ATLANTIS PRESS

Advances in Social Science, Education and Humanities Research, volume 349

6th International Conference on Community Development (ICCD 2019)

The Study of Utilization of Coconut Shell Compost (ARKOBA) to Increase the Growth and Yield of Rice (Oryza sativa L.) in West Kalimantan

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Abstract. **This study aimed to determine the effect of the bioactive compost (arkoba) coconut shell charcoal on the growth and the yield of rice plants (Oryza sativa L.) on alluvial soil. The research was conducted in Mulia Baru Sub-District, Delta Pawan District, Ketapang Regency. This study occurred for four months, starting from February 2018 - May 2018. The study used a Completely Randomized Design (CRD) with a dose of coconut shell bioactive compost charcoal treatment using six treatment levels, repeated four times where each replication consisted of 3 plant samples. With the result with 6 x 4 x 3 = 72 plants. The treatment was a0 = without giving ARKOBA, a1 = ARKOBA with a dose of 25 g / polybag (5 tons / ha), a2 = ARKOBA with a dose of 50 g / polybag (10 tons / ha), a3 = ARKOBA with a dose of 75 g / polybag (15 tons / ha), a4 = ARKOBA with a dose of 100 g / polybag (20 tons / ha), a5 = ARKOBA with a dose of 125 g / polybag (25 tons / ha). The parameters observed in the study were: plant height (cm), number of clump tillers (tillers), dry paddy grain weight (g), the weight of 100 grains of clump grain (g). The results showed that the dose treatment of coconut shell bioactive compost charcoal had a very significant effect on the variables, which is plant height, number of tillers, dry paddy grain weight and weight of 100 grains of dry grain. Treatment level a3 gave the best results on all variables observed plant height 88.88 cm, the number of tillers was 28.33 tillers, dry paddy grain weight was 20.52 g, and the weight of 100 dried grain seeds was 2.52 g.**

Keywords: charcoal, compost, bioactive, results, rice

INTRODUCTION

Generally, rice cultivation in West Kalimantan is carried out on alluvial soil. Alluvial soils have common properties: they are textured, moist, wet, hard (dry), gray without horizon and have low permeability [1]. The problems that exist in alluvial soil for rice cultivation, namely the content of Fe, Mn and Al tend to be high, low soil pH (5.3 - 5.8), so that aluminum poisoning is very high in plants because the amount of dissolved aluminum is quite large, the presence of relatively low P content, containing salt chemicals from sea water and pyrite and low organic matter content, needs to take appropriate steps to improve, such as the physical, chemical, and biological of alluvial soils to increase growth and production of rice.

The use of organic fertilizers on rice cultivation in alluvial soil is one of the alternative solutions. The use of organic fertilizers is able to maintain the balance of land and increase land productivity and reduce the adverse effects of the soil environment. Organic fertilizers are the result of the decomposition of organic materials, which are decomposed (overhauled) by microbes, which can provide nutrients needed by plants. Organic fertilizers are very important in supporting the physical, chemical, and biological buffer of soils so that they can increase fertilizer efficiency and land productivity [2]. Some of the other benefits of organic fertilizer are that it can provide macro and micro nutrients, containing topsoil which can increase soil cation exchange capacity, increase the activity of soil microorganisms, in acid soils can help increase soil pH which does not cause soil pollution and water pollution [3].

In West Kalimantan, the coconut shell is very abundant, but its utilization is still low, so the innovation needs to be done so that the shell does not become waste. Utilization of agricultural waste is one of the efforts to manage environmentally friendly agriculture. Most agricultural crop wastes are solid wastes that are not utilized optimally but have the potential to be processed into materials that are useful for increasing soil fertility in natural. Agricultural waste can be converted into biological charcoal (biochar). Biodiversity is a material produced by the pyrolysis process. Charcoal has the ability to absorb and release nutrients because it has a large surface area that is almost the same as colloidal soil. The results of the Masulili study [4] showed that the use of bio-charcoal (biochar) had a good effect on the

improvement of acid sulfate soil properties. Biological charcoal can be applied to the soil as a soil enhancer material besides biological charcoal can also be used as a constituent of organic fertilizer in the form of Bioactive Compost Charcoal [5]. Bioactive compost charcoal (ARKOBA) is an organic fertilizer produced from mixing biological charcoal and compost material through composting technology with the help of *lignoselulostic* microbes that remain alive in compost. Bioactive compost charcoal is made from three components of raw materials, namely: biological charcoal (biochar), compost material and bio activator [5].

