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Effect of Chicken Manure, Husk Charcoal on Growth, Production, P Availability of Shallot in Rice Fields

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Abstract

The study aims to find out the impact of poultry and coal fertilization on the growth, production and availability of P on red onions in savage land. The study used a random group plan (RAK) with two treatment factors. Chicken cage fertilizer factor and coal coal factor use each 4 levels. The results of the study showed that the dose of real chicken cage fertilizer up to a dose of 7.5 kg/plot improved the length of the leaves, the wet weight of the bulbs/plots, the Wet Weight of the plots/bulbs, the dry weight of plants/bubbles, the Dry Weight and Root Volume, the soil content, the saturation of the base, C-organic soil, soil pH and the availability of soil P, having no real impact on the amount of bulbs. The supply of coal to a dose of 5.7 kg/plot did not have a tangible effect on all the same parameters observed with the administration of poultry cage fertilizer doses. The interaction between the dosage of chicken cage fertilizer and coal has no tangible effect on all the observed parameters.

Kata Kunci: *Chicken Manure, Husk Charcoal, Shallots*

INTRODUCTION

The horticultural crop of shallots (Allium ascalonicum L.) is getting more and more attention from the public and the government. Besides cabbage, blunkol (flower cabbage), chili, tomato, and potato, shallots are the six main vegetable commodities exported over the past few years. To overcome the low and unstable shallot production, various studies have been carried out both extensification and intensification (Nugrahini, 2013). Since North Sumatra province still has a shallot deficit, its production must be increased. Onion consumption in North Sumatra reached 35,656 tons, or 2.59 kg per person per year, while production was only 8,078 tons in 2014, or a deficit of 27,578 tons, according (Badan Pusat Statistik Indonesia, 2018). In comparison, onion production only reached 16.3 thousand tons per year, while the demand reached 47.9 thousand tons in 2018 (Balai Penelitian Tanaman Hortikultura, 2018). Onions are imported from many provinces in China and India. When it comes to onion production in North Sumatra, some of the main problems that farmers face today are the application of agricultural technology, lack of government attention, limited land, and lack of knowledge.

Fertilizers are additives that plants need to grow, develop, and thrive. To improve plant nutrition and support their growth and development, organic fertilizers can be used instead of inorganic fertilizers (Suhastyo, 2019). Liquid organic fertilizer is one example of organic fertilizer that can be used (Susila, 2016). Given the limited availability of land for shallot cultivation, research on how to cultivate shallot plants as an alternative crop rotation after rice must be carried out. Paddy soil can come from dry land that is irrigated and then sown, or from swamp land that is drained by making drainage channels. The formation of H_2S in paddy field soils indicates the chemical nature of these soils, which inhibits plant nutrient absorption and enlarges root development, increases pH, and dissolves silica. Intensive weathering reactions cause paddy soil to have low silica content, which results in high nutrient losses, including silica

so that the role of organic fertilizers in the soil in addition to adding nutrients can also increase soil fertility, increase soil porosity, so as to improve soil drying and drainage and increase the activity of soil microorganisms (Nur et al., 2016). In addition, this fertilizer also contains binding agents, so plants can use fertilizer solutions that are applied directly to the soil (Fahri et al., 2018).

At each harvest, rice plants produce an average of 443 kilograms of silica per ha. Studies conducted on intensified rice fields in Java and outside Java show that most rice plants are no longer responsive to phosphorus and potassium fertilization. Therefore, intensification of paddy fields through soil conditioners and organic fertilizers is very important. Through the fermentation process, microorganisms from natural materials serve as a living and breeding medium to accelerate the destruction of organic matter. In addition, microorganisms can function as organic matter breakers and as liquid fertilizers (Budiyani et al., 2016). Husk charcoal, a soil improver, is made from organic waste and is easily available and environmentally friendly. Husk charcoal is a biological charcoal produced from incompletely burned organic waste (biomass), which leaves nutrients that can improve land efficiency. Charcoal is a solid material resulting from the carbonization of biomass. Rice husk, which is usually discarded by farmers after harvest, is one such biomass that can be used.

Manure P levels are higher than other manures; the type of concentrate fed affects the P levels of this nutrient combo. Chicken manure, combined with chicken food waste and chaff, is used as bedding for chicken coops. This manure can provide additional nutrients to the manure applied to the crop. Chicken manure always gives the best crop reaction in the first season. This is due to the high nutrient content of chicken manure, which decomposes faster than the same unique amount of other manures. Based on the description above, researchers want to investigate how the application of chicken manure and husk charcoal affects the growth, production, and P availability of shallot (Alliun Ascalonicum L) plants in paddy fields.

