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Liquid Organic Fertilizer Test and Tuber Cutting on Shallots (Allium Ascalonicum L.) Growth and Yield

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ABSTRACT

This research aims to analyze the effect of liquid organic fertilizer concentration and bulbs cutting on the growth and the yield of shallots (allium ascalonicum. L*). This research was conducted on december 02, 2021 until february 13, 2022 located in a garden plant food and horticulture tohudan, Tanon Lor, Gedongan, Colomadu, Karanganyar, Central Java, with an altitude of 105 m above see level. This research is Complete Random Blok Design (CRBD) factorials. The result showed that cutting tubers (P1) 0,25 a part on the parameters of observation of leaves, number of leaves, the wet weight of biomass, dry weight of biomass, number of tubers planted, number of tubers plot, tuber weight planted showed an increase with increasing LOF, while tuber weight a plot showed a decrease with increasing LOF concentration. The cutting of tubers (P2) 0,33 a part on the parameters of observation of number of leaves, the wet weight of biomass, dry weight of biomass, number of tubers planted, tuber weight planted showed an increase with increasing LOF, while the long narrow leaves, number of tubers plot, tuber weight a plot showed a decrease with increasing LOF concentration. The cutting of tubers (P3) 0,5 a part on the parameters of observation number of tubers planted, number of tubers plot showed an increase with increasing LOF, while the long narrow leaves, of number of leaves, the wet weight of biomass, dry weight of biomass, tuber weight planted, tuber weight a plot showed a decrease with increasing LOF concentration.*

Keywords: *Bulb Cutting, Complete Random Blok Design, Liquid Organic Fertillilzer, Shallots*

INTRODUCTION

Plants require nutrients throughout their life cycle, from planting to harvesting in order to grow and produce well. The continuity of plant cultivation is very dependent on the effort to manage nutrients on its cultivated land through applying biological fertilizers or biofertilizers with organic materials. The supply of biological fertilizers (such as microbial decomposers) along with organic matter on cultivated land is intended to obtain the optimal plant growth and yields (Suradi et al., 2022).

Shallot (Allium ascalonicum L.) is one of the plants of family Lilliaceae (Rahman et al., 2016) that become one of leading vegetable commodities that have been cultivated for a long time by farmers. Shallot production in Indonesia still fluctuates frequently and even suffers in meeting the needs of domestic consumers. Apart from being source of income, this commodity also opens up the job opportunities which contribute to nation's economic growth. The high economic value of shallot harvest can fulfil national consumption and become a source of income for farmers and has the potential as a foreign exchange earner (Novatriana & Hariyono, 2020).

The shallot cultivation has spread throughout Indonesia since it has a fairly high economic value. Therefore, in few decades, the average national shallot productivity was ranged from 8.5 to 10.5 tons/ha. Shallots are one of vegetable plants that have the potential to be cultivated in house by using polybags since it has short lifespan (60 days) and high economic value. Then, planting shallots around the house during Covid-19 pandemic can reduce community expenses in purchasing shallots as a kitchen spice (Jamaludin et al., 2021).

Shallots are one of the tuber plants that are very responsive to fertilization, especially fertilizers that contains potassium that can help plants absorb the nutrients for increasing the plant growth (Ernawati, 2015). The fertilizer is in the form of inoculants that utilize indigenous bacteria which are fertilizing technology with a biological approach, creating a stimulant by collecting a number of special microbes, namely N (nitrogen) batching bacteria, P (phosphate) solvent microbial, cellulose-degrading microbes, growth hormone indole acetic acid (IAA). These bacteria are active and aggressive in infecting the roots so that the roots will be spared from other bacterial infections that harm plants and can improve soil aeration, and the soil will be fertile. Bacteria with such capabilities are called PGPR (Plant Growth Promoting Rhizobacteria) which will help in the growth and production of plants and gradually restore soil fertility (Purba et al., 2020).

Liquid organic fertilizer (POC) is an organic materials fermentation from livestock manure and plant residues in the form of a solution that contain various kinds of nutrients needed by plants. One of POC products is POC Bio Slurry, which is the final solutions derived from the decay of animal manure that will be used as a nutrition for the soil. There are various nutrients in liquid Bio Slurry, including 68.59% of organic matter, 17.87 % C-org, 1.47% N, 0.52% P, 0.38% K, and 9.09% C/N that needed by the plants. Bio Slurry also has micro-nutrients called humic acids, amino acids, fatty acids, vitamin B12, auxin hormones, cytokinins, antibiotics, and micro-nutrients such as manganese (Mn), copper (Cu), iron (Fe), molybdenum (Mo), and zinc (Zn) that useful for plants and soil (Singgih & Yusmiati, 2018).

