

RESPONSE OF GROWTH AND PRODUCTION OF SHALLOTS (*ALLIUM ASCALONICUM* L) TO THE APPLICATION OF CHICKEN MANURE AND VOLCANIC ASH

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Abstract. The production of shallots can still be increased through technical improvements in cultivation, such as the application of organic fertilizers and the eruption of Mount Merapi (volcanic ash). Organic fertilizers have a significant role in improving the chemical and biological properties of the soil and do not have a negative impact on the environment, although the nutrient content of manure is not as high as that of artificial fertilizers. This study aims to determine the effect of chicken manure and volcanic ash on the growth and production of shallots (*Allium ascalonicum* L). The research method used was a factorial randomized block design (RAK) consisting of two treatment factors, namely factor I chicken manure (A) and factor II volcanic ash (V). The results showed that the application of chicken manure had a significant effect on plant height, number of leaves, tuber diameter, tuber wet weight, tuber dry weight. Volcanic ash treatment had no significant effect on plant height, number of leaves, tuber diameter, tuber number, tuber wet weight, and tuber dry weight. The interaction between chicken manure and volcanic ash had no significant effect on plant height, number of leaves, number of tubers, tuber diameter, tuber wet weight, and tuber dry weight.

Keywords: chicken manure; volcanic ash; shallots.

INTRODUCTION

Shallots (*Allium ascalonicum* L) are annual plants that grow in clumps and the tubers are formed from layers of enlarged and united leaves. Shallots are horticultural commodities that are included in the spice vegetable group and are used as food seasonings. The nutritional content of shallots per 100 g is 87 ml of water, 1.5 g of protein, 0.5 g of fiber, 11 g of carbohydrates, 30 mg of calcium, 0.5 g of iron.

The Central Bureau of Statistics of North Sumatra (2019) stated that the production of shallots in North Sumatra from 2014 to 2018 was 7,810 tons, 9,971 tons, 13,368 tons, 16,103 tons and 16,337 tons, respectively. Shallot production can still be increased through technical improvements in cultivation, among others: by providing organic fertilizers and the eruption of Mount Merapi (volcanic ash).

One type of organic fertilizer that can be used is chicken manure. Chicken manure is rich in N, P, and K nutrients, namely 2.6% (N), 2.9% (P), and 3.4% (K) with a C/N ratio of 8.3. The nutrient content in chicken manure is high because the liquid part (urine) mixes with the solid part, containing three times more nutrients than other manure (Ndambi, Pelster, Owino, De Buissonje, & Vellinga, 2019).

Eruption material adds easily weathered minerals that contain many beneficial elements for plants. A simple technology to accelerate the weathering of volcanic ash can be done by mixing organic matter. Organic materials

containing various types of organic acids are able to release those bound in the mineral structure of volcanic ash. Organic matter is also able to maintain moisture conditions so that physical, chemical and biological weathering takes place simultaneously to accelerate the release of plant nutrients from mineral nutrient-carrying reserves (Mulyaningsih, Kuntoro, & Alfian, 2012).

The volcanic ash layer which has the potential to contain soil-fertilizing nutrients for agriculture can actually only be utilized about 10 years after the volcanic ash spread event. A simple technology to accelerate the weathering of volcanic ash can be done by mixing organic matter. Organic materials containing various types of organic acids are able to release nutrients bound in the mineral structure of volcanic ash. Organic matter is also able to maintain moisture conditions so that physical, chemical and biological weathering can take place simultaneously to accelerate the release of plant nutrients from minerals carrying nutrient reserves.

The differences between this study and the previous one are 1) The effect of chicken manure on the growth and production of shallot (*Allium ascalonicum* L.). 2) The influence of volcanic ash on the growth and production of shallot (*Allium ascalonicum* L.). 3) The interaction effect between chicken manure and volcanic ash on the growth and production of shallot (*Allium ascalonicum* L.).

The purpose of this study was to determine the effect of chicken manure and volcanic ash on the growth and production of shallot (*Allium ascalonicum* L.).

The benefits of this research itself are

as one of the requirements to be able to obtain a Bachelor's degree in Agriculture at the Agrotechnology Study Program, Faculty of Agriculture, Indonesian Methodist University and as an additional reference material in the cultivation of shallots (*Allium ascalonicum* L).

METHODS

This research was conducted at UPT Seed Induk Palawija Tanjung Selamat, North Sumatra. This study used a Randomized Block Design (RAK) using 2 treatment factors, namely: The first factor was Chicken Manure (A) consisting of three levels, namely: A₀ = Control, A₁ = 2 kg/plot, A₂ = 4 kg/plot, A₃ = 6 kg/plot. The second factor of Volcanic Ash Fertilizer (V) consists of 3 levels, namely: V₁ = 0.5 kg/plot, V₂ = 1 kg/plot, V₃ = 1.5 kg/plot.

