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Application of Rice Husk Charcoal and Water Hyacinth Bokashi in Imperata Soil on the Growth and Yield of Sweet Corn

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Abstract

Rice husk charcoal is a solution to restore fertile soil conditions such as reed soil. Rice husk is easy to obtain and husk charcoal which binds water and nutrients and is then combined with water hyacinth bokashi has a positive impact on plant growth and yields. Nutrients in water hyacinth bokashi which are easily lost can be bound by rice husk charcoal. The research objective was to study the effect of the interaction of rice husk charcoal and water hyacinth bokashi on the growth and yield of sweet corn plants. The research location was the Sam Ratulangi University Experimental Garden, Wailan Tomohon North Sulawesi Province from March to September 2021. The study used a completely randomized factorial design. The factor I was rice husk charcoal (A): A0= without rice husk charcoal, A1 = 10 tons rice husk charcoal/ha, A2 = 20 tons rice husk charcoal/ha, A3= 30 tons rice husk charcoal/ha. Factor II was water hyacinth bokashi (B): B0= without bokashi, B1 = 10 tons of bokashi/ha, B2= 20 tons of bokashi/ha. The 12 experimental units were obtained which were repeated 3 times to obtain 36 experimental units. The data were analyzed using analysis of variance and if there were differences, it was continued with the Least Significant Difference (LSD) test at the level of 5%. The results showed that there was an interaction between rice husk charcoal and water hyacinth bokashi, significantly affecting the number of leaves and cob weight with sweet corn husks. The single effect of water hyacinth bokashi had a significant effect on the weight of sweet corn husks. A dose of 20 tons of water hyacinth bokashi increased the yield of sweet corn with a cob weight without a husk of 316.33 grams.

Keywords: *Imperata Soil; Rice Husk Charcoal; Water Hyacinth Bokashi*

Introduction

Post-harvest waste of rice has not been put to good use, including rice husks. Rice husk can be converted into charcoal and is useful as a soil enhancer, especially in improving soil physical properties such as porosity, aeration, and drainage. Makes it easier for roots to develop and absorb nutrients. Another advantage of giving charcoal to the soil, improving water and air circulation in the soil. The land covered with weeds in Indonesia is quite extensive. The area is nutrient-poor and abandoned land, the area is a land resource that can be fertilized and can be used to produce food security and biomass-based

energy. Imperata grass is a land that has the potential to be developed for agricultural extensification programs. Indonesia has about 30 million hectares of *Imperata cylindrica* and this can increase if there is a forest fire (Lembaga Ilmu Pengetahun Indonesia, 2016).

The results of this study indicated that the interaction of rice husk charcoal and trichoazolla compost increased the growth and yield of upland rice plants (Buckman & Brady, 1969). Furthermore, the results of the study showed that water hyacinth bokashi as a soil ameliorant increased growth, maize yield, and soil physical and chemical properties (Andrhea et al., 2018). Likewise the results of research where husk charcoal affects the growth and yield of tomatoes (Sondakh et al., 2015).

In North Sulawesi, rice husk waste has not been utilized optimally as charcoal and its addition to *Imperata* fields has not been done much. Therefore, this research was carried out so that productive land for food crops has increased. The charcoal husk is not a fertilizer so the application of charcoal husk cannot replace the role of fertilizer. Need to add fertilizer to meet plant nutrient requirements. Sweet corn plants were used as test plants for nutrient adequacy in *Imperata* soil.

Corn requires a minimum of 13 nutrients which are absorbed through the soil. Nutrients N, P, and K are required in larger quantities, so they are called primary nutrients. Nutrients Ca, Mg, and S are required in moderation and are called secondary nutrients. Primary and secondary nutrients are commonly called macronutrients. Fe, Mn, Zn, Cu, B, Mo, and Cl are needed in small amounts, they are called micronutrients. Elements C, H, and O are obtained from water and air (Faesal & Akil, 2016). The use of organic matter has increased, considering that the land has experienced degradation of organic matter, and the high cost of inorganic fertilizers (urea, ZA, SP36, and KCl). The application of rice husk charcoal and water hyacinth bokashi was applied to *Imperata* fields to increase the productive land area. Increasing the area of productive land can increase national food production so that food security and self-sufficiency can be achieved.

