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GROWTH AND YIELD RESPONSE OF SHALLOT PLANTS TO THE ADMINISTERING OF RICE HUSK BIOCHAR AND MANURE

RESPON PERTUMBUHAN DAN HASIL TANAMAN BAWANG MERAH TERHADAP PEMBERIAN BIOCHAR SEKAM PADI DAN PUPUK KANDANG

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Abstract

This research examines the effect of rice husk biochar and manure on the growth of shallots and the interaction between the two treatments carried out. This research was conducted in Gampong Pineung, Syiah Kuala District, Banda Aceh, from September to December 2023. The method used was a Randomized Block Design (RBD) with a 3x3 factorial design and three replications. The factors tested in this research were the dose of rice husk biochar (0, 10, and 20 tons/ha) and the dose of manure (0, 10, and 20 tons/ha). Several parameters were observed, such as plant height at the age of 15, 30, and 45 dap, the number of tubers per clump at the age of 30 and 45 dap, the weight of wet tubers and dry tubers per clump, and the potential yield per hectare. The results of the research showed that the dose of biochar had a very significant impact on plant height at 30 and 45 dap, the weight of wet tubers, the weight of dry tubers, and the potential yield per hectare. Plant height at 15, 30, and 45 dap, number of tubers per hill at 30 and 45 dap, wet and dry tuber weight per hill, and potential yield per hectare. The study showed that plant height at 30 and 45, wet tuber weight, dry tuber weight, and potential yield per hectare were all significantly affected by biochar dosage. It had no visible impact on the number of tubers per hill at 30 and 45 dap, or on plant height at 15. Plant height at 15 and 30 days was significantly affected by manure application, but plant height at 45 dap, number of tubers per hill at 30 and 45 dap, wet and dry tuber weight, and potential yield per hectare were not affected. In the study of shallot growth and yield results, there was no clear interaction between manure dosage and rice husk biochar.

Keywords*: *Red onion, rice husk biochar, manure

Abstrak

Riset ini untuk mengkaji pengaruh pemberian biochar sekam padi dan pupuk kandang terhadap pertumbuhan tanaman bawang merah serta interaksi antara kedua perlakuan yang dilakukan. Riset ini dilakukan di Gampong Pineung, Kecamatan Syiah Kuala, Banda Aceh, September sampai dengan Desember 2023. Metode yang dipakai ialah Rancangan Acak Kelompok (RAK) dengan rancangan faktorial 3x3 dan tiga kali ulangan. Faktor yang diuji dalam riset ini ialah dosis biochar sekam padi (0, 10, dan 20 ton/ha) dan dosis pupuk kandang (0, 10, dan 20 ton/ha). Beberapa parameter yang dilihat seperti: tinggi tanaman pada umur 15, 30, dan 45 hst, jumlah umbi per rumpun pada umur 30 dan 45 hst, bobot umbi basah dan umbi kering per rumpun, serta potensi hasil per hektar. Hasil riset menunjukkan bahwa dosis biochar memiliki dampak yang sangat signifikan terhadap tinggi tanaman pada 30 dan 45 hst, berat umbi basah, berat umbi kering, dan potensi hasil per hektar. Tinggi tanaman pada 15, 30, dan 45 hst, jumlah umbi per rumpun pada 30 dan 45 hst, berat umbi basah dan kering per rumpun, dan potensi hasil

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per hektar. Riset menunjukkan bahwa tinggi tanaman pada 30 dan 45 hst, berat umbi basah, berat umbi kering, dan potensi hasil per hektar semuanya dipengaruhi secara signifikan oleh dosis biochar. Itu tidak memiliki dampak yang terlihat pada jumlah umbi per rumpun pada 30 dan 45 hst, atau pada tinggi tanaman pada 15 hst. Tinggi tanaman pada umur 15 dan 30 hari sangat dipengaruhi oleh pemberian pupuk kandang, tetapi tinggi tanaman pada umur 45 hst, jumlah umbi per rumpun pada umur 30 dan 45 hst, berat umbi basah dan kering, dan potensi hasil per hektar tidak terpengaruh. Pada kajian hasil pertumbuhan dan hasil bawang merah, tidak ada interaksi yang jelas antara dosis pupuk kandang dan biochar sekam padi.

Kata Kunci: Bawang merah, biochar sekam padi, pupuk kandang

INTRODUCTION

Shallots (*Allium ascalonicum* L.) are included in the family *Lilyceae* is one of the commodity horticulture superior and has good prospects to fulfill consumption national, source income farmers, and state foreign exchange. The benefits of onion red them as vegetable spices, seasonings, and vegetable seasoning cuisine used to add taste and enjoyment to cooking, as a drug tradition (Kuttner, 2018). Red onion own active ingredients such as *flavonoids*, *saponins*, and substances *quercetin* which are very beneficial for health they lower levels of cholesterol, prevent clumping blood, lower pressure blood, are anti-oxidant as well, and prevent growth cell cancer (Wibowo *in* Jali *et al*., 2022).