RESEARCH METHOD

The materials used in this research are shallot seeds of Bima Brebes variety, chicken manure, husk charcoal biocar and Tricho Zia biofungicide. The tools used are hoes, machetes, garuh, buckets, meters, raffia ropes, analytical scales, and others that support this research. The parameters observed in this research were leaf length, wet weight of tubers/plant, wet weight of tubers/plot, dry weight of tubers/plant, dry weight of tubers/plot and root volume, soil CEC, base saturation, soil C-organic, soil pH and soil P availability, number of tubers.

This study used a Randomized Group Design (RAK) with 2 factors, namely:

1. The first factor, chicken manure with 4 levels, namely: M_0 = 0 kg/plot (0 ton/ha), M_1 = 3,75 kg/plot (10 ton/ha), M_2 = 7,50 kg/plot (20 ton/ha0, M_3 = 11,25 kg/plot (30 ton/ha)
2. The second factor, husk charcoal with 4 levels, namely: N_0 = 0 kg/plot (0 ton/ha), N_1 = 1,88 kg/plot (5 ton/ha), N_2 = 3,75 kg/plot (10 ton/ha), N_3 = 5,62 kg/plot (15 ton/ha)

The number of treatment combinations is 4 x 4 = 16, namely :
M_0N_0 ; M_1N_0 ; M_2N_0; M_3N_0 ; M_0N_1 ; M_1N_1 ; M_2N_1 ; M_3N_1 ; M_0N_2 ; M_1N_2 ; M_2N_2 ;M_3N_2 ; M_0N_3 ; M_1N_3 ; M_2N_3 ; M_3N_3
Data analysis was done by variance analysis with the following linear model:

$$Y_{ijk} = \mu + \rho_i + M_j + N_k + (MN)_{jk} + \varepsilon_{ijk}$$

Where :

Y_{ijk} = The observation result of the chicken manure factor at the jth level and the husk charcoal factor at the kth level in the i-th replication.
μ = Center value
ρ_i = Effect of the i-th replication
M_j = Effect of chicken manure factor at level j
N_k = Effect of the husk charcoal factor at the j-th level
$(MN)_{jk}$ = The interaction effect of the chicken manure factor at the jth level and the husk charcoal factor at the kth level.
ε_{ijk} = The effect of error in the i-th replication with the chicken manure factor at the jth level and the husk charcoal factor at the kth level.

For factors that have a real or very real effect on the variance analysis test, then the difference of means test is carried out using the DMRT (Duncan Multiple Range Test) test at the 5% level and the regression test

RESULTS OF RESEARCH AND DISCUSSION

Research Results

The results of the study can be noted by looking at the correlation coefficient between the parameters observed in Table 1 and Table 2.

Table 1. Correlation between Observed Parameters due to Effect of Chicken Manure Treatment

Parameters	PD	JU	BBUT	BBUP	BKUT	BKUP	KTK	KB	C-Org	pH	P
PD	1										
JU	0,77*	1									
BBUT	0,83*	0,73*	1								
BBUP	0,23tn	0,45tn	0,73*	1							
BKUT	0,85*	0,87*	0,97*	0,70*	1						
BKUP	0,33tn	0,48tn	0,80*	0,99*	0,76*	1					
KTK	0,09tn	0,68*	0,36tn	0,67*	0,51tn	0,61*	1				
KB	0,99*	0,73*	0,83*	0,23tn	0,84*	0,33tn	0,04tn	1			
C-Org	0,70*	0,96*	0,82*	0,68*	0,93*	0,70*	0,77*	0,67*	1		
pH	0,99*	0,71*	0,85*	0,27tn	0,85*	0,37tn	0,03tn	0,99*	0,66*	1	
P	0,95*	0,87*	0,95*	0,52tn	0,98*	0,50tn	0,36tn	0,94*	0,87*	0,94*	1

Notes :

$r_{0.05}$	= 0,58	BKUT	= Dry Weight of Tubers /Plant
*	= significant	BKUP	= Dry Weight of Tubers /Plot
tn	= not significant	KTK	= Cation Exchange Capacity
TT	= Plant Height	KB	= Base Saturation
JU	= Number of Tubers	C-Org	= C-Organic
BBUT	= Tubers Wet Weight /Plant	Klfl	= Chlorophyll Content
BBUP	= Tubers Wet Weight / Plot	P	= P Availability

Table 1 shows that in general the plant height parameter is significantly correlated with the number of bulbs, wet weight of bulbs per plant, dry weight of bulbs per plant, base saturation, soil C-organic, soil pH and P availability. This means that improving the physical and chemical properties of the soil will increase the growth of shallot plant height. Improvements in soil physical and chemical properties will further increase plant growth, where the looser the soil,

the better the growth of plant roots where the uptake of nutrients and water by plant roots will increase, so that plant growth and production will increase.

