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The Use of Biochar From Cow Feces and Bioboost in The Red Chili Plant (*Capsicum annum* L.)

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Abstract

The purpose of this research is to know the influence and interaction by giving biochar and bioboost of the growth and fruitage of chili. This research is used Randomized Block Design factorial patterned with 2 factor, the first treatment is biochar of cow feces with 4 standards of dosage (0; 5; 10; dan 15 ton ha^{-1}), meanwhile the second factor is bioboost with 3 standards of dosage (30, 60, dan 90 cc tan^{-1}). The interaction between biochar and bioboost gave the real influenced into the height, weight of fresh roots, oven-dry of the leaves, oven-dry of the chili each plant but gave not real influenced into the other variables. The height weight of dry chili was obtained into the interaction between biochar 10 ton ha^{-1} and 60 cc tan^{-1} is 3.20 g or increased by 28 % if compared with the lowest weight in bioboost 60 cc tan^{-1} without biochar is 2.25 g.

Keywords: biochar, feces cow, bioboost, chili.

1. Introduction

Red chili (*Capsicum annum* L.) is a plant that belongs to the Solanaceae plant family. Red chili is a vegetable commodity that cannot be left behind by people in their daily lives. High needs every day cause red chili is a strategic commodity. Red chili contains nutrients needed by humans such as vitamin A, vitamin C, carotene, iron, potassium, calcium, phosphorus and also contains alkaloids such as capsaicin, flavenoid, and essential oils [1].

Indonesia is a country that is rich in natural products and has a profitable agricultural potential if processed optimally. Seeing the facts so far, many agricultural wastes are left just after harvest, without regard to the added value of the processed waste. These wastes can still be utilized and processed into new products that can increase agricultural productivity. Agricultural land in Indonesia is very broad, many of which are critical land, land that is not well cultivated so that it gradually causes soil quality to decline and results in a decrease in agricultural productivity. If examined more closely the damaged agricultural land can be restored the level of fertility with good processing. The concept of biochar is offered as a soil enhancer. Biochar can be made with a variety of biomass, even agricultural wastes that meet the requirements. History shows, biochar has been traditionally used by farmers in various parts of the world. Various studies show biochar has the potential to improve soil structure and fertility. In Indonesia, the use of biochar on a large scale is relatively new, therefore the government plays an important role in providing understanding and guidance to the wider community, especially farmers, about the importance of biochar as a soil amendment material to support future agricultural production [2].

Biochar cow dung is a soil enhancer that can reduce air CO_2. Biochar can be a habitat for soil microbes but it is not consumed and generally, biochar applied to the soil can stay in the soil for hundreds of years. In the long term, biochar does not disturb the carbon-nitrogen balance and can hold water and make water and nutrients more available to plants. When used as a soil enhancer along with organic and inorganic biochar fertilizers can increase productivity and nutrient retention and availability for plants [3]. The results of the study [4] reported that a biochar dose of 5-10 tons ha^{-1} gave the best fresh weight of cobs and compost dose of 7.5-15 tons ha^{-1} gave the best results on plant height, fresh weight of cobs, and fresh weight of corn stover.

According to [5], stating that to speed up the maximum production, nutrition is given to plants, one of which is fertilizer application. Bioboost fertilizer can also support the success of the red chili plant. Bioboost fertilizer is a microbe that is given into the soil to increase nutrient uptake by plants from the soil. Microbes used are generally microbes that can live together (symbiosis) with host plants. The benefits obtained by both parties, the host plants get additional nutrients needed. Microbes contained in biological fertilizers include N-fixing microbes, microbial decomposition of organic matter, microbial decomposition of pesticide residues and microbes to increase the availability of P in the soil [6]. Bioboost fertilizer can also be used as an alternative to help provide nutrients and increase soil fertility as a result of soil biochemical processes because bioboost is a biological fertilizer that contains superior microorganisms [7].

2. Materials and Methods

This research was conducted at KNPI, Jl. Trengguli 1 No. 25, Denpasar. Located in Penatih Village, East Denpasar District. Denpasar. With a height of ± 49 meters above sea level. This trial was conducted from January 5 to April 13, 2018.

This research is a two-factor experiment using a Randomized Block Design (RBD) with factorial patterns. The treatment consisted of two factors: the first factor was the biochar dose of cow feces consisting of 4 levels namely 0 tons ha^{-1}, 5 tons ha^{-1} (25 g/polybag), 10 tons ha^{-1} (50 g/polybag), 15 tons ha^{-1} (75 g/polybag). While the second factor is the concentration of bioboost consisting of 3 levels, namely P1 = 5 cc tan^{-1}, P2 = 10 cc tan^{-1} and 15 cc tan^{-1}. This bioboost was given 6 times so that the total concentration was 30 cc tan^{-1}, 60 cc tan^{-1}, and 90 cc tan^{-1}. After giving bioboost to each plant watered evenly with as much as 500 cc of water.