Generally, the farmers in Indonesia are rarely treat their cultivating shallots, because the seeds used are medium or too small size, then the small tubers will tend to die easily when they are cut. The efforts to increase the yield of shallots are by selecting seed tubers and cutting tubers using a clean knife ranged from 1/3 and 1/4 from the tuber length to stimulate the shallots' growth, accelerate the plants growth, stimulate the side tubers' growth and be able to multiply their seedlings.

Another effort to obtain high growth and yields is can be used through good planting media. An ideal planting medium is the balance between nutrients, composition, and its structure for the plants can grow optimally since there are enough nutrients available for it. The use of right planting media will determine the growth of the planted seeds. In general, the planting media used must light, inexpensive, easy to obtain, loose and fertile for the optimum seedling growth (Mahdalena, 2016).

This research aims to determine the effect of POC concentration and seed tubers cutting on shallots growth and its yield. It is suspected that cutting the 1/3 tubers part and the concentration of liquid organic fertilizer (Bio Slurry) of 30 ml/l is able to give good results on shallot growth and yield (Allium ascalonicum L.).

LITERATURE REVIEW

Shallot (Allium ascalonicum L.) is assumed from Central Asia, around India, Pakistan, to Palestine. There is no official record when the shallots began to be known and used, but it is thought to have been known since more than 5000 years ago. It is estimated that Western Europe was only familiar with shallots around the Middle Ages and immediately spread to Eastern Europe. From Western Europe, the shallots spread widely to America, East and Southeast Asia that associated with spices hunting by Europeans on Asian continent (Tarigan & Sembiring, 2018).

Shallots (Allium ascolanicum, L) is one of the leading commodities in several regions in Indonesia, which is used as a cooking spice and contains several anti-cancer substances and substitutes for antibiotics, lowers blood pressure, cholesterol and lowers the blood sugar levels. The shallots contain calcium, phosphorus, iron, carbohydrates, vitamins A and C. Shallots grow well in fertile, loose soil, and contain lots of organic material. The best type of soil is sandy loam or dusty loam. The more humus contains in soil will increase the nutrient content such as N, P, K, Mn, Fe, Cu, Bo, Zn and other elements (Susikawati et al., 2018).

Shallots are important and prospective superior for agricultural commodities. The need for shallots is increasing as the population grows. The need for shallots in 2016 was 1,045,483, and is expected to continue to increase and reaches 1.31 million tons with an average growth of 3.26% until 2019. The condition of the soil and the use of fertilizers has a significant role in affecting the decline of shallots' productivity since it has an impact on soil fertility. Soil fertility can be increased by a combination of balanced use of organic and inorganic fertilizers in accordance with LEISA (Low External Input and Sustainable Agriculture) concept (Afrilliana et al., 2017).

One of the efforts to get good growth and yield of shallot is fertilization. Fertilization is an act of providing additional nutrients to the soil directly or indirectly. The plant growth and development are strongly influenced by the availability of nutrients in the soil. The organic fertilizers come from died plants or animals that contain nutrients needed by plants. Organic fertilizers are needed to restore the physical properties of the soil, although it takes a long-time process before it can be absorbed by plants. The application of fertilizers aims increase the growth and yield of shallots by the improvement in physical and chemical properties of the soil from the use of organic fertilizers and inorganic fertilizers (Jahung et al., 2022).

Organic fertilizers derived from livestock manure are very diverse including cow dung, goat dung, sheep dung, horse dung, buffalo dung, chicken dung, and pig dung. The functions of manure are improving soil structure, source of macro and micro nutrients for plants, increasing the soil ability to hold water, increasing the soil ability to retain nutrients (releasing nutrients according to plant needs) and a source of energy for microorganisms (Syafrullah, 2019).

Liquid organic fertilizers have several advantages that contain certain ingredients such as microorganisms that are rarely found in solid organic fertilizers. In the dry form, some microorganisms die and the substance is not active. When mixed with solid organic fertilizer, liquid organic fertilizer can activate the nutrients contained in it (Long et al., 2021).

RESEARCH METHODOLOGY

This research was conducted at BBTPH Surakarta that starting on 2nd December 2021 until 13th February 2022, at Tohudan Food Crops and Horticulture Seed Garden, Tanon Lor, Gedongan, Kec. Colomadu, Kab. Karanganyar, Central Java. It located at an altitude of ± 105 masl. This research used a completely randomized block design (RAKL) with 2 factors including Bio Slurry Concentration (POC) and Bulb Cutting that was repeated three times for each treatment. RAKL is called a randomized block design because the randomization of experimental treatment will be conducted in each group. This method is suitable when the heterogeneity of experimental data from one diversity can overcome the difficulties when preparing large amounts of homogeneous experimental data. In

RAKL, the data loss causes a new problem in the research because it does not meet the heterogeneity requirement (Kamila et al., 2021).The first factor was cutting tubers with treatment P1 (1/4 part), P2 (1/3 part), P3 (1/2 part) while the second factor was POC concentration with S0 treatment (Bio Slurry 0 ml/l), S1 (Bio Slurry 15 ml/l) , S2 (Bio Slurry 30 ml/l), S3 (Bio Slurry 45 ml/l). The observational data were analyzed using ANOVA and Regression test.

