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Biochar Rice Husk Charcoal on Growth and Production of Long Bean Plants (*Vigna sinensis* L.): Formulation Analysis

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ABSTRACT
Rice husk charcoal has an important role as a soil-improving material, especially in improving soil physical properties such as porosity, aerase and drainage so as to make it easier for roots to develop and absorb nutrients. This study aims toincrease the growth and production of long bean crops by providing biochar charcoal husks and improving land productivity in sustainable agricultural enterprises. This study used a Randomized Group Design (RAK) with one factor consisting of 5 treatments and 3 groups. The treatment in this study was B_0 = 0 tons / ha, B_1 = 2.5 tons / ha, B_2 = 5 tons / ha, B_3 = 7.5 tons / ha and B_4 = 10 tons / ha. The results showed that giving several doses of biochar charcoal husks to rice was able to increase the growth and yield of long bean plants. The provision of rice husk charcoal biochar has a noticeable influence on the parameters of plant height, fresh weight of plants and fruit weight of long bean plants per plot. The results of the study wereobtained in the B_3 treatment, namely the administration of rice husk charcoal biochar at a dose of 7.5 tons / ha for the parameters of plant height, fresh weight of long bean plants and fruit weight per plot.

Keywords: *Charcoal; Biochar; Productivity; Husk.*

INTRODUCTION
Agricultural business using chemicals continuously causes serious problems with the fertility and sustainability of agricultural land. One of the consequences caused is the decline in land productivity which causesa decrease in the production of cultivated plants. Therefore, it is necessary to carry out sustainable agricultural efforts to reduce the occurrence of land degradation. Sustainable agriculture is an advanced agricultural business with the controlled application of technology according to with the provisions of the established protocol, so as to obtain optimal productivity, high product quality, maintained environmental quality and optimal agricultural business economic income (Sumarno, 2010).

Sustainable agriculture utilizes natural ingredients dalam crop cultivation efforts that aim to maintain the quality of soil fertility. Sustainable agricultural management is based on the principles of health, ecology, justice, and protection. The principle of health in sustainable agriculture is that tanian activitiesmust pay attention to sustainability and improving the health of soil, plants, animals, earth, and humans as a whole because all these components are interconnected and inseparable. The use of rice husk charcoal biochar is a form of sustainable agriculture that utilizes residues or residues of agricultural products that are reused in an effort to increase the yield of cultivated plants.

Sustainable agriculture by utilizingbioc har charcoal husks of rice as a soil-forming material is very suitable to be developed, this is in line with the concept of environmentally friendly agriculture. Biochar is a soil-forming material that has long been known in agriculture which is useful for increasingsoil ductivity. Biochar (biological charcoal) has a high cation exchange capacity (KTK) so that it is able to bind soil cations that can be beneficial for plant growth. In addition, the role of biochar for the soil is to maintain moisture and increase soil fertility.

The advantages of giving charcoal to the soil, among others, can improve the circulation of water and air in the soil, can supply nutrients so that it can stimulate plant growth. According to Radjagukguk and Jutono (1983), charcoal from burning plant litter can increase soil pH and nutrient supply, especially Ca, Mg, K and Nurita and Jumberi (1997) stated that husk charcoal can also be used as an ameliorant

material as a provider of Ca, Mg and K and the administration of husk charcoal dapat increases the content of Ca and Mg in the soil. Research by Kolo and Raharjo (2016) proved that husk charcoal has an effect on tomato growth and yield, as well as Lolomsait research (2016) showed that husk charcoal has an effect on diameter stems and the length of red pepper fruits. The purpose of this study is to increase the growth and production of long bean crops by giving biochar of rice husk charcoal and increasing land productivity by carrying out sustainable agriculture.