RESULTS AND DISCUSSION

Results

1. Plant Height

Data on shallots showed that the chicken manure treatment had a significant effect on plant height at 2, 3, and 4 WAP. Volcanic ash treatment had no significant effect on plant height at 2, 3, 4 and 5 weeks after planting (MST). The interaction between the two treatments had no significant effect. Chicken manure treatment was at 4 WAP, the highest average was at A₃ and the lowest average was at A₀. The highest mean at 5 WAP due to volcanic ash treatment was V₁ and the lowest

average was at V₃.

2. Number of leaves (strands)

Data on the number of leaves of shallots showed that the average number of leaves was highest at the age of 2 and 3 WAP by the interaction treatment of chicken manure and volcanic ash. Chicken manure treatment had no significant effect on the number of leaves at 2, 3, 4 and 5 WAP. Volcanic ash treatment had no significant effect on plant height at the ages of 2, 3, 4 and 5 WAP, and the interaction between the two treatments had no significant effect on the number of leaves at all ages of observation.

3. Number of Bulbs per Sample (Cultivation)

Data on the number of bulbs showed that the application of chicken manure and volcanic ash, as well as the interaction between the two treatments, had no significant effect on the number of shallot bulbs. The highest average number of tubers was given to chicken manure in A₀ (5.78 bulbs) and the lowest average was at A₂ (5.22 bulbs). The highest average number of tubers due to volcanic ash was found in V₂ (5.83 bulbs) and the lowest was at V₃ (5.58 bulbs).

4. Bulb Diameter per Sample (mm) Bulb

Diameter data showed that the application of chicken manure material had a significant effect on tuber diameter. Volcanic ash had no significant effect on tuber diameter. The interaction between the treatment of chicken manure and volcanic ash had

no significant effect on the diameter of shallot bulbs.

The application of chicken manure material to the highest average tuber diameter was at₀ (20.38 mm) and the lowest average was at A₁ (17.83 mm). The highest average tuber diameter due to volcanic ash was found at V₂ (19.65 mm) and the lowest at V₁ (19.40 mm).

5. Wet Bulbs Weight Per Sample (g)

Wet tuber weight data per sample showed that the application of chicken manure had no significant effect on tuber wet weight. The application of volcanic ash had no significant effect on the wet weight of tubers. The interaction between the treatment of chicken manure and volcanic ash had no significant effect on the wet weight of shallot bulbs.

The highest average chicken manure application was found in₀ A₃ (41.93 g) and the lowest average was at A₁ (34.05 g). The highest average fresh weight of tubers due to volcanic ash was found at V₃ (39.56 g) and the lowest was at V₁ (34.22 g).

6. Dried Shallot Bulbs Weight (g)

Data on dry bulb weights of shallots due to the application of chicken manure and volcanic ash showed that the application of chicken manure had no significant effect on the dry weight parameters of shallot bulbs. The application of volcanic ash had no significant effect on the dry weight of shallot bulbs, and the interaction between the two treatments had no significant effect on the dry weight of shallot bulbs.

The application of chicken manure with the highest average dry weight of tubers was found in_{38.74} g) and the lowest average was at A₂ (31.31 g). The highest average dry weight of tubers due to volcanic ash was found at V₃ (36.75 g) and the lowest was at V₁ (31.69 g).

Discussion

1. The Effect of Chicken Manure on the Growth and Production of Shallots.

The results of observations on plant growth parameters including plant height and number of leaves, interaction treatment of chicken manure showed a significant effect. This proves that the application of chicken manure is able to provide a good growing environment and is able to meet the nutrient requirements to support plant vegetative growth. Treatment A₄ (6 kg) was the best growth for the growth of shallot (*Allium ascalonicum* L) compared to other treatments. It is suspected that the application of chicken manure is able to provide the nutrients needed by plants for growth and development can be absorbed by plants properly. The application of chicken manure at a dose of 30 tons/ha showed that growth and yields were always better than the doses of 20 tons/ha and 10 tons/ha on shallots. The dose of 30 tons/ha gave a high fresh bulb weight of shallots (19.70 tons/ha), which was 16.9% higher than without manure ([Firmansyah, Lukman, Khaririyatun, & Yufdy, 2015](#)).