Table 2. Correlation between Observed Parameters due to the Effect of Husk Charcoal Treatment

Parameters	PD	JU	BBUT	BBUP	BKUT	BKUP	KTK	KB	C-Org	pH	P
PD	1										
JU	-0,76*	1									
BBUT	0,70*	-0,96*	1								
BBUP	-0,17tn	-0,50tn	0,45tn	1							
BKUT	-0,75*	0,36tn	-0,48tn	0,56tn	1						
BKUP	0,05tn	-0,65*	0,75*	0,83*	0,07tn	1					
KTK	0,40tn	0,21tn	-0,37tn	-0,73*	-0,28tn	-0,88*	1				
KB	-0,39tn	-0,29tn	0,37tn	0,89*	0,46tn	0,89*	-0,96*	1			
C-Org	0,88*	-0,89*	0,75*	0,26tn	-0,35tn	0,27tn	0,23tn	-0,10tn	1		
pH	-0,02tn	-0,63*	0,56*	0,98*	0,46tn	0,84*	0,66*	0,83*	0,40tn	1	
P	-0,09tn	0,69*	0,61*	0,96*	0,39tn	0,82*	0,60*	0,77*	0,50tn	0,99*	1

Notes :

$r_{0.05}$	= 0,58	BKUT	= Dry Weight of Tubers /Plant
*	= significant	BKUP	= Dry Weight of Tubers /Plot
tn	= not significant	KTK	= Cation Exchange Capacity
TT	= Plant Height	KB	= Base Saturation
JU	= Number of Tubers	C-Org	= C-Organic
BBUT	= Tubers Wet Weight /Plant	Klfl	= Chlorophyll Content
BBUP	= Tubers Wet Weight / Plot	P	= P Availability

Table 2 shows that in general, plant height parameters are significantly correlated with the wet weight of tubers per plant and C-organic, and significantly negatively correlated with the dry weight of tubers per plant. The number of tubers was significantly negatively correlated with the wet weight of tubers per plant, dry weight of tubers per plant, soil C-organics, soil pH and P availability. The wet weight of tubers per plant was significantly positively correlated with the dry weight of tubers per plant, soil C-organics, soil pH and P availability. The wet weight of tubers per plot was significantly positively correlated with the dry weight of tubers per plot, soil base saturation, soil pH and P availability.

Discussion

Effect of Chicken Manure Dosage on Growth and Production of Shallot, and P Availability

The results showed that the application of chicken manure at a dose of 8.81 kg/plot was able to increase the length of plant leaves. This is thought to be due to an increase in nutrients due to the provision of increasing doses of manure that can be used by plants in the process of growth. This condition increases the supply of oxygen for respiration and root growth because gas exchange becomes better. Research by (Aisyah et al., 2019) showed that the application of 10 tons/ha chicken manure can increase plant height, number of leaves, and has no significant effect on the number of bulbs, the weight of fresh bulbs, the largest bulb circumference, and the weight of shelf-worthy bulbs of shallots. The results showed that the application of chicken manure had no significant effect on the number of bulbs. The number of bulbs of shallot plants

is influenced by the formation of the number of shallot tillers, where the formation of the number of tillers is more influenced by genetic factors of shallot plants. Chicken manure is one type of organic manure with the highest N content. Both in solid and liquid form, the N content reaches 1% (Mulyani, 2014).

The maximum wet bulb weight per plant can be achieved with a manure dose of 6.80 kg/plot. Nitrogen forms enzymes and chlorophyll molecules, radium activates various enzymes of protein synthesis and carbohydrate metabolism, and phosphorus performs energy transmission in plant cells. Onion bulb formation is strongly associated with cell division. (Fitri, 2012) study found that the dry weight of shallot plants was influenced by the amount of manure applied. Providing manure at a dose of 5.23 kg/plot produces the maximum wet bulb weight per plot. Increasing the dose of chicken manure will increase the supply of nitrogen elements, thus making the plants nitrogen-sufficient. Increased nitrogen supply will increase the photosynthesis process. The results of photosynthesis in the form of carbohydrates will be accumulated in the generative part and in shallots the accumulation of carbohydrates produced is mostly used for bulb formation. Increasing doses of manure will increase the supply of potassium in shallots affecting the growth, yield and quality of the bulbs.