3. Results and Discussion

3.1 Research Results

The significance of the effect of giving dairy cow biochar doses (B) and bioboost concentration (P) and their interactions (BXP) on the observed variables are presented in Table 1. The results of the statistical analysis of all the variables observed in this study are presented in Tables 2, 3 and 4.

Based on Table 1, the interaction between the treatment of cow feces biochar dose with bioboost concentration had a very significant effect ($P<0.01$) on root fresh weight per plant, oven-dry weight of plant leaves, oven-dry weight of fruit per plant, significantly affected ($P<0.05$) on plant height, and no significant effect ($P\geq0.05$) on other variables. Application of cow feces biochar on chili plants did not significantly influence ($P\geq0.05$) on most of the observed variables except the number of flowers, leaf fresh weight, stem fresh weight, root fresh weight, oven-dry weight, stem dry weight, and weight fresh fruit that is very significant effect ($P<0.01$). Whereas the bioboost concentration had no significant effect ($P\geq0.05$) on some of the observed variables except plant height, number of flowers, root fresh weight, oven-dry weight, stems which were highly significant ($P<0.01$) and significant ($P<0.05$) to the number of fruits, oven-dry weight, and oven-dry weight.

Table 1
Significance of the effect of giving biochar dose (B) and bioboost concentration (P) and their interactions (BXP) on the variables observed per plant

No	Variable	Treatment		
		Biochar (B)	Bioboost (P)	Interaction (BxP)
1	Plant height (cm)	ns	**	*
2	Number of leaves (strands)	ns	ns	ns
3	Leaf area (cm^2)	ns	ns	ns
4	The diameter of the stem (mm)	ns	ns	ns
5	Number of branches (pieces)	ns	ns	ns
6	Amount of flowers (florets)	**	**	ns
7	Amount of fruit	ns	*	ns
8	Fresh Root Weight (g)	**	**	**
9	Fresh stem weight (g)	**	ns	ns
10	Fresh weight of leaf (g)	**	ns	ns
11	Root oven-dry weight (g)	ns	ns	ns
12	Oven dry weight of the rod (g)	**	**	ns
13	Oven-dry weight (g)	**	*	**
14	Fresh weight of fruit per (g)	**	ns	ns
15	Fruit oven-dry weight (g)	ns	*	**

ns = not significant ($P \geq 0.05$), * = Significantly ($P<0.05$), ** = very significant ($P<0.01$)

Table 2
The average variable observed due to the influence of the biochar (B) dose

Treatment	Biochar (ton ha^{-1})				LSD 5%
	0	5	10	15	
Plant height (cm)	37.07 ab	36.49 b	38.27 a	37.68 ab	1.31
Number of leaves (strands)	71.78 a	74.89 a	75.11 a	74.56 a	-
Leaf area (cm^2)	3469.30 b	3835.62 ab	4091.95 a	4007.24 a	526.06
Diameter of stem (mm)	0.50 a	0.58 a	0.51 a	0.58 a	-
Number of branches (pieces)	38.44 a	41.56 a	41.11 a	39.44 a	-
Amount of flowers (florets)	11.22 b	11.89 b	13.00 ab	14.00 a	1.13
Amount of fruit	8.44 b	9.22 ab	10.33 a	8.44 a	1.42
Fresh root weight (g)	38.44 a	41.56 a	41.11 a	39.44 a	-
Fresh stem weight (g)	33.69 b	34.51 b	35.73 b	38.28 a	2.26
Fresh weight of leaf (g)	29.60 c	32.38 b	35.21a	31.99 bc	2.39
Root dry weight (g)	2.49 ab	3.09 a	2.43 b	2.33 b	0.62
The dry weight of stem (g)	6.38 b	6.16 b	5.82 b	7.22 a	0.64
Weight of oven leaf shells (g)	4.58 b	5.82 a	5.27 a	5.72 a	0.56
Fresh weight of fruit (g)	93.22 c	106.22 b	119.91 a	97.81 bc	10.44
Fruit oven-dry weight (g)	2.62 a	2.65 a	2.67 a	2.64 a	0.21

Note: The average value followed by the same lowercase letters on the same line, is not significantly different at the 5% level test

Table 3
The average of variables observed due to the influence of the Bioboost (P) concentration