METHOD

This research was conductedfrom March to July 2019 in the Experimental Land of the Agrotechnology. The materials used are rice husk charcoal, cow manure dolomite, A4 paper, raffia rope and F4 paper. The tools used are hoes, machetes, hand tractors, meters, pens, pencils, digital scales anda *handsprayer*. This study used a Randomized Group Design (RAK) with one factor. The treatment used was several doses of rice husk charcoal biochar consisting of three groups, so that 15 experimental units were obtained. The treatment of several doses of husk charcoal biochar is:
B_0 : 0 ton/ha B_1 : 2.5 ton/ha B_2 : 5 tons/ha B_3 : 7.5 ton/ha B_4 : 10 tons/ha
The additive linear model of this design is as follows:
$Yij = \mu + \alpha i + \beta j + \varepsilon ij$ i = 1, 2, 3 .... t
j = 1, 2, 3 .... r
Yij = response or observation value of the husk charcoal biochar treatment and group
μ = general median value
αi = effect of husk charcoal biochar treatment
βj = group influence
εij = effect of experimental error of the treatment of biochar charcoal husks and groups

The data was processed with variance analysis (ANOVA) using SAS 9.1.3 Portable software. If there was a noticeable difference, so the Duncan test (DNMRT) was carried out at the 5% test level.

Research implementation

The process of burning husk charcoal is carried out with the following stages: the burning site is chosen in an area far from housing or roads, becausea rice husk burning process will cause thick smoke. The base of the kiln is made of zinc plates. This is to facilitate the collection of husk charcoal. The fire was ignited the size of a pre-made cylinder. The fuel used kernewspaper bag, then the fire is ignited, then the fire is covered with cylinders. The cylindrical combustion chamber in which there was already a flame was hoarded with a few sacks of rice husks. The hoarding was carried out mountainous upwards as high as 1 meter with the top ofthe chimney heap poking out. After 20-30 minutes or when the peak of the rice husk heap looks blackened, the husk that is still brown below is raised towards the top. This activity is carried out continuously until all the rice husks are perfectly blackened. After all the husks turn black, then watered with water until evenly distributed. Watering is carried out to stop the burning process If the combustion process is not stopped, the husk charcoal will turninto ashes. After watering and the temperature decreases, the mountains of husk charcoal are disassembled and dried. Then the husk charcoal is put in sacks and stored in a dry place.

- **Tillage**

The research area has an area of 240 m^2 with inhomogeneous conditions due to the uneven slope of the land. The research area consisted of 15 experimental plots. Each experimental plot measures 3 x 1.8 m with a distance between plots of 0.5 m. The soil on the research plots was processedusing a tractor and then given dolomite to raise the soil pH at the same dose for each research plot. After the soil is treated, it is then mixed with manure at a dose of 20 tons / ha.

- **Seed Preparation**

The seeds of the panj ang bean varietyused in this study were first soaked in water. Soaking is carried out for 2 hours, intended to facilitate the germination of seeds after planting on research plots in the field. The seeds that have been finishedsoaking are dredged then planted in the planting hole that has been provided.

- **Planting**

Seeds are planted using tugal with a row spacing of 60 x 30 cm. Seeds are planted in planting pits of 2 seeds per planting hole with a depth of 3cm, then the pits are covered with earth so that birds or ants do not eat them.

- **Maintenance**

Plant maintenance includes weeding, insertion, watering, anderadication of pests, Weeding weeds are carried out once every two weeks, but if there are weeds that grow quickly before two weeks, weeds are still manually removed by hand. Insertion is carried out if in the planting pit there are no tumb uh seedsfrom the two seeds planted. Watering is carried out once every 2 days but watering is not done if it rains. Pest eradication is carried out if the attacking pest has already reached an economical threshold. Pests are identified first and thenidentified using appropriate pesticides .

- **Treatment**

The application of rice husk charcoal is carried out at the beginning of planting by immersing it into the soil in the perimeter of the planting pit. The dose ofcharcoal to rice husks is adjusted to the treatment, namely at 0 tons / ha or control, 2.5 tons / ha or 45 g / plant, 5 t / ha or 90 g / plant, 7.5 tons / ha or 135 g / plant and 10 tons / ha or 180 g / plant.

