

EFFECTS OF RICE HUSK ASH AND EGGHELL ON THE GROWTH AND YIELD OF RED CHILI (*Capsicum annuum* L.)

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Abstract

The purpose of this study was to determine the effect of rice husk ash dosage and eggshell on the growth and yield of red chili, and obtain a treatment that gives the best results on fruit red chili plant. The experiment was arranged with Group Random Design (RAK) with factorial design with two factors and three replications, factor I is dose rice husk ash consists of three levels ie A0: 0 g /plant, A1: 25 gr / plant, A2: 50 g / plant, G3: 75gr / plant. The second factor is the dose eggshell consists of 3 levels ie: C0: 0 g / plant, W1: 15 gr / plant and W2: 30 gr / plant. The experiment will have 9 combination treatment from those 2 factors. The results showed that the provision of rice husk ash give the significant effect on height plant growth and the number of leaves, the best dose is the provision of rice husk ash 50 gr / plant. Provision of eggshell give real effect on plant yield of red pepper that is the number of productive branches, number of fruits per plant and fruit weight crop with the best dosage is 30 gr / plant.

Keywords: eggshell, red chili, rice husk ash

1. INTRODUCTION

Red chili (*Capsicum annuum* L.) is a high economically valuable of vegetables commodity. The need for red chili is increase continually along with the increase of people in Indonesia. The last few months, the price of red pepper in Indonesia was soared. The increase was caused by minimum supply on the market due to disrupted by several things, such as the low production of pepper plants caused by the weather and crop cultivation factors. The high price of red chili has not aligned with the profit received by farmers for production input factors such as the price of fertilizers and insecticides that are increasingly expensive.

Lately, use of agricultural waste and livestock serve as alternative to lower the production costs. Agricultural waste which easy to find in Blitar is rice husk ash and eggshell. Farmers using agricultural waste which is easily obtained as alternative organic fertilizers in order to reduce dependence on fertilizer's organic. Ash from burning rice husk is basically a waste, but it is a source of quite high nutrients. Based on the analysis of rice husk ash carried by Tamtomo, *et al* (2015), the content of nutrients in the rice husk ash is quite high especially for P is 0.2107%, K amounted to 0.3979%, 0.4758% is Ca and Mg content is 0.0868%. According Setyorini (2003) in Kusuma A, H (2013), rice husk ash has metal binding function. In addition, the rice husk ash serve to loosen the soil, so that it can simplify plant roots to absorb nutrients. Results of Norhasanah's study (2012) showed that the dosage of rice husk ash have very significant effect on all variables, which husk ash dose 48 g / polybag is the best dose of the vegetative growth of cayenne pepper plant varieties Green Chakra, that is at the variable plant height and number of branches crop. Husk ash dosage of 72 g / polybag is the best dose to generative growth cayenne pepper plant that is at the variable age of the plant during flowering, and the number of flower planting.

Eggshells flour contain calcium (Ca) and magnesium (Mg), which can increase the pH of the soil. According Sundari (2010) in the ES Goddess (2016), egg shells containing nearly 95.1% consisting of organic salts, 3.3% organic materials (especially proteins), and 1.6% water) about 98.5% and Magnesium carbonate (MgCO Most organic materials consisting of compounds of calcium carbonate (CaCO) about 0.85%. According Stadelman and Owen (1989) in the Goddess ES (2016) states, the amount of mineral in 2.25 grams egg shell consisting of 2.21 grams of calcium, magnesium 0.02 grams, 0.02 grams of phosphorus and a little iron and sulfur. The results of Nurjayanti (2012) study, the granting of an eggshell flour can be used as a substitute for lime, because it can raise the pH of alluvial soil and gives the same red chili's yield growth with the addition of compost mixture and flour eggshell. Marita M. M (2013) reported that the use of chicken egg shells with the dose of 8 g / plant to control fusarium wilt in tomato plants exhibited by some plants can still survive and thrive well in comparison with the control plants. The result of Sham, Z. Z (2014) research reported that giving the egg shell powder at 25 gr / plant can increase soil pH levels from 4.2 to 6.8. The waste egg shells can be used as fertilizer because it contains calcium and can enhance the Adenium plant height.

2. MATERIAL AND METHODS

The experiment was conducted in Blitar in March until August 2017. The experiment was arranged in a randomized block design (RAK) with factorial design with two factors and three replications, factor I is dose rice husk ash consists of three levels ie A0: 0 g / tan, A1 : 25 gr / tan, A2: 50 gr / tan, G3: 75gr / plant. The second factor is the dose eggshell consists of three levels ie: C0: 0 g / tan, W1: 15 gr / tan and W2: 30 gr / plant. The experiment will have 9 combination treatment from those 2 factors. Observation of the plant include: plant height, number of leaves per plant, stem diameter, planting fruit number and weight of the fresh fruit crop. Data were analyzed using Analysis of Variance (ANOVA) at 5% .If there is a real effect between treatment continued with HSD test level of 5%.