Providing manure at a dose of 5.44 kg/plot produces dry bulb weight per plant and maximum dry weight per plot. Nitrogen elements absorbed by plants will produce nucleic acids contained in the cell nucleus and play a role in the process of cell division so that plant development occurs including the formation of leaf layers that develop into shallot bulbs. The highest yield of bulb dry weight per plot with a range of 674 - 2223.50 g/plot (1.80 - 5.93 tons/ha). The use of manure has the disadvantage that its decomposition is slow so that its availability to plants is also slow (Idris, 2017).

The results showed that the application of chicken manure significantly increased soil CEC, base saturation, soil C-organic, soil pH and soil P availability. According to (Dwi Saputra et al., 2018), soil aggregate stability is influenced by soil C-organic content, CEC, clay content in soil, total pore space and available water. With the increase in soil C-organic content, CEC, and the higher clay content in the soil, the soil will usually have stable aggregate stability. In addition, the soil will also have a high pore space and have a high water storage capacity as well. There is an increase in C-organic content in the addition of chicken manure with higher doses. This is because the addition of manure can increase the C-organic content in the soil. According to (Mustoyo et al., 2013) generally more than 90 percent of organic matter tissue contains the element C, which when added to the soil will increase the content of soil C-organic elements. The use of environmentally friendly organic fertilizer (chicken manure) which is useful for plant growth and the resulting organic fertilizer is very good, this can be seen from the absence of a pungent odor in well-managed chicken manure and plants given organic fertilizer experience rapid growth (Ginting et al., 2023). The benefits of chicken manure are to improve the growth and quality of root performance, increase plant strength so that plants become sturdy and strong, and increase plant resistance (Harahap, 2021).

The higher the dose of manure, the higher the soil pH. This is thought to be caused by the release of OH- ions and the release of organic acids contained by the chicken manure, if the concentration of H+ ions in the soil rises, the pH will decrease and if the concentration of OH- ions rises, the pH will increase. Organic acids such as humic acid sulfuric acid can react with Al3+ in soil solution which is the cause of soil acidity or contributor of H+ ions (Fikdalillah et al., 2016) The results showed that the application of manure can increase the amount of phosphorus in the soil. This happens because chicken manure can increase the amount of phosphorus present in the soil. Since organic matter is a source of N, P, and S, the increase in P-Total caused by the application of organic matter is closely related to the P content of organic

matter. According to (Fikdalillah et al., 2016) the increase in P-Available may be due to improved soil conditions. The increase in soil pH caused by the application of chicken manure may be the main factor.

Effect of Husk Charcoal on Growth and Production of Shallot Plants and P Availability

The results of the variance test showed that the husk charcoal dose treatment did not significantly affect leaf length, number of bulbs, wet weight of bulbs per plant, wet weight of bulbs per plot, CEC, base saturation, C-organic, pH, and soil P availability. Since husk charcoal added in large or small amounts is difficult to decompose, the addition of large or small amounts of husk charcoal does not help to increase the growth and bulb formation of shallots. The husk charcoal treatment did not significantly alter shallot growth or production. This may be because the addition of husk charcoal has a greater influence on root development than the crown (Irawan, 2015). Due to its porous nature, it is suspected that the plants experience water shortage, so the addition of the most husk charcoal shows unrealistic growth and production, although in fact the addition of husk charcoal should be beneficial because it can improve the physical properties of the soil. Improvements in soil physical and chemical properties will further enhance plant growth, where the looser the soil, the better the growth of plant roots where the uptake of nutrients and water by plant roots will increase, so that plant growth and production will increase.

Interaction between Doses of Chicken Manure and Husk Charcoal on Red Onion Crop Production, and P Availability

Analysis of variance showed that the interaction between doses of chicken manure and husk charcoal did not significantly affect leaf length, number of tubers, tuber wet weight per plant, tuber wet weight per plot, soil CEC, base saturation, soil C-organic, soil pH, and soil P availability. This is because chicken manure and husk charcoal perform the same function, so their application does not affect the interaction between the two treatments.

CONCLUSIONS

The treatment of chicken manure doses up to a dose of 7.5 kg/plot significantly increased leaf length, bulb wet weight per plant, bulb wet weight per plot, bulb dry weight per plant, bulb dry weight per plot and root volume, soil CEC, base saturation, soil C-organic, soil pH and soil P availability, but had no significant effect on the number of bulbs. The application of husk charcoal up to a dose of 5.7 kg/plot had no significant effect on leaf length, number of tubers, wet weight of tubers per plant, wet weight of tubers per plot, dry weight of tubers per plant, dry weight of tubers per plot, root volume, soil CEC, base saturation, soil C-organic, soil pH and soil P availability. The interaction between doses of chicken manure and husk charcoal had no significant effect on all parameters observed.

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