cannot be separated in their farming activities (Marsono 2001).

Based on the higher dose of fertilizer was application in crops, this availability of elements for growth, and according with the Sutedjo (2002) which states that the need for nutrients in each phase of growth is different. Cow manure is a type of cow organic, including fertilizer for a certain time, so when using it, necessary to ripen for a certain period so that it can quickly decompose so that it is directly absorbed by plants (Jumin, 2005; Setiawan et al, 2021). Organic fertilizer from cow manure is an example of organic fertilizers derived from livestock, either in the form of solid manure (feces) mixed with food scraps or urine, so the quality of manure varies depending on the type, age and health of livestock, type and levels and nutrient content. Manure usually consists of a mixture of 0.5% N; 0.25 P2O5 and 0.5 K2O (Allison, 1973). Solid cow manure with a moisture content of 85% contains 0.4% N; 0.2% P2O5 and 0.5% K2O and a liquid with a concentration of 95% contains 1% N; 0.2% P2O5 and 0.1% K2O (Listyawati, 1997).

The benefits using of cow manure is add more nutrients in soil, increasing organic, having a positive effect on the physical, chemical and biological properties of the soil, encouraging the life of microorganisms, and returning leached nutrients. That the effect of applying cow manure in soil will increase water holding capacity, increase organic matter in soil, improve soil structure, so that it is a good medium for plant growth (Sarief, 1989; Jayantie et al, 2017). Some important nutrient content in organic materials such as nitrogen, phosphate, potassium, calcium, magnesium and available micronutrients (Bo, Cu, Mn, Zn, etc.) are very necessary for plants to growth and yield (Setedjo, 2002). The results of this study showed that by increasing the dose of cow manure organic fertilizer was gave a response in plant growth and yield (Jayanti et al, 2017). With dose in 4 kg/plot was the right dose and was recommended based on research results on the growth and yield of long bean crops, this is in accordance with the level of soil fertility (Hasibuan 2006; Selamet et al, 2022). The level of soil fertility is strongly influenced by the nutrient content in soil and microflora, therefore the addition of organic matter in soil increases the level of soil fertility (Foth, 1991), and the longer of level fertility, the more productive the crops.

The results of this exprimental with analysis of variance showed that there was no significantly different interaction ($p < 0.05$) between the tofu waste and cow manure treatments for all parameters observed. This situation is due to the absorption of nutrients in the soil by plant roots supported by sufficient nutrient content in the soil during the field planting period and supported by extensive root development. By the availability of sufficient nutrients in the soil, plants are followed by greater growth and production. Poerwoidodo (1992) states that if one factor has a stronger influence than other factors, then the influence of these factors is covered and if each factor has a very different nature of influence and working nature it will produce a relationship that has no significant effect in supporting plant growth and production.

Furthermore, Hakim (1986), stated that plant growth will be better if the factors affecting growth are balancing and providing benefits. If the factors cannot be controlled, the expected growth cannot be obtained to be maximum resulting. Combination treatment in factorial treatment is a combination of single treatments that are tried in a design (Yitnosumarto, 1991; Gaspersz, 1995). On the other hand, the effect of factorial treatment or combination treatment can be divided into three types, namely: (1) simple effect or single effect; (2) the main effect or factor effect, and (3) the interaction effect or cooperation between levels of a single factor or treatment (Federer, 1977; Steel & Torrie, 1989).

IV. Conclusion

After processing the data, it was founded tofu waste a good type of organic was used as fertilizer and has been appling to long bean crops. Based on analysis using DMRT, it was a significantly different on the growth and yield of long beans as compared to untreated plants. From some of the treatments with different doses in each plot, it turned out that was showed more entresting results with dose in 2 kg/plot, and this dose can be recommended to farmers in long bean cultivation. In contrast to the results of using compost from cow manure, which dose in 4 kg/plot, a significantly different effect than without application cow manure compost to the growth and yield of long bean crops. It is clear that the use of cow manure compost is higher than tofu waste compost, but both provide the best results. From the use of 4 kg/plot was the right dose for the growth and yield of long bean plants and can be recommended for use in farmers who cultivate long beans. The combination of cow manure compost and tofu waste was insignificantly. Although statistically not significantly

different in combination, but we can still see a good combination by looking at the highest yield obtained from the combination of 3 kg/plot tofu waste and 6 kg/plot cow manure compost.

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