- **Harvest**

This harvesting is carried out 5 times. With harvesting criteria, namely, the young pods are fully filled, the color of the pods is evenly green, and also the bean pods are easy to break.

- **Observation Parameters**

The observational perameters in this study include:

- **Plant Height (cm)**

Measurement of plant height is carried out once every 1 week after the plant is 7 days old until the age of 28 days. Measurements are carried out using a meter.

- **Fresh Weight of Plants (g)**

The fresh weight of the plant is calculated after the plantis 35 days old (before out the primordia of flowers). The destructive sample plants are carefully hoeed, then washed in a bucket so that the plants are clean from the ground, after the plants are clean they are dredged and then weighed their weights using a digital gan tape.

- **Fruit Weight Per Plot (kg)**

This observation is carried out by weighing the fruits that have been harvested on each plant by collecting the harvested fruits and then weighing the weight for each experimental plot. Fruit harvestingis carried out 5 times so that the weight of the fruit is calculated by adding up all the crops. The data of the observations are analyzed and displayed in the form of graphs

RESULT AND DISCUSSION

- **Plant Height**

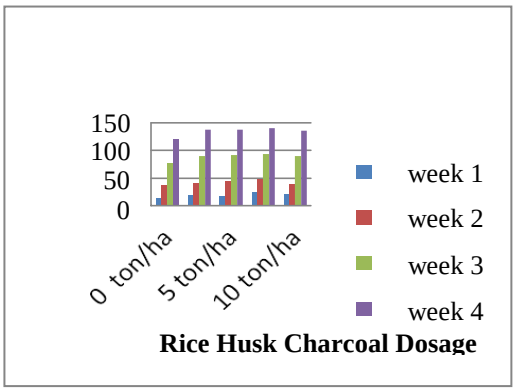

Figure 1. Plant Height String Beans

Figure 1 above shows that the administration of multiple doses of rice husk charcoal biochar was able to increase the height of the long bean plant for all treatments when compared to without the administration of rice husk charcoal biochar. Tall long bean plants mengalammy growth rate is significant for each week of observation. Tall the highest plants in the first, second, third and fourth weeks were obtained at the treatment of 7.5 tons / ha, namely 23.6 cm, 47.3 cm, 93.6 cm and 140.3 cm. The height of the long bean plant increases with the administration of rice husk charcoal biochar around 16.6 – 87% dibanding without treatment.

The application of rice husk charcoal of 7.5 tons / ha is able to increase the growth of the height of the long bean plant, this is because the addition of husk charcoal to the growing medium will be beneficial, including streamlining fertilization because in addition to improving soil properties (porosity, aerase), husk charcoal also functions as a nutrient binder (when excess nutrients) that will be used by plants when there is a lack of nutrients, then the nutrients are released slowly according to plant needs or slow railease (Komarayati et al. 2003). The results of research by Supriyanto and Fiona (2010) that the addition of husk charcoal to the growing media has a real influence on the growth of jabon seedling height. The addition of husk charcoal can increase the growthof ting gi seedlings jabon by 18.31% - 28.36%.

- **Fresh Weight of Plants**

The results of the fingerprint analysis (ANOVA) using the SAS program showed that the administration of husk charcoal biochar had a significant influence on the fresh weight of the string bean plant. The average fresh bobot of long bean plants with the treatment of adding biochar charcoal rice husks can be seen in Table 1.