3. RESULTS AND DISCUSSION

Effect of Rice Husk Ash and Egg Shells on Red Chili Plant High

The results of analysis of variance (ANOVA) 5% indicates that there is no interaction between treatment of rice husk ash (A) and the dose of egg shells (C) on the observation of the plant height at all ages, but in treatment of giving rice husk ash at the age of 60 and 80 DAP are a significant effect on plant height. In table 1 shows that treatment with the giving of ash dose of 25 g / crop (A1) and 50 g / plant (A2), showed that the average of plant height is better than without the provision of rice husk ash (A0) at the age of 60 DAP. In the treatment of eggshell is significantly affected plant height at 80 DAP observations. Giving an eggshell with a dose of 30 g / plant is the best treatment in plant height of 63.35 cm (Table 1). On treatment of giving rice husk ash and eggshell separately each treatment gives a significant effect on the age of 60 DAP, it is presumably because at the age of 20 DAP and 40 DAP, nutrient content contained in husk ash and eggshell not decompose so that it can not be improve the rooting environment, consequently nutrients can not be absorbed by plants. At the age of 60 and 80 DAP, the giving of husk ash and eggshell separately able to increase plant growth. It is suspected that macro nutrients and micro elements contained in rice husk ash and eggshell already can be used to run the metabolism of plants so that the plants can show better growth than the control. Hardjowigeno (2003) explains that the plant metabolic disorders can be caused by lack of nutrients such as phosphorus that inhibits plant growth. Furthermore, Butcher and Richard

(2003) explain that not just containing phosphorus as much as 0.3%, eggshell containing micro elements (magnesium, sodium, calcium, zinc, manganese and copper) of 0.3%. Magnesium (Mg) plays an important role in the transport of phosphate in plants. Thus, the phosphate content in plants can be increased by the addition of magnesium through the eggshell.

Table 1. Average of Heigh Plant (cm) at Various Treatment

Treatment	Observation Age			
	20 DAP	40DAP	60 DAP	80 DAP
Rice husk ash				
A0	9.30 a	22,03 a	44,33 a	61,25 a
A1	9.54a	23.43 a	51,45 b	60,81 a
A2	10.26 a	24.09 a	52,01 b	64,86 b
Eggshell				
C0	9.68 a	26.10 a	46,71 a	60,92 a
C1	11.87 a	26,98 a	50.04 a	61,87 ab
C2	10.91 a	23.88 a	51,345 a	63,35 b

Description: The figure followed by the same letter in the same column showed no significant difference in test HSD 5%. DAP = days after planting.

Effect of Rice Husk Ash and Eggshell on Total Leaf Red Chili Plant

Results of analysis of variance (ANOVA) 5% indicates that there is no interaction between treatment of rice husk ash (A) and the dose of eggshells (C) to the number of leaves in all observation age, but in treatment giving of rice husk ash at the age of 60 and 80 DAP have significant effect on the plant. In Table 2 showed that treatment with the giving of ash in dose of 25 g / plant (A1) gives significantly different from the treatment of 50 g / plant (A2) and produce average of number of leaves that are better than without the giving of rice husk ash (A0), that is 217.67. In the treatment of eggshell giving is significantly affected the number of leaves at the age of 80 DAP observations. Giving an eggshell with a dose of 30 g / plant is the best treatment result in number of leaves amounted to 224.45 leaves. From the results of Table 2 indicated that the vegetative growth of the plants treated with rice husk ash 50 g / plant showed better growth in variable plant height and number of leaves, allegedly on dose of 50 g / plants can improve soil structure and add nutrients so that the vegetative growth of the plant will be better. bAccording to Ali et al. (2012) in Baharudin, R (2016), if the organic material is available, the activity of soil organisms can improve nutrient availability, nutrient cycling, and the formation of soil micro and macro pores. Kusuma, A. H (2013) indicate that the addition of charcoal or rice husk ash in various proportions potentially increased lateral root length and shoot dry weight. Give of eggshell 30 g / plant showed a better vegetative growth than the control, it is suspected because of the provision of an eggshell 30 gr / plant is enough to add nutrients that plants need. Kastono (2005), explains that along with the increase in nutrients, the growth of vegetative organs also increased, so that it will affect the results.

Table 2. Average of Number of leaves at Various Treatment

Treatment	Observation Age			
	20 DAP	40 DAP	60 DAP	80 DAP
Rice Husk Ash				
A0	35.76 a	72,34 a	131,78 a	189.90 a
A1	33.65a	76.03 a	139,45 a	203.22 ab
A2	35.12 a	74.61 a	145,44 b	217,67 b
Eggshell				
C0	34.70 a	76.75 a	135,33 a	201,24 a
C1	37.61 a	72,98 a	139,25 b	208,45 a
C2	35.87 a	73.92 a	147,36 c	224,45 b

Description: The figure followed by the same letter in the same column showed no significant difference in test HSD 5%. DAP = days after planting.