Treatment	Bioboost (cc tan^{-1})			LSD 5%
	5	10	15	
Plant height (cm)	36.81 b	38.74 a	36.58 b	1.51
Number of leaves (strands)	73.75 ab	77.25 a	71.25 b	5.97
Leaf area (cm^2)	4121.04 a	3806.04 a	3626.04 a	-
The diameter of the stem (mm)	0.50 a	0.58 a	0.54 a	-
Number of branches (pieces)	39.92 a	40.67 a	39.83 a	-
Amount of flowers (florets)	12.42 b	13.92 a	11.25 b	1.31
Amount of fruit	9.83 ab	10.58 a	8.50 b	1.64
Fresh root weight (g)	39.92 a	40.67 a	39.83 a	-
Fresh stem weight (g)	35.07 a	36.35 a	35.24 a	2.6
Fresh weight of leaf (g)	32.10 a	33.34 a	31.44 a	-
Root dry weight (g)	2.55 a	2.95 a	2.27 a	0.72
The dry weight of stem (g)	6.06 b	7.12 a	6.05 b	0.73
Leaf dry weight (g)	5.01 b	5.83 a	5.22 ab	0.64
Fresh weight of fruit (g)	98.80 b	111.55 a	102.53 ab	12.05
Fruit oven-dry weight (g)	2.58 b	2.84 a	2.52 b	0.24

Note: The average value followed by the same lowercase letters on the same line, is not significantly different at the 5% level test

Table 4
Average oven-dry weight of fruit per plant (g) on the interaction between biochar cow feces (B) and bioboost (P).

Treatment	P1	P2	P3
B0	3.07 ab	2.50 de	2.28 e
B1	2.32 de	3.02 abc	2.62 cde
B2	2.40 de	3.20 a	2.40 de
B3	2.53 de	2.63 bcde	2.77 bcd

The same letter behind the average shows no significant difference at the Duncan test level of 5%

3.2 Discussion

The results showed that the interaction between the biochar dose of 10 tons ha^{-1} with a bioboost concentration of 60 cc tan^{-1} (B2P2) gave the highest dry weight per fruit ie 3.20 g, an increase of 28.00% when compared with the lowest yield in treatments without biochar with bioboost 60 cc tan^{-1} (B0P2) that is equal to 2.50 g. The high dry weight of this fruit is supported by the presence of a positive and real correlation to the observed variables such as maximum plant height (0.41*), leaf area (0.40*), number of flowers (0.47**), fresh leaf weight (0.42*), oven root dry weight (0.43**), and fresh fruit weight (0.51**). The high dry weight of fruit oven on B2P2 is also supported by the highest fresh fruit weight obtained in the 10 ton ha^{-1} biochar treatment which is 119.91 g significantly different and increased by 28.63% compared to without biochar of 93.22 g. This is thought to be due to the ability of biochar to increase the main cation, P, and concentration of N in the soil. Cow feces biochar is a soil enhancer that can retain nutrients and water in the soil. The addition of biochar also causes increased soil porosity, C-organic, and microbial activity. According to [8] states that the ability of biochar which is useful in maintaining humidity can help plants in periods of drought can act as a trigger for plant growth and retain nutrients in the soil so that nutrients in the soil are not easily lost in the washing process in the soil and will ultimately affect the increase yields. Furthermore, the results of the study [9], showed that the utilization of biochar bamboo waste dosage of 10 tons ha^{-1} had a significant effect on plant height and total wet weight of corn plants. The best growth response of maize was obtained in the treatment of biochar 10 tons ha^{-1} and compost fertilizer 20 tons ha^{-1} [10].

The high dry weight of the fruit oven on B2P2 is thought to be caused by bioboost besides containing organisms such as Azotobacter sp, Azospirillum, Pseudomonas, Bacillus which play a role as nitrogen fixers also contain macro and micronutrients which support the availability of nutrients for plant growth. Nitrogen is the main constituent of protein and chlorophyll formation. With the increase of chlorophyll the photosynthesis activity will increase which will also increase the photosynthate produced. These photosynthates will be transferred to plant organs that are actively carrying out metabolic processes so that the growth of roots, stems, and leaves of plants is better and will further affect crop yields. This is also supported by [11] suggesting that the nutrients available to plants through the process of photosynthesis produce carbohydrates which are then raised to the organs of plants, this will stimulate the growth, extension, and enlargement of vegetative and generative parts. According to [12], the bacteria Azospirillum, Pseudomonas, and Bacillus can add N_2 so that it can repair N, as a phosphate solvent, and produce hormones that can consequently change roots, thereby increasing root biomass and more exploiting soil volume, increasing nutrient uptake in growth and production plant. Chili. Bioboost biological fertilizers also contain natural growth hormones such as gibberellins, auxins (IAA), cytokinins, kinetin, and zeatin which can support growth [13].

4. Conclusion

The interaction between biochar dosage of cow feces with bioboost concentration significantly affected root fresh weight, oven-dry weight, and oven fruit dry weight per plant and significantly affected the maximum plant height per plant, but no significant effect on other variables.

The highest dry weight per fruit was obtained in the interaction between biochar dose of 10 tons ha^{-1} with bioboost concentration of 60 cc tan^{-1} which was 3.20 g or an increase of 28% when compared to the lowest oven-dry weight in the interaction without biochar with bioboost concentration 60 cc tan^{-1} which is 2.50 g. The highest fresh fruit weight was obtained in the biochar treatment of 10 tons ha^{-1}, namely 119.91 g significantly different and increased by 28.63% compared to without biochar at 93.22 g.

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