THE EFFECT OF THE USE OF VARIOUS KINDS OF BIOCHAR ON PAKCOY PLANTS

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THE EFFECT OF THE USE OF VARIOUS KINDS OF BIOCHAR AND SOIL NUTRIENTS ON PAKCOY (*Brassica rapa* L.)

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Abstract. Biochar is a medium that is very suitable for soil. Making biochar itself is obtained from agricultural production waste. Utilization of agricultural waste is expected to produce new media that can increase agricultural production. This study aims to see how much influence the various types of biochar and soil nutrients (NPK fertilizer and Plant Growth Promoting Rhizobacteria) on Pakcoy. The method used was factorial completely randomized design (CRD). Where the first factor is various types of biochar, namely from rice husks, coconut shells, oil palm fruit bunches, corn cobs and coffee fruit skins. The second factor is control, giving NPK and giving PGPR. The results obtained were the effect of Biochar and soil nutrients on the parameters of number of leaves to the pakcoy plant.

1. Introduction

Biochar is solid form of carbon-rich charcoal (C) which is converted from biomass such as rice husks, straw, coconut shells, used sawn timber, tree branches, wood chips, corn cobs, sago dregs and the like through an incomplete combustion process with minimum oxygen (pyrolysis) [1][2][3]. The characteristics of biochar such as chemical composition, surface chemistry, particle and pore size distribution, as well as physical and chemical stabilization mechanisms of biochar in soil determine the effect of biochar on soil function. Biochar has long been known in Indonesia, especially as a source of energy (fuel and heat). The potential for biochar raw materials is relatively abundant, namely in the form of agricultural waste which is difficult to decompose or with a high C/N ratio. Nationally, the potential for agricultural biomass per year that can be converted into biochar is estimated at around 10.7 million tons which will produce 3.1 million tons of biochar. The highest potential comes from rice husk which reaches 6.8 million tonnes / year and is estimated to produce biochar of around 1.77 million t / year or about 56.48% of the total potential of biochar [4]. Therefore, Jember Regency as one of the central districts for food storage and plantations has the potential to provide raw materials for making biochar in a sustainable manner.

The benefits of providing biochar for soil fertility is as a soil repairer that can improve soil chemical, biological and physical properties and can improve the quality of agricultural land because it can reduce biomass waste [5]. The addition of biochar is also reported to increase soil pH and soil

cation exchange capacity (CEC) and increase nutrient availability in the soil. There are three mechanisms of nutrient availability, namely (1) direct nutrient supply from biochar (2) the ability of biochar to maintain nutrients, and (3) dynamics of microorganisms in the soil [6][7][8][4][9][10]. The ability of biochar to improve soil physical properties, among others, reduces density and affects the soil pore space, thereby increasing the soil's ability to retain water, especially in sandy and dry soils [4][9][8][11]. The organic compounds contained in biochar also act as a substrate for biota in the soil so that the population and activity increases which have an impact on improving the chemical and physical properties of the soil. Another function of biochar administration is to be able to mitigate greenhouse gases by reducing N2O emissions due to reduced activity of denitrifying bacteria [12].

Basically, the soil also needs nutrients that help soil fertility. Some that are considered suitable and capable of enriching the soil are NPK and PGPR (Plant Growth Promoting Rhizobacteria) fertilizers. Plant Growth Promoting Rhizobacteria (PGPR) can be said to be a battery in the root area. These bacteria are used as biological organic fertilizers. Then NPK fertilizer contains three important elements that plants need in large quantities, namely nitrogen (N), phosphorus (P) and potassium (K). So this study aims to determine the effect of biochar and the addition of NPK and PGPR on Pakcoy. Pakcoy plants were used because of their short age, so the effect of the treatment can be known more quickly

2. Material and Method

2.1 Data Source

The data used in this study are primary data, namely the results of observations made by lecturers and students at the Jember State Polytechnic in August - September 2020. The method used was factorial completely randomized design with the first factor of 5 types of biochar, namely rice husks, corn cobs, coconut shells, coffee skin and oil palm fruit from Jember area. Then the second factor, there are three elements that are enriched, namely control (without giving), giving NPK and PGPR. So there are 15 treatment combinations in Table 1 and there are 3 replications.

