



Effect of Biological Organisms Fertilizers and Growth Regulators for Yield of Shallot (*Allium ascalonicum* L.)

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Abstract

Shallot production and productivity of Indonesia is still low; thus, needs to be increased by providing biological organic fertilizers (POH) and growth regulators (ZPT). The research was carried out in the Covid-19 Pandemic Area from December 2019 to March 2020 in Talotenreng Village, Wajo Regency. The aim of this study was to determine the shallot (*Allium ascalonicum* L.) productivity by using POH and ZPT. Two experimental factors with the Randomized Block Design were used as method for this study. The first factor was the POH (P) concentration of 0 ml liter of water⁻¹, 10 ml liter of water⁻¹, 20 ml liter of water⁻¹, and 30 liter of water⁻¹. The second factor was the ZPT concentration (Z) of 0 ml liter of water⁻¹, 1.0 ml liter of water⁻¹, 1.5 ml liter of water⁻¹, and 2.0 ml liter of water⁻¹. The experimental results showed that the POH concentration significantly affected the weight of fresh blubs per plot and the concentration of growth regulators had a significant effect on the number of bulbs per plot and the productivity of shallots as much as 8.09 t ha⁻¹.

Keywords: Biological organics, fertilizer, growth regulators, shallots, yield

A. Introduction

Shallots are one of the horticultural vegetable commodities commonly used as basic needs and almost always needed by household consumers as seasoning ingredients and food industry ingredients. In addition, shallots are being used for other purpose like traditional medicine and are preferred due to its distinctive aroma and taste (Surajudin, As'ad, Yusuf, and Mas'ud, 2015). The use of shallots by the community tends to increase along with the population growth. Nowadays, the increasing consumption of fast food in the community (fried rice, satay, *tongseng*, etc.) increases the shallot needs. Furthermore, there are also some preserved food products that use fried shallots (Iriani, 2013).

Shallots contain high vitamins and minerals; hence, this spice hold an important meaning for the community, both from an economic point of view and nutritional content. In every 100 grams of shallots contains 88.00 g of water, 9.20 mg of carbohydrates, 1.50 g of protein, 0.30 g of fat, 0.03 g of vitamin B1, 2.00 mg of vitamin C, 36.00 mg of Ca, 0.80 mg of Fe, 40.00 mg of phosphorus and 39.00 calories of energy (Berlian and Rahayu, 2004).

The low productivity of shallots can be improved should the factors that affect the shallot farming system such as soil, climate, production technology, capital, and labor are managed optimally.

Fertilization is an effort to increase land and shallot productivity. In general, shallot farmers tend to use inorganic fertilizers (NPK) higher than the recommended dose, which causes soil damage, environmental pollution (Righi, Lucialli, & Bruzzi, 2005), and certain pests development, which can ultimately lead to a decrease in shallot productivity. To overcome this problem, alternative technologies that can reduce the input of artificial fertilizers are needed (Zafari & Kianmehr, 2012), preserve land fertility, increase the quantity and quality of yields, and increase farmers' income. One of them is by replacing some of the inputs of chemical fertilizers with organic, natural and biological fertilizers (useful microorganisms).

Using certain effective microbes, organic fertilizers that have not been completely decomposed can be decomposed into useful organic fertilizers for plants. According to Simanungkalit (2007), biofertilizers are living microorganisms provided for the soil as inoculants to facilitate or provide certain nutrients for the plants. Alternative biofertilizers have been distributed and used by the community, which indicate the good prospects of biofertilizers in developing farming as an alternative in environmentally friendly nutrient management. The use of certain organic fertilizers and biofertilizers is suspected to be able to substitute the use of >50% artificial fertilizers in food/horticultural crop farming and effectively increase crop productivity (Suwandi, Sopha, & Yudi, 2015).

In addition to the use of POH to increase shallot productivity, Growth Regulating Substances (ZPT) also can be used. Growth regulators are non-nutrient chemical compounds (nutrients) with certain concentrations that can affect the yield of cultivated plants (Salisbury and Ross, 1995). One of the widely available natural ZPT is corn ZPT which contains organic compounds (Asrijal, Syam'un, Musa, Riadi, 2018). These organic compounds include auxins and cytokinins. Auxins function in inducing cell elongation, influencing apical dominance, inhibition of axillary and adventitious shoots and initiation of roots while cytokinins function to stimulate cell division in tissues and stimulate shoot growth (Salisbury and Ross, 1995). Therefore, the application of growth regulators is expected to increase the growth and yield of shallots. Thus, this study was aimed to determine the effectiveness of biological organic fertilizer and growth regulators use to increase the yields of shallots (*Allium ascalanicum* L.).

