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THE INFLUENCE OF BIOCHAR TYPES OF SOIL AND DOSAGE SOYBEAN SUBSTRATION

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Abstract: *The objective of this research was to determine the effect of soil type, biochar type and dose of soybean seed germination in a glass house as biochar quality test. The study used a randomized block design with three factors and two replications. First factor were biochar type application: B1 (Rice hull biochar/RHB); B2(Maize Strover Biochar/MSB); B3 (Rice straw biochar/RSB); B4 (Bagasse Biochar/BB); B5 (Tapioca residue Biochar/TRB); B6 (Oil palm empty fruit bunch/OPB). Second Factor were biochar rate application : 10 t/ha (M1); 20 t/ha (M2). The third Factor was soil type/origin application: Soil from Rampah District (T1); Soil from Medan (T2); District Soil from Galang District(T3). The results of this research showed biochar type, doses of application, soil type, and its interaction significantly affected soybean germination and growth of soybean germination. Rice hull biochar and Bagasse Biochar showed the highest soybean germination percentage and rice hull biochar, and tapioca residue biochar showed the highest growth of soybean germination. Soil from the growth of soybean germination Medan district does biochar at 20 t/ha and interaction 2 factor T2B1 dan B2M1 showed the highest soybean germination percentage.*

Keywords: *Biochar, germination, soybean, rice husk.*

1. INTODUCTION:

Soybeans, rice, and corn are the primary food commodities. Soybeans have a high nutritional value, so they are used as an area as food, healthy food ingredients, and food and non-food industry raw materials [2]. The content of soybeans includes protein, fat, vitamins, minerals and fiber that are the best. Soy isoflavonoid content is higher than other food crops. Soybeans also contain several vital phospholipids in fat, namely lecithin, cephalin and lipositolga [1].

Soybean needs continue to increase from year to year. Average soybean consumption is currently around 8.97 kg/ capita/year. In 2015 the total national demand for soybeans reached 2.71 million tons. The projection of soybean consumption in 2015 reached 3.35 million tons. To meet these national needs, if national average productivity can be achieved at 1.5 tons/ha, then the area of soybean land to meet the above requirements is 2.24 million ha by 2025 [3][4].

The use of biochar made from agricultural waste as ameliorant material is now being promoted because it is readily available, cheap and can last a long time in the soil because the decomposition process is slow or relatively resistant to microorganism attacks. Addition of biochar can improve soil fertility [5], able to restore the quality of degraded soil [6], improve crop yields, prevent nutrient leaching, act as a remediation of organic contaminants [6], play a role in immobilizing heavy metals such as Cd, Zn and Pb in the soil [7][8] can adsorb herbicides [9] and pesticides or neutralize natural toxins in the decomposition of organic matter.

The application of biochar into the soil can alter the mineralization of organic matter [1] related to the release of nutrients such as nitrogen [10]. Changes in nutrient status soil can affect seed germination and seedling growth. Some compounds in biochar have the potential to either inhibit or stimulate seed germination and seedling growth. Biochar can improve [11] and reduce [12] plant growth and yield. This research aims to determine the effect of type, the dose of biochar on soybean germination on various kinds of soil in the greenhouse as a test of the quality of biochar.

2. LITERATURE REVIEWS:

Biochar raw materials are cheap and easy to obtain, namely in the form of agricultural organic waste, especially those that are difficult to decompose or with high C / N ratios, including coconut shells, coconut fiber, cocoa peel, rice husks, corn leaves / stems, mangrove logs, coconut skin oil palm, empty palm oil bunches, and others. Biochar has been shown to survive in the soil for up to> 1000 years and is capable of sequestering carbon in the ground [2], where indigenous Amazonians have given charcoal to the soil for a long time and until now (100-1000 years later) it has been proven that the quality of the physical and chemical properties of the land is far better than that of the surrounding area [12].

Addition of biochar can change soil nutrient availability, increase soil CEC and fertilization efficiency, improve plant growth and yield, reduce soil erosion and also increase water retention capacity. Information on how biochar amendments affect soil properties, seed germination and seedling growth and microorganism populations are minimal [13].