Table 1. Combination Treatments

No.	Treatment	Note
1	B1P1	Rice husk + Control
2	B1P2	Rice husk + NPK
3	B1P3	Rice Husk + PGPR
4	B2P1	Corncob + Control
5	B2P2	Corncob + NPK
6	B2P3	Corncob + PGPR
7	B3P1	Coconut Shell + Control
8	B3P2	Coconut shell + NPK
9	B3P3	Coconut shell + PGPR
10	B4P1	Coffee husk + Control
11	B4P2	Coffee Husk + NPK
12	B4P3	Coffee Husk + PGPR
13	B5P1	Oil palm Waste + Control
14	B5P2	Oil Palm waste + NPK
15	B5P3	Oil Palm waste + PGPR

The Parameters of this research is number of leaves, leaf area, fresh weight of Tajuk, dry weight of tajuk, fresh weight of roots, dry weight of roots, fresh weight of pakcoy plant and dry weight of pakcoy plant.

2.2 Completely randomized design

The experimental design used in this study was a factorial completely randomized design. The Factorial Completely Randomized Design Formula is as follows:

$$y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$$

Note:

μ = the general of average
α_i = treatment factor 1st
β_i = treatment factor 2nd
$(\alpha\beta)_{ij}$ = interaction of factor 1st and factor 2nd
ε_{ijk} = error effect of factor 1st and 2nd with replication

2.3 Test of Honestly significant difference (HSD)

Honestly significant difference (HSD) is one further test used by using the Tukey Table. The formula used is as follows:

$$r = Q_{\alpha(p,v)} \times \sqrt{\frac{MSE}{n}}$$

Note:

r = Tukey Test
$Q_{\alpha(p,v)}$ = Tukey Table value with p is treatment and v is degree of error
MSE = value of Mean Square Error
n = number of replications

3. Result and Discussion

The results obtained from the analysis of the use of Biochar, NPK and PGPR using the Factorial Completely Randomized Design are as follows in Table 1:

Table 2. Analysis Results

Parameter	Observation	B	P	B X P	CV (%)
Number of leaves	07 DAP	*	NS	NS	12,72
	14 DAP	NS	NS	NS	15,09
	28 DAP	NS	*	NS	14,14
Leaf area	07 DAP	NS	NS	NS	31,74
	14 DAP	NS	NS	NS	31,25
	21 DAP	NS	NS	NS	37,39
	28 DAP	NS	NS	NS	38,62
Fresh weight of tajuk	28 DAP	NS	NS	NS	56,85
Dry Weight of Tajuk	28 DAP	NS	NS	NS	43,86
Weight of fresh roots	28 DAP	NS	NS	NS	45,04
Weight of dry roots	28 DAP	NS	NS	NS	35,18
Fresh Weight of pakcoy plant	28 DAP	NS	NS	NS	55,86
Dry weight of pakcoy plant	28 DAP	NS	NS	NS	42,78

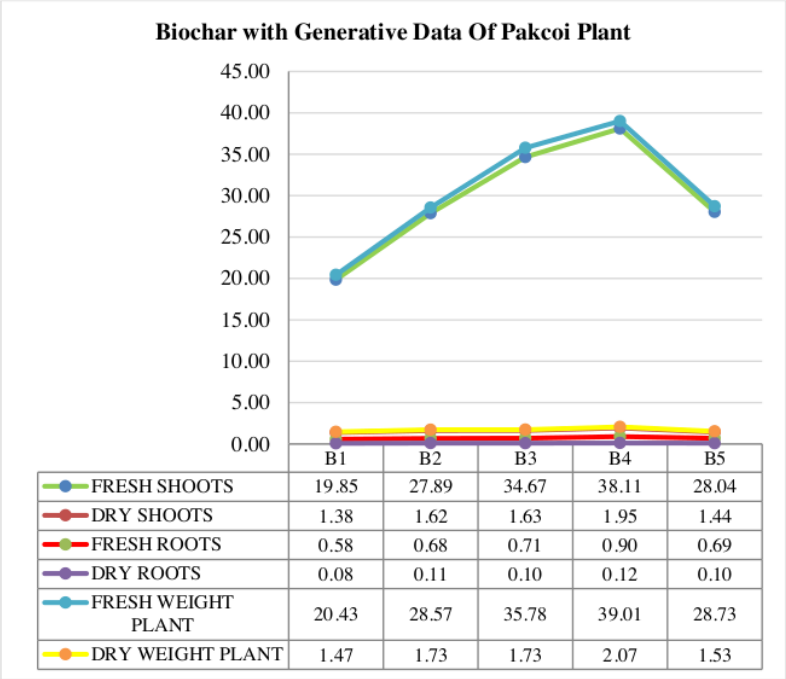
Note :