METHOD

The study was conducted in Ketapang Regency, took place from February 2018 - May 2018. The materials used were the seeds of Ciherang variety, alluvial soil, bioactive compost charcoal, polybags and pesticides and the tools used were hoes, machetes, liters, buckets, meters, analytic weigh scales, plastics, sacks, stationery, pH, cameras and thermometers.

This study used a Completely Randomized Design (CRD) with dose treatment of coconut shell bioactive compost charcoal (a) with six levels of treatment, which was repeated four times where each replication consisted of 3 plant samples. So that it gets 6 x 4 x 3 = 72 plants.

The planting media in the form of alluvial soil is cleaned, then soaked for one night and destroyed to become mud. Coconut shell compost charcoal is given one week before planting by mixing with soil. The provision of N, P and K fertilizers are given the following 1/2 recommendations: fertilizer is given twice, namely first fertilization one week after planting (MST) and three weeks after planting with Urea fertilizer/polybag 0.625 g, SP36 / polybag 0.3375 g, and KCL / polybag 0.25 g into each polybag. After the rice seedlings three weeks after sowing can be transferred to the prepared polybag. Maintenance includes embedding, weeding, controlling pests, and diseases. Observations carried out during the study included Plant Height (cm), Number of tillers/clumps (tillers), Dry / Clumped Grain Weight (g), the weight of 100 grains of dry grain (g).

RESULT

Growth of Rice

Growth observed included plant height and number of tillers per clump.

Table 1. Effects of Coconut Shell Bioactive Compost Doses on Growth of Rice

Treatment	Plant Height (cm)	Number of tillers per clump (Tillers)
a0	65,33 a	17,50 a
a1	84,23 b	20,66 ab
a2	84,19 b	26,08 b
a3	88,88 b	28,33 b
a4	86,35 b	23,75 ab
a5	80,01 b	23,08 ab

Note: The number followed by the same letter is not significantly different from the BNJ test with a confidence level of 5%.

From Table 1, it is known that at the level of treatment a3 is very significantly different from the treatment level a0 but not significantly different from the level of treatment a1, a2, a4 and a5. The treatment level of a3 showed the highest average for rice plant height, which was 88.88 cm, while the lowest treatment level was a0, which was 65.33 cm. At the level of treatment, a3 showed the highest average for observation of plant height, which was 88.88 cm. This result explains that giving coconut shell bioactive compost charcoal tends to increase plant height. This shows that giving coconut shell bioactive compost charcoal is able to provide nutrients for plants so that it can help the process of photosynthesis, which ultimately can spur plant growth. This is in line with the opinion of Sutedjo and Kartasoeputra [6], stating that plants will thrive if nutrients are available in the soil, due to plant growth depends on nutrients obtained from the soil and is influenced by the addition of nutrients obtained from compost. As well as the microelements contained in the coconut shell bioactive compost charcoal so that it meets the needs of plants and is utilized by plants for its growth. According to Rismunandar [7], N plays a role for vegetative growth, P plays a role in enzymatic reactions that are important in cell division so that it is directly related to plant height, K plays a role in maintaining important turgor pressure to improve photosynthesis and metabolic processes. Added by the Ca important for leaf growth, Mg makes chlorophyll healthy and the S influences the formation of chlorophyll along with N functions.

The less optimal growth of plant height in the treatment that is not given coconut shell bioactive compost charcoal (a0) is due to the low availability of nutrients in the soil so that the process of extension and cell division at the end of the plant is not optimal. This is in line with the opinion of Marsono and Sigit [8], the effect of coconut shell bioactive compost charcoal on its use will provide nutrients needed for plants such as macronutrients (N, P and K). Organic materials in compost can bind nutrients that are easily lost and provide them to plants. The increase in plant height is closely related to macro nutrients, one of which is Nitrogen. Nitrogen is needed by chlorophyll and protein plants. According to Rafi [9] the element Nitrogen serves as a constituent of many essential compounds for plants, for example, amino acids. The more nutrients the nitrogen absorbs by plants will increase plant growth and development. According to Hakim et al. [10], organic fertilizers have physical advantages that can reduce soil consistency or density, help dissolve elements, reduce fertilizer requirements by creating a soil aeration system, increase water retention and improve soil structure.