Effect of Rice Husk Ash and Eggshell on Red Chili Yield

Results of analysis of variance (ANOVA) 5% indicates that there is no interaction between treatment of rice husk ash (A) and the dose of eggshell (C) to the number of productive branches, The number of fruit / plant and weight of fruit / plant (g), but the treatment of rice husk ash are showed the significant effect. In Table 3 showed that treatment with rice husk ash with dose of 25 g / crop (A1) and 50 g / plant (A2) produces the number of productive branches are better than without the provision of rice husk ash (A0). Treatment rice husk ash with a dose of 50 g / plant (A2) were significantly different and produce the best productive branch number compared to the treatment giving chaff 25 g / plant (A1). In the treatment of eggshell significantly affect the number of productive branches. Giving an eggshell with a dose of 30 g / plant is the best treatment and produce a number of productive branches of 19.12 (Table 3).

Table 3. Number of productive branches, the number of fruit / plant and the weight of fresh fruit / plant

Treatment	Haverst		
	Number of productive branches	Number of fruit/plant	Weight of fresh fruit / plant (g)
Rice Husk Ash			
A0	11.22 a	19,55 a	379,23 a
A1	19,01 b	35,21 b	390,78 a
A2	22,45 c	37,47 b	421,32 b
Eggshell			
C0	16,67 a	25,81 a	349,56 a
C1	17,55 ab	31,63 b	401,46 a
C2	19,12 b	35,82 c	439,34 b

Description: The figure followed by the same letter in the same column showed no significant difference in test HSD 5%. DAP = days after planting.

In Table 3 showed that treatment of rice husk ash was significantly different to the number of fruit / plant. Provision of rice husk ash with a dose of 25 g / crop (A1) is not different from rice husk ash treatment dose of 50 gr / plant. This is presumably because rice husk ash can improve soil structure and becomes more crumbs so that root growth is getting better. This is consistent with the results of research Septiawan (2014) that the application of organic manures rice husk ash and compost able to soften the very hard soil aggregates into the ground that is able to bind water longer, so that the land will be stabilized by aeration of soil to be better because the pore space land increases due to the formation of aggregates. Furthermore, according to Nurida (2009) in Septiawan (2014) which stated that the composition of the soil aggregates or fragments of soil affect the growth of roots and canopy, and perhaps eventually to the production of the plant. In the treatment of eggshell also making a significant difference to the number of fruit / plant. The best treatment contained in the giving of the eggshell of 30 g / plant, and produce the amount of fruit amounting to 35.82 fruit / plant. In Table 3, demonstrated that treatment of rice husk ash with a dose of 50 g / plant capable to produce the highest fruit weight of 421.32 g / plant and significantly different compared to the treatment without rice husk ash (A0). Treatment without rice husk ash (A0) is not significantly different from rice husk ash treatment dose of 25 g / plant. This indicates that the provision of rice husk ash 25 g / plant has not been enough to increase the number of pieces of red chili plants. Increased fruit weight indicated on rice husk ash dosage 50 g / plant. This is presumably because Si contained in the rice husk ash can increase the availability of P, by replacing the P ions bound to the land component with Si ions, so that P becomes more available. Yulianti C, E (2011) demonstrated that provision rice husk ash can increase the carbon content of silica are available, P-available in the soil. Giving rice husk ash also give good influence on the uptake of Si-plants. The function of Phosphorus (P) is to stimulate root growth, accelerate flowering, seed and fruit ripening. Lingga (2008) adds that, P element required to reproduce plants generative growth (flower and fruit).

In the treatment of egg shells 30 g / plant also produces the highest fruit weight and significantly different compared with those without eggshell (C0) and the treatment of eggshell 15 g / plant (C1). The best treatment is contained in the provision of eggshell amounting to 30 g / plant can produce fruit weight of 439.34 g / plant. Giving eggshell could be expected to improve the growth and yield, because the eggshell contain macro and micro nutrients required by plants. Butcher and Richard (2003) in Noviansyah, B, et al (2015) states that the eggshell contain as much as 0.3% phosphorus and contain trace elements (magnesium, sodium, potassium, zinc, manganese and copper) of 0.3%. Phosphorus plays a role in energy transfer in the plant cells, such as ADP and ATP. Additionally, phosphorus acts as the building blocks of nucleic acids (DNA and RNA), lipids and proteins (Agustin, 1990). Phosphorus (P) for plants is useful to stimulate root growth, especially root seeds and young plants. Additionally, phosphorus serves as raw material for the formation of a specific protein; help assimilation and respiration; and accelerate flowering, seeds, and fruit. Calcium (Ca) served to stimulate the formation of root hairs, hardened stems of plants, and stimulates the formation of seeds. The calcium present in the stems and leaves is believed to neutralize the compound or unfavorable atmosphere on the ground (Turang, AC, *et al*, 2015). Furthermore, Ayyub *et al* (2012) adding that Calcium has a role which is important in maintaining the quality of the fruit, preserving the integrity of the cells, and the growth of the fruit.

4. CONCLUSION

1. Provision of rice husk ash give the significant effect on plant growth on plant heigh and the number of leaves, the best dose is the provision of rice husk ash 50 g / plant

2. Giving eggshell give the significant effect on plant yield which is the amount of red pepper productive branches, number of fruits per plant and the weight of the fruit crop, the best dosage 30 g / plant.

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