DAP : Days after planting

NS : Non Significant

* : significant of 5%

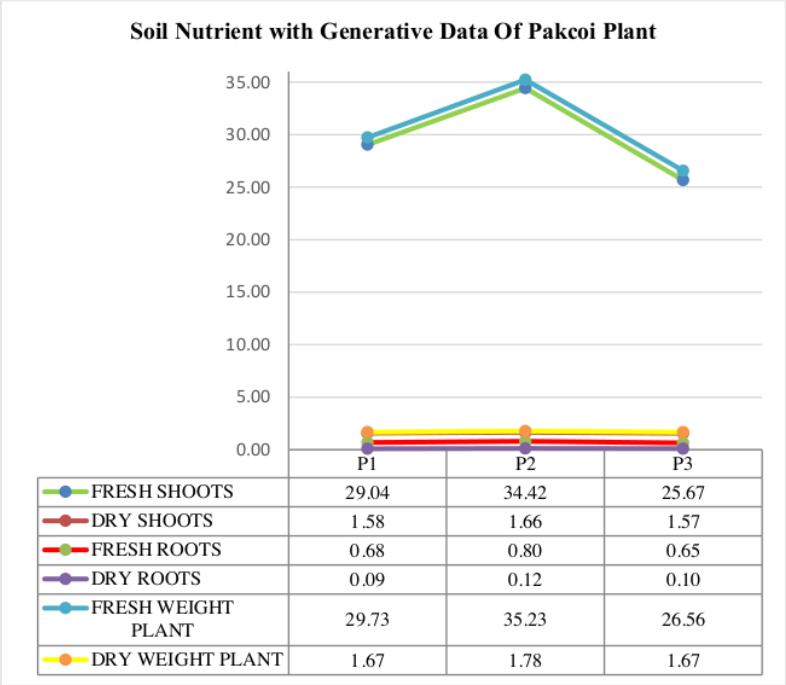
Based on Table 1, it can be seen that only the number of leaves, the effect of biochar and the provision of nutrients to enrich the soil have a significant effect. However, when seen in Figure 1, and Figure 2 all parameters have the same effect in providing biochar and providing nutrients in enriching the soil.



	B1	B2	B3	B4	B5
FRESH SHOOTS	19.85	27.89	34.67	38.11	28.04
DRY SHOOTS	1.38	1.62	1.63	1.95	1.44
FRESH ROOTS	0.58	0.68	0.71	0.90	0.69
DRY ROOTS	0.08	0.11	0.10	0.12	0.10
FRESH WEIGHT PLANT	20.43	28.57	35.78	39.01	28.73
DRY WEIGHT PLANT	1.47	1.73	1.73	2.07	1.53

Figure 1. Average Between Biochar with Leaf Area

From Figure 1, it can be seen that the effect of using coffee skins (B4) is higher than the others



	P1	P2	P3
FRESH SHOOTS	29.04	34.42	25.67
DRY SHOOTS	1.58	1.66	1.57
FRESH ROOTS	0.68	0.80	0.65
DRY ROOTS	0.09	0.12	0.10
FRESH WEIGHT PLANT	29.73	35.23	26.56
DRY WEIGHT PLANT	1.67	1.78	1.67

Figure 2. Average between Soil Nutrient with Generative Data Of Pakcoi Plant

From Figure 2. It can be seen that the highest is the provision of NPK which is higher than that without control and provision of PGPR.

Based on Table 2. states that there are an effect of Biochar application and soil nutrition on the number of leaves of the 7th and 28th observation days after planting. So that further analysis is needed in Table 3. And Table 4. As follows:

Table 3. Tukey Test of Number of leaves on 7th observation

Treatments	Means	Result
B1	4,11	a
B2	5,11	b
B3	5,11	b
B4	4,93	b
B5	4,81	ab

Where : Table value of tukey is 0,79

Dari Tabel 3 terlihat bahwa perlakuan yang berpengaruh adalah B2 (Corncoid) dan B3 (Coconut Shell).

Table 4. Tukey Test of Number of leaves on 28th observation

Treatments	Means	Result
P1	8.49	a
P2	9.73	b
P3	8.42	a

Where : Table value of tukey is 0,94

From Table 4.Which has a significant average effect on treatment P2 (PGPR)

4. Conclusion

The use of biochar and elements that enrich the soil, namely NPK and PGPR affect the pakcoy plant on the parameter of number of leaves to the pakcoy plant. The use of biochar with coffee husks and NPK can provide growth for pakcoi plants.

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