



The Effect of Vermicompost on the Growth of Soybean (*Glycine max* L.)

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Abstract. The growth and production of soybean (*Glycine max* L.) fertilized by vermicompost was conducted. The vermicompost used consisted of 4 levels, namely: K0 = no vermicompost, K1 = 60 g, K2 = 90 g and K3 = 120 g, each treatment was replicate 3 times. The results showed that the dose of vermicompost significantly affected to the number of branches, number of pods and seed weight, however the organic fertilizer not significantly affected on plant height, flowering age, number of empty pods and seeds dry weight. The interaction dose of vermicompost has no significant effect on plant height, number of branches, flowering age, number of pods, number of filled pods, number of seed and 100 seeds dry weight.

Keyword: organic fertilizer, vermicompost, soybean

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1 Introduction

Soybean is an important crop in the revitalization of agricultural food crops in Indonesia [1]. Soybean is one of the main food commodities in Indonesia. According to BPS [2], soybean production in 2010, 2011, 2012 and 2013 was 908.11 thousand tons, 851.29 thousand tons, 779.74 thousand tons and 779.99 thousand tons, respectively. This shows a decrease in soybean production in Indonesia. The need for soybean increases every year, along with increasing population growth and the development of soybean processing industries.

According to BPS [2], the increase in soybean needs in Indonesia was 2.78 million tons in 2010, increasing to 3.22 million tons in 2011, 3.43 million tons in 2012, and 3.6 million tons in 2013. The increased need for soybeans was not accompanied by an increase in soybean production. The shortage of domestic soybean needs is met by importing. According to Setiawan [3]

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soybean imports in 2013 reached 73% or as much as 1.9 million tons came from the United States and Brazil whose value is equivalent to US \$ 1.5 billion.

In order to increase soybean production, it can be done by applying vermicompost as organic fertilizer, which is an environmentally friendly organic material, containing essential elements derived from 95% of worm droppings and 5% of material resulting from the decomposition of microorganisms that is useful for improving soil physical, chemical and biological properties [4]. Kascing is also an alternative organic fertilizer that contains nutrients both macro and micro and contains growth hormones for plants. Worm manure (vermi compost) which becomes compost is an excellent organic fertilizer for plants because it is easily absorbed and contains nutrients needed for plant growth [4].

2 Materials and Methods

2.1 Variety of soybean

Anjosmoro variety soybean used in this experiment, vermi compost and topsoil soil. The tools used in this study are: tripe, hoe, meter, fat sheet, treatment plank, calculator, stationery, ruler, 10 kg polybag, and other tools that support the implementation of this research.

2.2 Land preparation

The area used is first cleared of rubbish, weeds, remnants of plant roots, rocks, then leveled. Then made a place / unit and made drainage to prevent standing water during the rainy season.

2.3 Preparation of planting media

The soil used as a planting medium is the top layer (top soil). Furthermore, the soil is put into a 10 kg polybag mixed evenly with vermicompost fertilizer in accordance with the treatment.

2.4 Planting

Planting is done when the soil is moist, but not wet. Then the soybean seeds are planted with a depth of 2-3 cm, the number of seeds planted 1 seed per hole then covered with soil so as not to be disturbed by ants or other pests.

2.5 Maintenance

Sprinkling, watering is done every morning or evening evenly on all plants in accordance with plant conditions and field conditions. Weeding is done if weeds are found in the experimental plot in a poly bag and pest and disease control is carried out if the plant is attacked by spraying a pepticide.

2.6 Parameter observed

Observations were made with 108 predetermined sample plants. Harvesting can be done according to the age determination of the variety used. Soybean plants can be harvested after the pods are old enough, where the pods are brown, the leaves turn yellow and begin to fall. This must also be adjusted to the local visual situation. Number of replications: 3 replications, Experiment unit: 36 units, Number of plants per unit: 4 plants, Number of sample plants: 2 plants, Total number of plants: 144 plants Total sample plants: 108 plants, Spacing between polybags: 25 cm x 30 cm, Distance between plots: 30 cm, Distance between replications: 1 m, Area plot: 75 cm x 80 cm, Land area: 5.25 mx 15 m. Parameters observed consists of plant height, number of branches, flowering age, number of pods and empty pods, wet and dry seed weight.

3 Result and Discussion

3.1 Height of soybean plants

The average height of soybean plants at ages 2, 3, 4, and 5 after planting due to the treatment of vermicompost fertilizer is presented in Table 1.

Table 1. Height of soybean (cm) treated by vermi compost

Treatments	Plant height (cm) after harvesting (weeks)			
	2	3	4	5
No vermi compost	14.58	18.45	24.22	33.43
60 g	15.17	19.69	26.46	37.58
90 g	15.09	19.98	27.97	37.79
120 g	15.05	19.17	26.67	36.34

Table 1. shows that the highest height of plants at the age of 5 after planting at K2 treatment with a dose (90 g) followed by K1 treatment at a dose (30 g), K3 at a dose (120 g), and K0 at a dose (30 g) .

3.2 Number of Branches (weeks)

Average number of branches of soybean plants in the treatment of vermicompost can be seen in Table 2.

Table 2. Number of branches of soybean treated by vermicompost

Treatments	Number of branches after planting (weeks)			
	3	4	5	6
No vermi compost	3.00 d	6.11	8.22	10.89
60 g	3.17 c	6.17	8.89	11.50
90 g	3.67 a	6.22	8.33	11.39
120 g	3.56 ab	6.17	8.78	11.50

Note: numbers followed by different notations in each column are significantly different according to the Honest Reality Test (BNJ) at the 5% level

From table 2 shows the age of 3 with no vermicompost (control) have significantly affected the number of branches of soybean plants in all other treatments. In the 120 g the number of branches significantly affected the number of branches. At dose 60 g but did not significantly affect the number of branches in the K2 treatment with a dose (90 g). The effect of vermicompost on time flowering of soybean is showed in Table 3.