The charcoal husk is a planting medium that is easy to make and does not need to be sterilized because the microbes have died during the burning process. The charcoal husk contains nutrients 0.3% N, 15% P2O5, 31% K2O, and several nutrients with a pH of 6.8. Charcoal husk has high water-holding ability, crumbly texture, water cycle, and high cation exchange capacity, and absorbs sunlight effectively. Water hyacinth (*Eichornia crassipes*) is a fast-growing weed. If not controlled, it will cause environmental problems. In Tondano Lake, Minahasa Regency, the water hyacinth weed is very disturbing to the lake ecosystem and the activities of the people around the lake. For that, it needs to be managed so that it is useful. In addition to having a negative impact, water hyacinth has a positive impact as fodder, raw materials for handicrafts, and basic ingredients for organic fertilizer. Utilization of water hyacinth bokashi in sweet corn cultivation can increase soil physical, chemical, and biological fertility. It is not yet known the effect of the interaction between rice husk charcoal and water hyacinth bokashi in increasing the growth and yield of sweet corn. For this reason, research on the effect of the interaction of rice husk charcoal and water hyacinth bokashi on the growth and yield of sweet corn needs to be carried out.

Method

The research location was the Sam Ratulangi University Experimental Garden, Wailan Tomohon North Sulawesi Province from March to September 2021. The materials and tools used are sweet corn seeds of the Exotic Pertiwi variety, water hyacinth, chicken manure, effective microorganism-4, rice bran, sugar, rice husk, zinc plate, nails, drill, polybags, sieve, scales, bamboo, plastic meter, container water, and stationery. The study used a completely randomized factorial design. The factor I was rice husk charcoal (A): A0= without rice husk charcoal, A1 = 10 tons rice husk charcoal/ha, A2 = 20 tons rice husk charcoal/ha, A3= 30 tons rice husk charcoal/ha. Factor II was water hyacinth bokashi (B): B0= without bokashi, B1 = 10 tons of bokashi/ha, B2= 20 tons of bokashi/ha. The 12 experimental units were obtained

which were repeated 3 times to obtain 36 experimental units. The data were analyzed using analysis of variance and if there were differences, it was continued with the *Least Significant Difference* (LSD) test at the level of 5%.

Results and Discussion

High Sweet Corn

The results of statistical analysis showed that the effect of the interaction between rice husk charcoal and water hyacinth bokashi and the effect of a single treatment was not significant on the height of sweet corn. The height of sweet corn is in Figure 1.

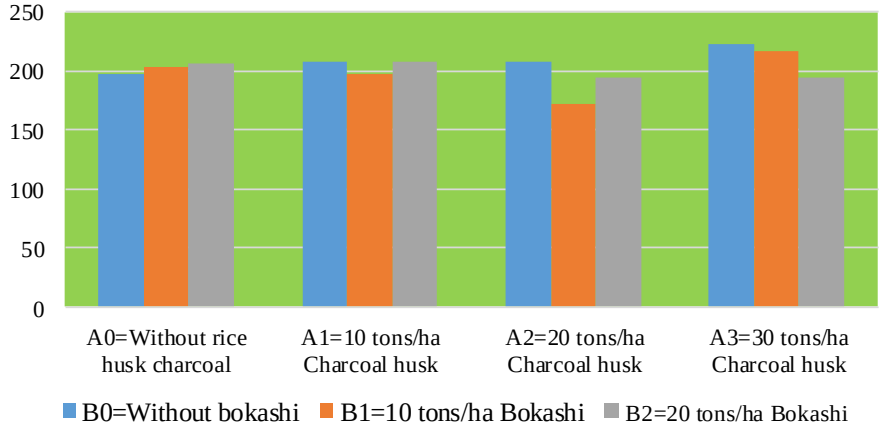

Figure 1. Sweet corn height (cm)

Number of Leaves

The results of statistical analysis showed that the effect of the interaction between rice husk charcoal and water hyacinth bokashi was significant on the number of sweet corn leaves. The interaction model can be seen in Figure 2.