The planting medium used in this research was regosol soil with cow manure as basic fertilizer. The experimental plots were made with a size of 80 x 60 cm in 36 plots. The fertilization is conducted when the plants are 10 DAP. The harvesting is conducted at the age of 60 DAP when the shallot leaves has fall.

RESULT AND DISCUSSION

Table 1. Regression equation for shallot plant growth due to POC. Concentration

Treatment		**The Estimated Value of Shallot Growth**			
		Leaf length (cm)	Number of leaves	Wet weight of shallot (gr)	Dry Weight of shallot (gr)
P1	**S0**	27.81	18.55	44.53	1.09
	S1	28.51	20.62	46.49	1.16
	S2	29.21	22.70	48.44	1.23
	S3	29.91	24.77	50.39	1.30
P2	**S0**	33.32	20.39	59.15	1.78
	S1	32.59	22.09	60.29	1.85
	S2	31.86	23.79	61.43	1.92
	S3	31.13	25.50	62.57	1.99
P3	**S0**	34.96	25.95	70.29	1.96
	S1	33.41	24.24	62.40	1.77
	S2	31.85	22.54	54.50	1.57
	S3	30.30	20.84	46.61	1.37

The graph of leaf length growth rate of shallot plants 2 weeks after planting (MST) to 6 weeks after planting (MST) is presented in Figure 1.

Figure 1. The graph of Shallot Length in 2-6 WAP due to POC concentration on 3 cuttings of seed tubers.

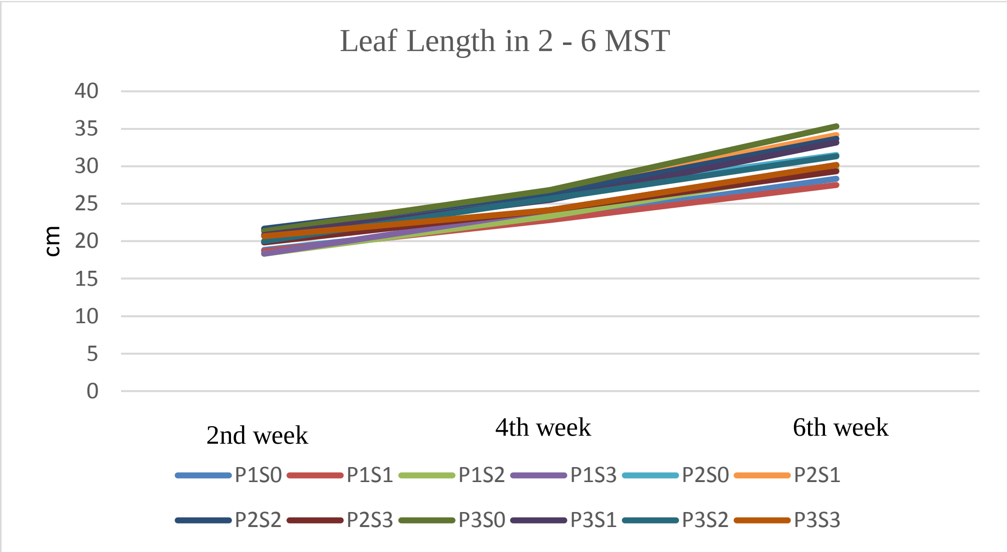

Figure 1 shows the observation of leaf length at the age of 2 WAP to 6 WAP. The treatment of cutting tubers showed that had a significant effect on the observation of leaf length. This is in accordance with the opinion of Rukmana in Mustofa (2021) that cutting tubers will accelerate the plant growth and multiply its tillers. The purpose of cutting tubers is for stimulate and accelerate the plant growth and stimulate the tillers' growth.

The cutting treatment (P1), increased while the cutting treatment (P2) and cutting (P3) decreased along with the addition of POC concentration to shallot length, it was suspected that high rainfall could result in less macro and micro nutrients absorption. The high rainfall can result in rapid loss of nutrients provided and disrupted the shallots' growth. This similar with Mufairoh (2018) statement that the plant height is influenced by various nutrients including N, P, K, S and micro elements, including Cu, Na, and Zn. The stunting plants due to inhibited formation of cells, carbohydrates, and proteins are caused by a lack of macro and micro elements.