The results showed that the treatment with chicken manure had no

significant effect on the number of tubers. ([Luta, 2021](#)) stated that shallots are not able to form enough tillers and leaves, this is due to genetic factors. ([Azmi, Hidayat, & Wiguna, 2011](#)) stated that the number of different tubers in Maja and Sumenep was influenced by genetic factors of each variety. ([Simanjuntak, Elfiati, & Delvian, 2015](#)) stated that the number of tillers of shallot is a plant genetic trait that is not easily changed by external factors. ([Savitri, 2021](#)); ([Dikinya & Mufwanzala, 2010](#)) stated that the application of chicken manure gave the highest average on the wet weight parameters of tubers per plot because chicken manure at a certain dose met the nutrient needs of shallots so that plant growth and production were optimal.

2. The Effect of Volcanic Ash on the Growth and Production of Shallots

The variance showed that volcanic ash had no significant effect on the growth and production of shallots. The application of volcanic ash had no significant effect on all parameters, namely plant height, number of leaves, number of tubers, tuber diameter, tuber wet weight, tuber dry weight. Shallots mixed with volcanic ash with varying content and different fertility levels did not significantly increase the growth of shallot plants. This is because the soil structure is getting harder so that plant roots cannot take up or absorb nutrients and water. It was also suspected that volcanic ash could not increase the growth of the number of tillers which was influenced by tuber

size, which was also related to the wet weight and dry weight of tubers. Potassium in soil is found in minerals that weather and release potassium ions. The adsorption ions on the cations are exchanged and quickly available for plant absorption. Organic soils contain little potassium. The K-dd value obtained in Sinabung volcanic ash is 0.58 me/100g which includes the moderate criteria ([Aziz, Saud, Rahim, & Ahmed, 2012](#)).

The dust that covers the top layer of the soil will gradually decay and mix with the soil and the process of formation (genesis) of new soil will begin. Volcanic ash deposited on the soil surface will undergo chemical weathering with the help of water and organic acids in the soil ([Saragih, Damanik, & Siagian, 2014](#)); ([Óskarsson, Riishuus, & Arnalds, 2012](#)). This weathering process takes a very long time which can reach thousands and even millions of years if it occurs naturally in nature. The results of further weathering of volcanic ash resulted in the addition of levels of cations (Ca, Mg, K and Na) in the soil by almost 50% from the previous state.

3. The Interaction Effect of Chicken Manure on Growth and Production of Shallots

The results of the variance test showed that the interaction between chicken manure and volcanic ash had no significant effect on plant height, number of leaves, number of tubers, tuber diameter, wet weight, and plant dry weight. Shallot. This is thought to

be due to chicken manure and volcanic ash not being able to synergize in supporting the growth and production of shallots. ([Gómez & Michel Jr, 2013](#)) stated that based on soil analysis after incubation, the addition of volcanic ash from Mount Merapi did not always have a positive effect on soil chemical properties. Soil fertility has a negative effect in the short term because the mineral dust content may be available for plants to take so it needs to be assisted with fertilization, chicken manure can help the process of weathering volcanic ash to maintain soil fertility.

Soil fertility has a negative effect in the short term because the mineral dust content may be available for plants to take so it needs to be assisted with fertilization, chicken manure can help the process of weathering volcanic ash to maintain soil fertility. The positive impact on the soil, indirectly, is to enrich and rejuvenate the soil which also increases plant growth, while the negative impact results in a decrease in crop production. ([Kwiatkowska-Malina, 2018](#)) stated that organic matter containing various types of organic acids was able to release nutrients bound in the mineral structure of the ash. ([Qadaryanty, Sembiring, & Hidayat, 2020](#)) stated that the content of volcanic ash from the eruption of Mount Sinabung was classified as acidic with a pH range of 4.30-4.98. Volcanic ash that turns into mud even has a lower pH value of around 3.80 while the soil that has been mixed with volcanic ash itself has a pH range of 4.83. During

the eruption, heavy rainfall caused the volcanic ash on the soil surface to be carried to the subsoil, while at the time of taking volcanic ash the soil had started to dry up, so the pH value dropped.

CONCLUSIONS

Chicken manure at doses of 0 kg, 2 kg, 4 kg, and 6 kg had a significant effect on plant height per sample, and tuber diameter per sample, but did not significantly affect the number of persampe leaves, number of tubers per sample, tuber wet weight and dry weight. tubers.

Volcanic ash had no significant effect on plant height per sample, number of leaves per sample, number of tubers per sample, tuber diameter per sample, wet weight per sample, dry weight per sample.

The interaction of chicken manure and volcanic ash had no significant effect on plant height per sample, number of leaves per sample, number of tubers per sample, tuber diameter per sample, wet weight per sample and dry weight per sample.

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