3. RESEARCH METHODS:

This research was conducted in the Growth Center Kopertis I Medan greenhouse. The study used a Factorial Randomized Block Design which had two replications with three treatment factors. The first factor is the type of biochar (B) which consists of 6 levels, namely: Biochar from Rice Husk (B1), Biochar from Corn Waste (B2), Biochar from Rice Straw Waste (B3), Biochar from Sugarcane Waste (B4), Biochar from Cassava Waste. (B5), Biochar from Oil Palm Empty Fruit Bunches (B6). The second factor is the dose of biochar (M) which consists of 2 levels, namely: 10 tons/ha (M1), 20 tons/ha (M2). The third factor is the type of soil which consists of 3 levels, namely: Land from Rampah (T1), Land from Medan (T2) and Land from Galang (T3).

Observations made on

This study included the percentage of germination at the age of 5 to 10 days after planting, seed vigor index, germination coefficient, crown length, root length, crown weight, root weight, and root volume. Percentage of sprouts (%) was observed starting from day 5 to day 10 and calculated using the formula:

$$PK(\%) = \frac{\text{total of soybean} \times 100\,\%}{\text{Total of sample}}$$

Vigor seeds were observed until the 10th day and calculated using the formula

$$I.V = \frac{G1}{D1} + \frac{G2}{D2} + \frac{G3}{D3} + \ldots + \frac{Gn}{Dn}$$

Wheres:

G = Number of seeds that germinate on a certain day,
D = Time corresponding to that number,
n = Number of days in the final calculation

The data obtained were analyzed using the F test to see the diversity of results and then tested the difference in difference with DMRT at α 5%.

4. RESULTS AND DISCUSSION:

The results of the analysis of variance showed that the treatment of a single factor of biochar type had a significant effect on the percentage of soybean germination at the age of 5 to 10 days after planting, seed vigor index, and soybean germination coefficient. The single treatment type of biochar which shows the highest percentage of soybean germination is rice husk biochar (B1) and sugarcane waste biochar (B4), this can be seen in Figures 1, 2 and 3.

The results of Zemriyetti et al. (2014) showed that the chemical characteristics of biochar from various organic wastes showed that nutrient content varied depending on the organic waste used. Rice husk biochar showed the highest nutrient content for total C, Na2O, SO4, Al2O3, organic matter, corn waste biochar showed the highest value for pH, sugarcane waste biochar showed the highest value for P2O5, ash content, electrical conductivity, coconut fiber biochar showed the highest value for total N, and K2O and rice straw biochar showed the highest values for pH, CaO, MgO, while for other nutrient content found in moderate amounts. The effects of biochar on soil properties tend to vary significantly between different biochar because biochar properties are determined by biomass sources and pyrolysis conditions such as temperature and activation treatment (Chan et al. 2007, 2008; Gaskin et al. 2008; Chan and Xu 009;009; Novak et al. 2009; Nguyen et al. 2010).