The cutting treatment (P1) and cutting (P2), increased while cutting treatment (P3) decreased with the addition of POC concentration to the amount of shallot. The increase in the number of leaves due to the large amount of nitrogen nutrients absorbed by shallot plants with the right portion is capable in making more leaves and having high chlorophyll. This agrees Irfan (2013) stated that increasing the number of leaves on plant will be directly proportional in increasing photosynthetic capacity.

The cutting treatment (P1) and cutting (P2) is increased, while the cutting treatment (P3) decreased with the addition of POC concentration to wet weight of shallot. The wet weight of shallot is influenced by the amount of N and K elements that are absorbed that can affect the wet weight of the shallot. The decrease and increase in wet weight yield are not only influenced by the elements of N and K, but also caused by P in the soil (Mufairoh et al., 2018).

The cutting treatment (P1) and cutting (P2), increased while the cutting treatment (P3) decreased with the addition of POC concentration to dry weight of shallot. It is estimated that there is a difference in leaf diameter size as in ¼ cutting part that gives a large leaf diameter, while ½ cutting part gives the small leaf diameter that caused the difference in the photosynthesize. This result is in accordance with Haloho (2019) that the increase in soluble solids in shallots due to the amount of light received during tubing period, resulting in high shallots weights. This also happens because of drying, respiration, and oven.

Table 2. The regression equation of shallots crop yields due to POC. concentration

Treatment		**The Estimated Value of Shallot Growth**			
		Number of shallots planted	Number of shallots per plot	Planting shallots weight (grams)	Shallots weight per plot (grams)
P1	**S0**	5.70	70.89	31.25	359.24
	S1	5.94	71.91	32.49	333.51
	S2	6.18	72.92	33.72	307.78
	S3	6.43	73.94	34.96	282.05
P2	**S0**	8.15	84.34	39.17	406.33
	S1	8.37	81.60	40.27	386.00
	S2	8.59	78.86	41.38	365.66
	S3	8.81	76.12	42.48	345.33
P3	**S0**	10.73	90.77	39.77	338.99
	S1	10.93	92.49	36.76	335.08
	S2	11.12	94.22	33.74	331.16
	S3	11.32	95.95	30.73	327.24

The treatment of cutting (P1), cutting (P2), and cutting (P3) increased along with the addition of POC concentration to the number of shallots planted, because the provision of POC can increase the growth and yield of shallot plants. This result is similar with Lasmini (2018) that the application of POC is not only able to increase the growth and yield of shallots, but also to improve the soil quality by giving nutrition to physical, chemical, and biological soil. Another opinion according to Nugraha (2014) that the larger leaves in plants, it will increase the function for photosynthesis that will absorb more sunlight and CO2 fixation that able to affect the assimilation results in shallots bulbs.

The cutting treatment (P1) and cutting (P3) increased, while the cutting treatment (P2) decreased along with the addition of POC concentration to the number of shallots bulbs. The ends cutting of different bulbs on shallot plants can affect the number of bulbs per plot, this is in agreement with Auliya & Wardiyati (2020) that cutting the ends of bulbs can accelerate the growth and increase the number of tillers.

The cutting treatment (P1) and cutting (P2), increased while the cutting treatment (P3) decreased along with the addition of POC concentration in shallots weight since the larger cutting in the end of the tubers caused injuries and affected the plants during the growth period and influencing the yield of tuber weight (Baswarsiati et al., 2013).

The treatment of cutting (P1), cutting (P2), and cutting (P3) decreased along with the addition of POC concentration in tuber weight per plot due to improper fertilization and the absorption of K elements. This is in line with the opinion of Winarto and Napitupulu in Mufairoh (2018) that the relevant source of nutrition is fertilizer. The application of K fertilizer is affecting the tuber weight of the plots. In addition, according to Prasetyo (2017) there are various things that cause the low production of shallots, including poor seeds, cultivation methods, types of cultivars, and inappropriate fertilizer application.

CONCLUSION

The tuber weight per plant of bulb cutting (P1) ¼ of leaf length, the number of leaves, wet plant, dry plant, number of tubers planted and number of tubers per plot showed the development with increasing POC concentration, while tuber weight per plot showed a decrease with increasing POC concentration. The cutting tubers (P2) 1/3 part for the number of leaves, wet plant, dry plant, number of tubers planted and the weight of tubers planted showed an increase with increasing concentration of POC. While leaf length, number of tubers per plot, weight of tuber plots showed a decrease with increasing concentration OF POC. Meanwhile, the cutting tubers (P3) ½ part for the number of tubers planted and the number of tubers per plot showed an increase with increasing POC concentration. While leaf length, number of leaves, wet plant, dry plant, weight of planted tubers and weight of tuber plots showed a decrease with increasing POC concentration.

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