Table 3. Time flowering of sybeans after fertilized byvermicompost
Doses of vermicompost (g)/ time of flowering (days)

Treatment	No vermicompost	60	90	120
	47.67	51.67	51.33	52.00
	49.33	52.67	51.00	52.00
	53.33	51.33	53.67	54.00
Average	50.11	51.89	52.00	52.67

Table 3. Show that the vermicompost fertilizer treatment at the age of flowering soybean plants is the fastest in the K3 treatment with a dose (120 g) followed by K2 at a dose (90 g), K1 at a dose (60 g), and K0 (control) . The average of soybean pods in the treatment of vermicompost can be seen in table 4. Table 4. shows that the vermicompost fertilizer treatment on the Number of Empty Pods of soybean plants was mostly found in the K1 treatment at a dose (60 g) and K3 at a dose (120 g) followed by K2 (90 g), and K0 at a dose (control) .

Table 4. The number ofempty pods of soybean fertilized by vermicompost

Treatments	Doses of vermicompost (g)			
	0	60	90	120
	16.83	20.17	17.67	20.83
	16.00	20.33	19.17	19.83
	18.67	18.67	15.83	18.50
Average	17.17	19.72	17.56	19.72

Table 5. shows that the vermicompost fertilizer treatment on the most number of pods contained in the K3 treatment at a dose (120 g) followed by the treatment K1 at a dose (60 g), K0 at a dose (control), and K2 (60 g).

Table 5. The number of pods withof soybean seedsfertilized by vermicompost

Treatments	Doses of vermicompost (g)			
	0	60	90	120
	53.00	84.00	70.83	81.17
	67.50	81.67	51.17	84.83
	68.17	62.33	49.17	78.33
Average	62.89c	76.00ab	57.06cd	81.44 a

Note: numbers followed by different notations in each column are significantly different according to the Honest Reality Test (BNJ) at the 5% level

3.3 Number of Seed Weight per Plant (g)

Table 6. presents a different test of the average weight of seeds per soybean plant due to vermicompost fertilizer treatment. Treatment K1 (60 g) had higher seed weight per plant compared to K0 (control), K2 (90 g), and K3 (120 g).

Table 6. The number of seed weights of soybean fertilized by vermin compost
Doses of vermicompost (g)/number of seed weight (g)

Perlakuan	K0 (g)	K1 (g)	K2 (g)	K3 (g)
	34.06	45.70	39.05	35.96
	31.61	37.25	34.37	41.37
	33.76	43.14	37.95	45.11
Rataan	33.14 d	42.03 a	37.12 c	40.81ab

Table 7. Shows that the treatment of vermicompost fertilizer at the highest dry weight of 100 soybean seeds was found in the K3 treatment at a dose (120 g) followed by K2 at a dose (90 g), K1 at a dose (60 g), and K0 at a dose (control) .

Table 7. Average dry weight of 100 seeds due to vermicompost fertilizer treatment (g)
Doses of vermicompost (g)/seeds dry weight (g)

Perlakuan	0	60	90	120
	11.53	13.76	13.61	13.14
	12.00	12.44	12.95	14.10
	12.78	12.12	14.01	13.82
Rataan	4.00	4.15	4.32	4.70

The results of the research on the application of vermicompost fertilizer to the growth of soybean plants have a better number of branches, number of pods and weight of seeds per sample compared to without applying vermicompost fertilizer. This is due to vermicompost fertilizer containing high organic matter which can improve the physical properties of the soil. Organic matter can improve soil structure and increase the ability of the soil to absorb nutrients [5]. One of the functions of organic matter in the soil is to provide a loose, crumbly and easily processed soil structure so that it becomes a good medium for plant growth [6].

The results showed that the application of vermicompost fertilizer of 120 g / polybag had been able to improve the physical properties of the soil, where the soil structure became loose. Changes in soil structure to loose can cause rapid and normal root development so that plant growth will be fast and normal.

The application of vermicompost fertilizer can increase the growth and production of soybean plants. This is due to the application of vermicompost fertilizer can increase the content of soil

microorganisms, especially earthworms which will remodel organic matter faster. The process of decomposition or decomposition of organic matter which is faster will increase the supply of nutrients in plants. According to Musnawar [7] that the application of vermicompost fertilizer can accelerate plant growth and production. Application of vermicompost fertilizer can improve the physical and biological properties of the soil.

According Mulat [4] that the application of vermicompost fertilizer can accelerate the availability of nutrients in the soil, through a faster overhaul of organic matter. Besides that vermicompost fertilizer also contains growth hormones so that it can accelerate plant growth besides fulvic acid and humic acid contained in organics can bind toxic substances in the soil.

The results of analysis of variance showed that the interaction between the dosage of vermicompost fertilizer and mycorrhizae had no significant effect on plant height, number of branches, flowering age, number of empty pods, number of filled pods, number of seed weight per sample, and dry weight of 100 seeds.

4 Conclusion

The vermin compost fertilizer has a significant effect on the number of branches, the number of pods contained, and the number of seed weight per plant with the best dose of 120 g / polybag. The interaction of vermicompost fertilizer dose has no significant effect on plant height, number of branches, flowering age, number of empty pods, number of filled pods, number of seed weight per sample, and 100 seed dry weight.

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