Red onion own content nutrition, every 100 g of onion red contains energy 43 kcal, protein 1.4 g, total fat 0.2 g, total carbohydrate 10.3 g, ash 0.6 g, sodium 12.0 mg, B- Carotene 788.0 meg, total carotene 50.0 meg, vitamin A, Vitamin B_1, Vitamin B_2, Vitamin B_3, Vitamin C, phosphorus, potassium, copper, zinc, iron, iron and sodium (Jaelani, 2007).

Based on data from the annual report of the Ministry of Agriculture, shallot production in Aceh Province in 2020 with a harvest area reaching 1,471 ha was able to produce 11,246 tons of shallots with a productivity of 7.78 tons/ha, in 2021 with a harvest area of 1,190 ha was able to produce 10,136 tons of shallots with a productivity of 8.5 tons/ha, then in 2022 with a harvest area of 1,236 ha was able to produce 10,070 ha of shallots with a productivity of 8.15 tons/ha. The data shows a decrease in shallot production (Ministry of Agriculture, 2023). The community's need for shallots continues to increase, one of the efforts made to increase shallot production is by applying biochar supported by the provision of cow dung fertilizer.

Biochar is a carbon-rich black charcoal used as a soil conditioner in agriculture that is made by heating biomass, including wood, litter, manure, and other waste, at high temperatures with little to no oxygen (Evizal & Prasmatiwi, 2023). Additionally, Gani (2009) noted that biochar may serve as a habitat for soil microbes without acting as a food source for them, which is why it is used as a soil conditioner. Generally speaking, biochar put into the soil can endure for hundreds to thousands of years. Although it helps retain water in the soil and make it more available to plants, biochar does not permanently upset the carbon-nitrogen balance.

The incorporation of biochar into the soil can enhance the availability of cations, phosphorus (P), and total nitrogen (N) levels in the soil. Additionally, the cation exchange capacity (CEC) can rise by up to 40% of the initial CEC, and soil pH can increase by one unit. Applying biochar at doses ranging from 0.5 to 20 tons/ha can boost plant productivity by 20 to 200% (Lehmann and Rondon, 2006). According to Kolo and Raharjo (2016), rice husk charcoal

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significantly influences plant growth and yield. Research by Jurika *et al*., (2022), revealed that applying rice husk biochar at a dose of 10 tons/ha had a significant effect on the number of leaves at 44 days after planting (dap) and also influenced the leaf count at 34 dap, with red onion growth showing improvement at this 10 tons/ha rice husk biochar dose.

Along with the application of biochar, another effective approach to improve shallot production is the use of organic fertilizers like manure. Manure plays a vital role in enhancing the soil's chemical, biological, and physical characteristics. Chemically, it increases the exchange capacity for cations and anions, provides essential nutrients, raises the pH of the soil, and helps neutralize harmful elements such as iron (Fe), aluminum (Al), manganese (Mn), and heavy metals. Biologically, manure stimulates microbial activity in the soil, which results in the production of growth regulators that support plant development (Mulyani, 2010). Physically, it enhances the soil's ability to retain water, reduces bulk density, improves total porosity, helps stabilize soil aggregates, and boosts humus content, all of which are advantageous for the growth of vegetable crops (Sutanto, 2005).

Manure derived from cow dung contains 0.7% N, 0.2% P, and 0.58% K (Agustina, 2011). Cow manure contains high levels of fiber such as cellulose, which is beneficial for the soil including loosening the soil, improving soil texture and structure, increasing porosity, aeration and soil microorganism composition, facilitating plant root growth, longer water absorption in the soil (Widiowati and Hartatik, 2010).

Cow manure with a dose of 10 tons/ha gave the highest results in plant height, number of leaves, and dry weight of shallot plants (Indriyana *et al*., 2020). The results of a study by Sejati *et al*., (2017) showed that administering chicken manure with a dose of 10 tons/ha can increase the wet bulbs of the Crok Kuning variety of shallots from 17.3 g/clump to 19.8 g/clump. The administration of chicken manure with a dose of 10 tons/ha had a significant effect on the diameter of the bulbs, the wet weight of the bulbs, and the dry weight of the bulbs per clump (Sukmasari and Atmawijaya, 2022). Furthermore, Yuwono (2005), added that the administration of manure to vegetable plants reached between 10-20 tons/ha. Based on the description above, it is necessary to research the growth and yield response of shallot plants to the provision of rice husk biochar and manure, as well as the interaction between the two.

RESEARCH METHODS

Place and Time of Research

This research was conducted in Gampong Pineung Syiah Kuala District, Banda Aceh City with a height of 3 m above sea level. Research starts from September to December 2023.