In Table 1 it is known that the average number of tillers of rice in the a3 level of treatment differed very significantly from the treatment level a0, but not significantly different from the level of treatment a1, a2,

a4, and a5. The level of treatment of a3 gave the highest mean for the number of tillers of rice plant ie 28.33 tillers and the level of treatment a0 gave the lowest mean for the number of tillers of paddy plant ie 15.67 tillers. This is suspected in a3 treatment to get good nutrients so that the nutrients will be used by plants for growth (Harjadi, 2005). Added by Markarim A Karim. [11] that nutrients in the form of Nitrogen, Phosphorus and Potassium are needed in large quantities especially during vegetative growth, the supply of N, P, K, Ca, and Mg macronutrients and microelements obtained from coconut shell bioactive compost charcoal can meet the needs and utilized the plant for its growth. Besides giving compost charcoal will also increase soil pores which can absorb and store water and nutrients (Gusmailina et al., 2009). Compost charcoal has better quality than ordinary compost produced conventionally, because of the presence of charcoal that blends with compost, so it can quickly improve the root environment conditions while being able to improve the physical, chemical, and biological properties of the soil which makes plant growth better [5].

Rice Production

Rice crop production observed included dry grain weight per plant cluster and weight of 100 grains of dry grain.

Table 2. Effect of Coconut Shell Bioactive Compost Dose on Rice Production.

Treatment	Grain Weight (g)	Dry Weight of 100 Grain (g)
a0	10,84 a	1,85 a
a1	14,63 ab	2,20 ab
a2	17,53 bc	2,24 b
a3	20,53 c	2,52 b
a4	13,39 a	2,34 b
a5	12,17 a	2,27 b

Note: The number followed by the same letter is not significantly different from the BNJ test with a confidence level of 5%.

From Table 2 it is known that the mean dry grain weight of paddy planters at a3 treatment level was significantly different from the treatment levels a0, a1, a4 and a5, but not significantly different from the level of treatment a2. The treatment level of a3 gave the highest average for dry rice grain weight of rice plant clumps which was 20.53 g while the lowest was the treatment level a0 which was 10.84 g.

At a3 treatment, level showed the highest average observed observation of clumps of dry grain weight of 20.53 g. It is assumed that rice plants in the a3 treatment received optimal nutrient supply from coconut shell bioactive compost charcoal to meet the needs of plants for their growth. This is due to the high nutrient content given so that it is sufficient for nutrient requirements in the photosynthesis process so that the photosynthesis process goes well and the photosynthetic produced is increasing so that it can increase the percentage of rice grain. Harjadi [12] states that photosynthetic produced during photosynthesis will be utilized by plants in physiological and metabolic processes such as the process of cell respiration and the formation of various organic compounds, which are used for filling seeds which ultimately increases the rice grain.

Whereas at the level of a0 shows the average dry weight of the dry grain, which is 10.84 g. This is caused by the nutrient content obtained by plants so that it is not sufficient for nutrient requirements in the process of photosynthesis so that the photosynthesis process does not go well.

According to Hakim [10] the low nutrient availability in the reproductive phase causes the inhibition of some plant metabolic processes that have an impact on crop yields, P deficiency can result in inhibited root development, inhibition of flower formation, and decrease in the number of seeds.

The results of the BNJ test in Table 2 show that the average weight of 100 grain of dry grain a3 treatment level was significantly different from the treatment levels a0 and a1, but not significantly different treatment levels a2, a4 and a5. The treatment level of a3 gave the highest average for the weight of 100 grains of dry grain which was 2.52 g, while the lowest level of treatment was a0 which was 1.85 g.

At the level of treatment, a3 showed the highest average observed weight of 100 grains of dry grain which was 2.52 g, this was assumed to be the rice plants in the treatment of A3 received optimal nutrient supply from coconut shell bioactive compost charcoal to meet the needs of plants for growth. Nutrients that can be absorbed by plants will determine the products produced. Adequate nutrients will cause plant photosynthesis to increase, where the results of photosynthetic processes play a role in the vegetative phase and play a major role in the generative phase. In the generative phase, carbohydrate accumulation occurs from the results of photosynthesis in plant reproductive organs [12].

At the level of a0 shows the average dry grain weight, which is 1.85 g. This is because there are no nutrients that can be absorbed by plants. Hidayati [13] states that land that suffers from P deficiency can cause most of the grain formed to be hollow, rice grains are not formed, 100 grains are low and grain quality is also low.

CONCLUSION

The treatment of coconut shell bioactive compost charcoal has a very significant effect on variables, such as plant height, number of tillers, dry weight of clumps and weight of 100 grains of dry grain. The level of treatment of A3 gave the best results on all variables observed plant height 88.88 cm, number of tillers 28.33 tillers, dry paddy grain weight 20.52 g, and weight of 100 dried grain seeds 2.52 g.

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