B. Methodology

The research was conducted in Talotenreng Village, Wajo Regency from December 2019 to March 2020. The materials used were shallots of the Bima Brebes variety, NPK fertilizer, water, ZPT, and POH. The tools used were machetes, scales, meters, labels, sickles, hoes, sprinkles, and writing utensils. The study used a randomized block design analysis with 2 factors: Factor I of POH concentration (P), which consisted of 0 ml liter of water⁻¹ (P0), 10 ml liter of water⁻¹ (P1), 20 ml liter of water⁻¹ (P2), and 30 ml liter of water⁻¹ (P3). While, Factor II : ZPT concentration (Z) of 0 ml liter of water⁻¹ (Z0), 1.0 ml liter of water⁻¹ (Z1), 1.5 ml liter of water⁻¹ (Z2), and 2.0 ml liter of water⁻¹ (Z3). The experiment was performed in triplicates; thus, there were 48 experimental plots in total.

The land preparation included land clearing and tillage. The land was cleared from plant debris with a sickle to ensure the condition fit for cultivation. Soil tillage was performed by hoeing as deep as 30 cm and creating size of 1.5 m x 1.2 m plot with a trench depth of 30 cm and a trench width of 50 cm as a plot divider.

First, the shallot bulbs were cut into parts. Shallot bulbs were planted with a distancing of 15 cm x 15 cm and 1/3 of the bulb was planted on the side of the planting hole. Each planting hole was filled with vertically planting shallot bulb with its tip facing above the soil. At the beginning of growth, watering was carried out twice, namely in the morning and evening depending on environmental conditions. The morning watering was attempted as early as possible while shallot still looks wet, to reduce pest attacks. Afternoon watering was stopped when the percentage of plant growth had reached more than 90%.

Since fertilization was not used as a treatment; hence, the fertilizer was applied at similar dose to all plants according to the recommended dose for shallots. The type of fertilizer used was NPK. Fertilization was carried out twice, namely at 7 days after planting (DAP) and 21 DAP.

Weeding was started at 7 DAP by removing weeds or wild plants that interfered the shallots growth and development. Bloating was performed at 3, 4, and 5 DAP. The damaged or landslide plots were re-tied by strengthening the edges of the spaces. Pest control was performed when pest attacks were found by mechanical means and/or with insecticides and fungicides.

Application of biofertilizer (POH) was conducted in 4 times with a span of a week at 20 DAP, 27 DAP, 34 DAP, and 41 DAP. POH was applied by spraying on all parts of the plant with certain concentration, namely the first treatment (P0/control) with a concentration of 0 ml liter of water⁻¹, the second (P1) 10 ml liter of water⁻¹, the third (P2) 20 ml liter of water⁻¹, and the fourth treatment (P3) 30 ml liter of water⁻¹. The application of growth regulators (ZPT) was performed 4 times with a span of a week at 20 DAP, 27 DAP, 34 DAP, and 41 DAP. PGR was applied by spraying on all parts of the plant with certain concentration, namely the first treatment (Z0/control) 0 ml liter of water⁻¹, the second (Z1) 1 ml liter of water⁻¹, the third (Z2) 1.5 ml liter of water⁻¹, and the fourth treatment (Z3) 2 ml liter of water⁻¹.

Shallots were harvested at 60-75 days after planting. Harvesting is characterized by a change in leaf color to pale yellow, the top foliage has dried up and emit a distinctive aroma. The best time to harvest shallot is when the soil is dry and sunny days. The harvest done by lifting the bulb clusters carefully. The parameters of the sample plants observed were the number of bulbs, bulbs weight per plot, and bulb weight per hectare. The data was analysed using Analysis of Variance (ANOVA), if there is significant effect found, it was then followed by Least Significant Difference Test Analysis with the confidence level of 5% (Gaspersz, 1991).

C. Result and Discussion

The results showed that the ZPT concentration was significantly different to the number of bulbs per plot and the POH concentration was significantly different to the fresh bulbs weight per plot and per hectare. While the interaction between POH and PGR was not significantly different on the number of bulbs per plot and the weight of fresh bulbs per plot and per hectare.