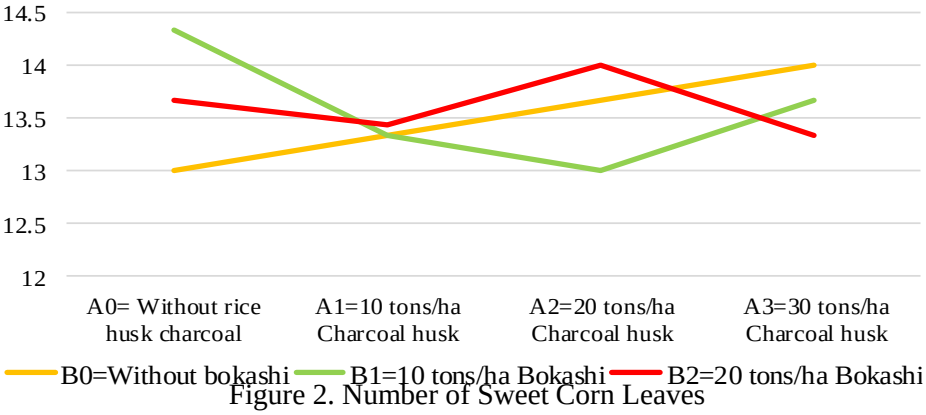

Figure 2. Number of Sweet Corn Leaves

Corn Cob Weight

The results of statistical analysis showed that the effect of interaction between rice husk charcoal compost and water hyacinth bokashi was not significant on the weight of sweet corn cobs. Giving water hyacinth bokashi had a significant effect on cob weight. The *Least Significant Difference* (LSD) test results of 5% can be seen in Table 1.

Table 1. Effect of water hyacinth bokashi on sweet corn cob weight

Treatment	The average weight of sweet corn cobs without husks (grams)
B0 = Without bokashi	279.58 a
B1 = 10 tons/ha Bokashi	293.67 a
B2 = 20 tons/ha Bokashi	316.33 b
LSD 5%	0.95

Note: Numbers followed by the same letters are not significantly different based on the Least Significant Difference (LSD) test at the level of 5%

Discussion

The interaction between rice husk charcoal compost and water hyacinth bokashi had a significant effect on the number of sweet corn leaves. The higher the dose of rice husk charcoal in the treatment without bokashi, the greater the number of leaves. Giving water hyacinth bokashi at a dose of 20 tons/ha followed by giving 30 tons/ha of husk charcoal (Figure 2) can increase the number of sweet corn leaves. It is suspected that at the beginning of giving water hyacinth bokashi the C/N ratio was still considered high, namely 21.11%. An important aspect of the total nutrient balance is the ratio of organic carbon to nitrogen (C/N). In living metabolism, microorganisms utilize about 30 parts of carbon for each part of nitrogen. About 20 parts of carbon are oxidized to CO2 and 10 parts are used to synthesize protoplasm. The number of leaves is counted at harvest; it is suspected that the composting process has been running perfectly. Organic matter absorbed by plants is organic matter with a C/N ratio of around 12-15 (Peretiwi, 2016). Water hyacinth bokashi contains nitrogen elements that function to optimize plant growth. Nitrogen is generally needed for the formation or growth of the vegetative parts of plants, namely leaves, and plays an important role in the formation of green leaf substances that are useful in the process of photosynthesis.

The effect of water hyacinth bokashi was significant on the yield of sweet corn on cobs without husks (Table 1). The 20 tons of water hyacinth bokashi/ha (B2) is the best cob weight weighing 316.33 grams. This indicates an increase in the soil fertility of *Imperata* soil. Based on the description of the sweet corn plant, the Exotic Pertiwi variety weighs 250–400 g per cob (Kementerian Pertanian, 2009). The cob yields obtained in this study met the description standards based on the Ministry of Agriculture.

Sweet corn can grow in almost every type of soil, but for maximum production, it requires soil conditions at a level of soil acidity (pH between 5.8-6.8), with nutrient content of N, P, and K in the criteria of medium-high. The application of water hyacinth bokashi increased the soil pH of Imperata by 5.27 (including sour) so that the sweet corn could absorb nutrients properly. The water hyacinth bokashi added adds organic matter to Imperata soil and plays a role in increasing soil fertility, and will determine soil productivity, provide nutrients for plants, and improve the physical, biological and chemical properties of the soil.

Nutrients nitrogen, phosphorus, and potassium contained in water hyacinth bokashi can play a role in the growth and yield of sweet corn. Nitrogen is a constituent of amino acids needed in the formation or growth of vegetative parts such as stems, leaves, and roots. Nitrogen is a macronutrient that is absorbed by plants in large quantities, but for soils in the tropics, N is one of the elements that is often found to be deficient to increase crop production (Marchner, 2002). Phosphorus serves as an energy source in various plant metabolic reactions, plays an important role in increasing yields, and provides lots of photosynthates which are distributed to the seeds so that corn seed yields increase. Fruit size and fruit quality are influenced by the availability of potassium (Mapegau, 2010; Suryani & Marlina, 2020).

Conclusion

The single effect of water hyacinth bokashi had a significant effect on the weight of sweet corn husks. A dose of 20 tons of water hyacinth bokashi increased the yield of sweet corn with a weight of cobs without husks of 316.33 grams. The use of water hyacinth bokashi on sweet corn is beneficial for increasing yields and is beneficial for maintaining health and soil fertility.

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