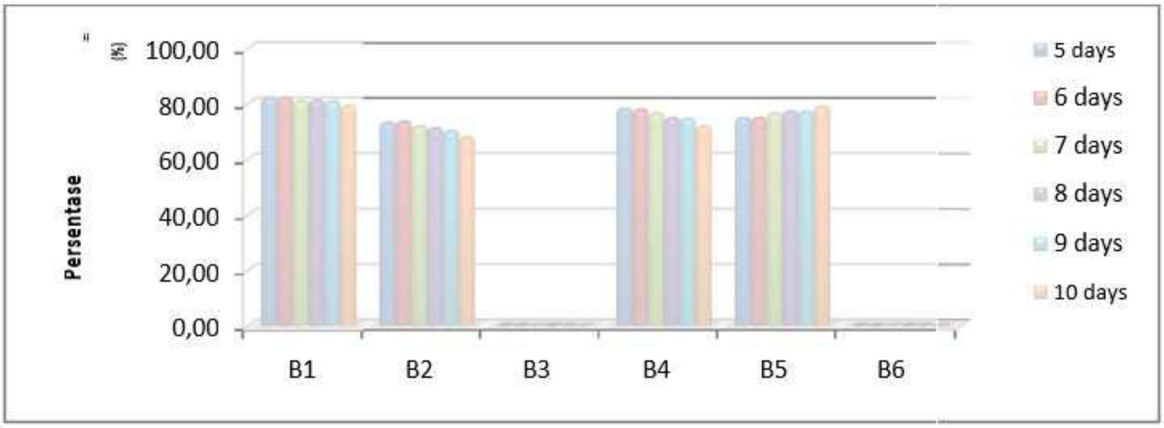

Figure 1. Percentage of soybean germination in the age of 5 to 10 days after planting in biochar type treatment.

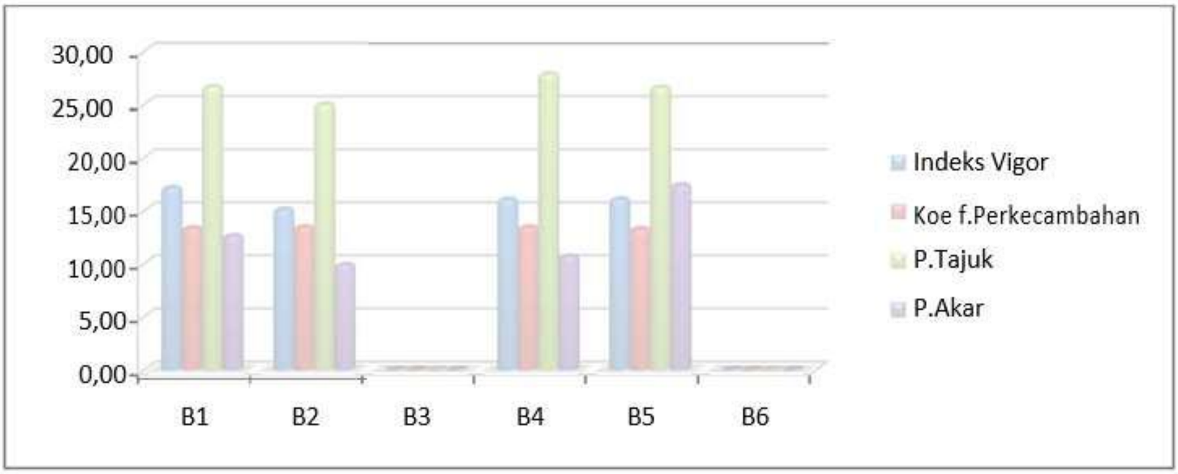

Figure 2. Vigor index, germination coefficient, crown length, soybean root length 10 days after treatment in biochar type treatment.

The results showed that the administration of biochar types of rice straw and empty bunches of oil palm was not suitable to be a germination medium, this was seen from the 0% germination percentage. This may be due to the fact that biochar of rice straw and oil palm empty fruit contains chemical compounds that can inhibit germination. Black et al (2006) stated that there are several classes of chemical compounds that can inhibit germination, namely gases (H2S, NH3, Cl2, SO2), h eteroside (allyl-isothiocyanate, β-phenethyl-isothiocyanate), aldehydes (acetaldehyde, benzaldehyde, aldehyde salicylate, cinnamaldehyde), organic acids (malic acid, citric acid, acetic acid), aromatic acids (cinnamic acid and its derivatives, phenolic acids {caffeic acid, ferulic acid, vanillic acid, ρ-coum aric acid, ρ-hydroxybenzoid acid}); unsaturated lactone (parasorbic acid, anemonin, coumarin, osthenol, phthalides); alka loid (cocaine, physostigine, caffeine, kin a, synconin, strychnine, codeine); amino acids (proline); various other groups.

5. CONCLUSION:

The highest percentage of soybean addition was obtained in the single treatment of biochar types, namely rice husk biochar and sugarcane waste biochar and is a type of soil originating from Indonesia, the type of soil originating from the field, where the growth is really high.

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