Research Materials and Tools

Materials used onion red variety Ilokos, rice husk biochar rice, fertilizer pen cows, pesticides vegetable. The pesticide the vegetable used is leaf soursop 100 sheets that are ground and dissolved in 5 liters of water and fermented for 24 hours. Then solution the filtered using a cloth smooth, 1 liter This solution is diluted with 10 l of clean water and then sprayed on the part

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of the infected plants. This solution is used for 1 use. The tools used are a hand tractor, 1-liter volume hand sprayer, hoe, sieve size 2 mes, rake, knife, gembor 5 l capacity, scales, rope raffia, caliper push, board name, and tool write.

Design Study

This research uses a Randomized Block Design (RBD) pattern factorial 3 x 3 with 3 repetitions so that There are 9 combinations of treatment and 27 units of experiment. There are two factors studied that is rice husk biochar dosage rice (B) consists of from 3 levels namely 0 tons/ha, 10 tons/ha, and 20 tons/ha while dose fertilizer cage (P) consists of from 3 levels namely 0 tons/ha, 10 tons/ha, and 20 tons/ha. If the results of the F test show real influence, then The analysis was continued with the Real Difference test. Smallest (BNT) at 5 %.

Observed Parameters

Parameters observed in 9 plant samples in this research are as follows:

1. Plant Height (cm)
   Plant height is measured at the age of 15, 30, and 45 dap, by measuring a tall plant from the base of the stem that has been given a sign until the end of the tallest leaf.
2. Number of Bulbs Per Clump
   Amount tubers per clump calculated at the age of 30 and 45 dap. The calculation was conducted on 9 sample plants by counting the amount of tubers per clump.
3. Wet Bulb Weight Per Clump (g)
   Weighing weight wet done moment harvest, using clean plant from the remains dirt Then weighed.
4. Dry Tuber Weight Per Clump (g)
   Weighing the weight dry plant after dried air for 7 days.
5. Potential Yield per Hectare (tons)
   Potential yield per hectare calculated using the formula:

$$\text{Potential Yield} = \frac{\text{Land area in 1 ha x Weight tuber dry per clump}}{\text{Planting distance}}$$

RESULTS AND DISCUSSION

The Effect of Rice Husk Biochar

The outcomes of the F test in the variance analysis showed that the amount of rice husk biochar applied significantly affected plant height at 30 and 45 dap, as well as the wet and dry tuber weights per clump and the potential yield per hectare. It also had a notable effect on plant height at 15 days after planting (dap), but did not influence the number of tubers per clump at 30 and 45 dap. Table 1 displays the average growth and yield of shallots for varying rice husk biochar doses.

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Table 1. Average Growth and Yield of Red Onion Plants in Various Rice Husk Biochar Dosage

Observed parameters	Rice Husk Biochar Dosage (ton/ha)			BNJ $_{0.05}$
	B $_0$	B $_1$	B $_2$	
Plant Height (cm)				
15 dap	18.23 a	19.74 b	19.76 b	1.13
30 dap	23.34 a	26.53 b	28.09 b	1.74
45 dap	33.18 a	35.51 b	37.61 b	2.10
Number of Bulbs Per Clump				
30 dap	6.44	6.49	7.18	-
45 dap	6.78	6.69	7.24	-
Wet Bulb Weight Per Clump (g)	20.07 a	24.53 b	28.69 c	1.72
Dry Tuber Weight Per Clump (g)	16.82 a	19.51 b	24.21 c	1.45
Potential Yield Per Hectare (ton/ha)	3.28 a	3.71 b	4.76 c	0.38

Description: Numbers followed by the same letter on the same line are different. No real at 5% level (BNJ Test)

Table 1 shows that rice husk biochar application rice on plants onion red can increase the tall plants at the ages of 15, 30, and 45 dap, the number of tubers per clump at the age of 30 and 45 dap, weight tuber wet per clump, weight tuber dry per clump and potential yield per hectare. This shows the more tall rice husk biochar dosage the rice given the more tall growth and production plant onion red. Treatment of B_2 with a dose of rice husk biochar 20 tons/ha of rice is a better dose compared to treatment others. This is because the biochar given into the land already decomposes well so plant growth and yield of onion red are optimal.

Evizal and Prasmatiwi (2023), stated that the addition of biochar to land is capable repair characteristic physical, chemical, and biological soil that increases porosity, capacity holding water, aggregation of land, and increase pH. In addition, biochar can also increase capacity swap cation, the content of carbon organic, retention and availability of nutrients, as well as increase life microbes, mesofauna, and macrofauna. Hussain *et al.*, (2017) added that repair characteristics land the influential to appearance of agronomist plants, especially in matter growth and production.