Table 1. Average fresh weight of long bean plants with biochar feeding of rice husk charcoal

Fresh Charcoal Dosage (ton/ha)	Weight Rice Husk (grams)
0 ton/ha	300,00 a
2.5 tons/ha	322,67 a
5 tons/ha	329,67 Ab
7.5 tons/ha	366,67 c
10 tons/ha	354,33 Ab

The numbers followed by lowercase letters are not the same in the column, differ markedly according to the Duncan Test at a rate of 5%. Based on Table 1 above, it is explained that there was a significant increase in the fresh weight of the string bean plant by giving charcoal rice husks at a dose of 7.5 tons/ha compared to all treatments. The fresh weight of the long bean plant experienced anincrease of n by 7.56 – 22.22 % versus without treatment. The administration of rice husk charcoal at a dose of 7.5 tons / ha had a noticeable and highest effect compared to other treatments. The fresh weight of plants increases by giving rice husk charcoal because rice husk charcoal is able to improve the physical properties of the soil (texture, structure, aerase, drainage and porosity) causing the soil to become loose so that the growth and absorption of plant nutrients becomes better. Bernadinus and Wiryanta (2008) explained that husk charcoal has a high carbon content (C) so that it makes the soil more friable. The use of burnt husks for planting media does not need to be sterilized anymore because pathogenic microbes have died during the process of burning ice.

- **Fruit Weight Per Plot**

The results of fingerprinting (ANOVA) with the administration of rice husk charcoal have a noticeable effect compared to without treatment. The highest fruit weight yield was obtained at the treatment of 7.5 tons / ha, which was 11.35 kg per plot or equivalent to 21 tons / ha. The application of rice husk charcoal is able to increase the yield of long beans because husk charcoal is able to improve soil fertility so that plant growth and development are better. Djatmiko *et al.* (1985) explained that charcoal isa porous solid material and is the result of the combustion of a material containing the element C. Most of its pores are still covered with hydrocarbons, and other organic compounds and their components consist of *fixed carbon*, ash, water, nitrogen, and sulfur. Husk charcoal has an important role as a planting medium instead of soil. Husk charcoal is porous, light, not dirty and sufficiently able to hold water.

Morphologically charcoal has an effective pore for binding and storing soil nutrients. The application of husk charcoal especially on nutrient-poor lands can build up and improve soil fertility, because it can improve several functions including: air and groundwater circulation, soil pH, stimulate the formation of endo-spores and ectomycorrhiza, and absorb excess soil CO2. So that it can increase the productivity of land and plantation forests (Pari, 2002).

Indranada (1989) explained that one way to improve planting media that has poor drainage is to add husk charcoal to the media. This will increase the weight of the soil volume (bulk density), so that the soil has a lotof pores and pores not dense. Such conditions will increase the total pore space and speed up the drainage of groundwater. Result the weight of the long bean fruit per plot can be seen in the chart below.

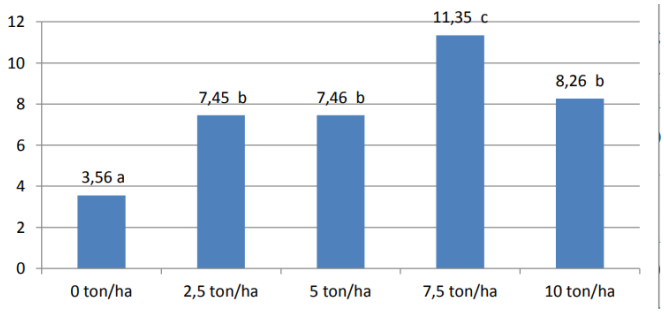

Figure 2. Result the weight of the long bean fruit

The presence of peninthe weight of the fruit per plot is influenced by the total pore space of the soil. Increased total pore space of the soil will add to the growth of the lateral roots of the plant. Lateral roots increase in length due to cracks formed due to the addition of soil reformers dwith various proportions of its addition. These cracks lead to the presence of a space that can be penetrated by the lateral roots. According to Hasanah (2009), root growth occurs by the way the roots enter the macro pores that are larger in size than hemeters of roots or whose diameter is equal to the diameter root.

CONCLUSION

Giving several doses of rice husk charcoal was able to increase the growth and development of long bean plants compared to without treatment for the parameters of plant height, fresh weight of the plant and fruit weight per plot. The best treatment was obtained on pemberian charcoal husks of rice at a dose of 7.5 tons/ha.

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