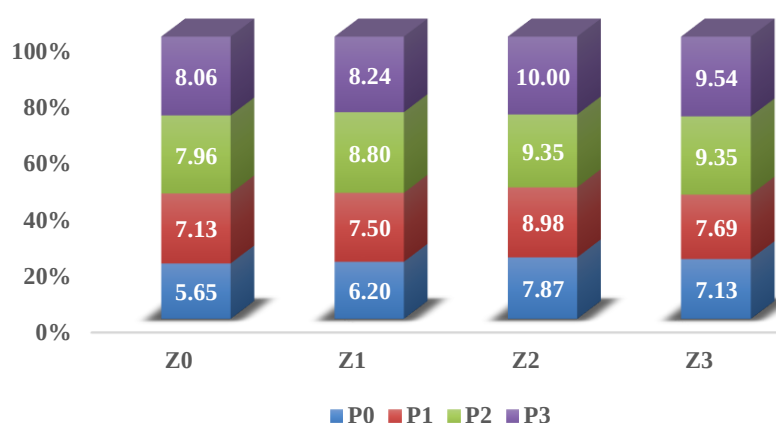


Figure 1. Diagram of the interaction between POH and ZPT on the Weight of Fresh Bulbs per Hectare

Table 1. Average Number of Shallot Bulbs at various ZPT concentrations

ZPT Concentration	Average	Different Value	LSD $\alpha = 0.05$
Z0	18.7	b	1.02
Z1	19.4	b	
Z2	21.2	a	
Z3	19.5	b	

Note: Numbers followed by the same letter are not significantly different at LSD = 0.05.

Table 2. Average Weight of Shallot Fresh Bulbs at various POH concentrations

POH Concentration	Average	Different Value	BNT $\alpha = 0.05$
P0	3.63	c	0.59
P1	4.23	b	
P2	4.79	ab	
P3	4.84	a	

Note: Numbers followed by the same letter not significantly different at LSD = 0.05.

Table 3. Average Weight of Shallot Fresh Bulbs per hectare at various POH concentrations

POH Concentration	Average	Different Value	LSD $\alpha = 0.05$
P0	20.14	c	3.27
P1	23.47	b	
P2	26.60	ab	
P3	26.88	a	

Note: Numbers followed by the same letter are not significantly different at LSD = 0.05.

The results of LSD test (0.05) in Table 1 showed that the best and highest number of bulbs was produced by a ZPT concentration of 1.5 ml liter of water⁻¹, which was significantly different from other PGR concentrations. Growth regulators are non-nutritive organic compounds that in low concentrations can encourage, inhibit, or qualitatively change plant growth and development (Widyastuti and Tjokrokusumo in Asrijal, Syam'un, Musa, Riadi, 2018). PGR concentration significantly affected the number of bulbs per plot, it can be due to PGR contains elements that can assist in plant metabolism processes. This is in line with Asrijal (2020), sweetcorn extract produced the highest yield components, namely the number of bulbs per clump (7.02 bulbs), bulbs yield per clump (30.91 g), and bulbs yield per hectare (17.30 t ha⁻¹).

The results of LSD test (0.05) in Tables 2 and 3 showed that the best and highest fresh weight of bulbs was produced by a POH concentration of 30 ml liter of water⁻¹, which was significantly different from the POH concentration of 0 ml liter of water⁻¹ and 10 ml liter of water⁻¹, per plot and per hectare, but not significantly different from POH concentration of 20 ml liter of water⁻¹. It is assumed that the microbes present in POH are able to support shallots growth and production. According to Ghoname & Shafeek (2005), the use of organic fertilizers and biofertilizers can increase plant growth, yield, and quality of crop yields. Based on Suwandi, Sopha, & Yudi (2015) the best doses to increase shallots yields were 2 tons/ha of organic fertilizer (compost), 300 kg/ha Urea + 300 kg/ha ZA, 300 kg/ha SP36, 200 kg/ha KCl. Rahmawati (2020) stated that NPK dose of 350 kg/ha and distancing of 25 x 25 cm was the best for plant height, number of leaves, leaf width, and fresh weight of lettuce.

The interaction between POH and PGR produced yields of 8.09 t ha⁻¹. It is higher than Olvie Grietjie Tandi and Faisal (2020), shallot as one of the local superior varieties has an average yield potential 7-8 t/ha at the farmer level in Minahasa District. However, this result was lower than Asrijal (2020) with yield of 17.30 t ha⁻¹ bulbs per hectare.

D. Conclusion

POH concentration of 30 ml liter of water⁻¹, the highest was in fresh bulbs weight per hectare. ZPT concentration of 1.5 ml liter of water⁻¹, the highest was in the number of bulbs per plot. The interaction between POH concentration of 30 ml liter of water⁻¹ and ZPT concentration of 1.5 ml liter of water⁻¹, the highest was in fresh bulbs weight per hectare of 8.09 t ha⁻¹.

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