The use of rice husk biochar rice on field agriculture can improve C-organic content (material organic) by 42.86%, soil pH, and capacity swap cations (Rahman *et al.*, 2022). Provision of rice husk biochar rice with a dose of 20 tons/ha is proven capable increase crop yields onion red, namely weight tuber wet per clump, weight tuber dry per clump, and potential yield per hectare. This is by the results of Jali *et al.*, (2022) research show that rice husk biochar application rice with a dose of 20 tons/ha has an effect real to the amount of tubers per clump and weight tuber wet per plot. Provision of charcoal husk rice on plants onion red with a dose of 20 tons/ha has an effect real to tuber volume (Bahri, 2012 *in* Jali *et al.*, 2022). Meena, Lal, and Yadav (2020) stated that the addition of 1 mg C/ha in land agriculture can increase crop yields plant of 20 to 300 kg/ha.

Effect of Manure

The results of the F test on the analysis of variance show that dose fertilizer pen very real influence to tall plant age 15 dap, influential real to tall plant age 30 days, but influential no real

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to tall plant age 45 dap, number tubers per clump age 35 and 45 dap, weight tuber wet per clump, weight tuber dry per clump, and potential yield per hectare. Average plant growth and yield onion red consequence giving various dose fertilizer The cage can be seen in Table 2.

Table 2. Average Growth and Yield of Red Onion Plants in Various Manure Dosage

Observed parameters	Manure Dosage (ton/ha)			BNJ $_{0.05}$
	P_0	P_1	P_2	
Plant Height (cm)				
15 dap	17.83 a	19.18 b	20.71 c	1.13
30 dap	23.83 a	25.29 b	26.71 b	1.74
45 dap	35.20	35.47	35.62	-
Number of Bulbs Per Clump				
30 dap	6.67	6.57	6.93	-
45 dap	6.67	6.89	7.25	-
Wet Bulb Weight Per Clump (g)	23.62	24.31	25.36	-
Dry Tuber Weight Per Clump (g)	19.55	20.01	20.99	-
Potential Yield Per Hectare (ton/ha)	3.79	3.93	4.03	-

Description: Numbers followed by the same letter on the same line are different. No real at 5% level (BNJ Test)

Table 2 shows that giving fertilizer cage in plants onion red can increase growth tall plants at the ages of 15, 30, and 45 dap, the number of tubers per clump age 30 and 45 dap, weight tuber wet per clump, weight tuber dry per clump, and potential yield per hectare. Treatment of P_2 with fertilizer 20 tons/ha cage is better dose compared to treatment others. This is because a fertilizer pen is a fertilizer completely containing macro and micronutrients.

Manure is one of fertilizer organic containing macro and micronutrients. Macronutrients contained in fertilizer pen namely N, P, K, Ca, Mg, and S, as well as micronutrients like iron (Fe), copper (Cu), and molybdenum (Risnandar and Setiono, 2014). Manure cow in each ton contains N 22 kg, P 2.6 kg, and K 13.7 kg. The N element contained in fertilizer pen cow functions as a component main in the formation of chlorophyll, which accelerates the results of photosynthesis. The results of photosynthesis the overhauled through respiration so that produce assimilation required in the process of cell division. Increased production assimilates through respiration, and then the quantity and size of cells will increase, thus the growth process of plants and the formation of flowers takes place more quickly (Prasetyo and Sinaga, 2017).

Fresh weight of plants per clump, fresh weight of tubers per clump, weight dry plants per clump, weight dry tubers per clump, and tuber volume per clump were all improved by feeding fertilizer pen cattle at a dose of 20 tons/ha, according to research findings by Juwanda and Wadli (2018). According to Mubarok and Sanusi (2024), fertilizer pen calves treated with a 15 tons/ha dosage have an impact on both heavy wet and heavy dry tubers. According to Pakpahan *et al*., (2020), applying up to 20 tons of fertilizer per hectare and 20 tons of corn biochar per hectare has an impact on the weight of both wet and dry onion plants.

Interaction

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Analysis results Variance fingerprints show that No there is real interaction between rice husk biochar dosage rice and dosage fertilizer pen to plant growth and yield onion red, which is marked with all the observed parameters, namely: height plant age 15, 30, and 45 dap, the number tubers per clump age 30 and 45 dap, weight tuber wet per clump, weight tuber dry per clump, and potential yield per hectare. This shows that rice husk biochar dosage rice and dosage fertilizer pen in a way simultaneously do not influence plant growth and yield of onion red.

CONCLUSION

Rice husk biochar application rice with a dose of 20 tons/ha affects plant growth and yields onion red. Giving fertilizer cages with a dose of 20 tons/ha has an effect on tall plants aged 15 and 30 dap, but influential and not real against other parameters. There is no real interaction between rice husk biochar dosage rice and fertilizer pen to all observation parameters.

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