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File name:	d_response_of_shallot_A6526-Article_Text-29847-4-10-20210...
File size:	603.42K
Page count:	7
Word count:	5,900
Character count:	27,961
Submission date:	01-Apr-2022 07:08PM (UTC+0700)
Submission ID:	1798812184

NUSANTARA BIOSCIENCE
Vol. 12, No. 2, pp. 127-133
November 2020

ISSN: 2087-3948
E-ISSN: 2087-3956
DOI: 10.13057/nusbiosci/n120207

Growth and yield response of shallot (*Allium ascalonicum* L. var. Tuktuk) from different source materials applied with liquid biofertilizers

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Manuscript received: 8 July 2020. Revision accepted: 24 September 2020.

Abstract. *Purba JH, Wahyuni PS, Zulkarnaen, Sasmita N, Yuniti IGD, Pandawani NP. 2020. Growth and yield response of shallot (Allium ascalonicum L. var. Tuktuk) from different source materials applied with liquid biofertilizers. Nusantara Bioscience 12: 127-133.* This research was to examine growth and yield of shallots using different sources of propagation material, namely true shallot seed (TSS) and bulbs. Soil biological fertility, which was generally low, was improved by the addition of liquid organic fertilizer. The purpose of this study a) to determine the differences in the propagation of plants from seeds and bulbs of shallot Tuktuk varieties, and b) to determine the effect of liquid biofertilizer maxigrow and rhizobacteria. The study used a one-factor randomized design. The results showed that the growth and yield of shallots propagated with bulbs were better than the origin of the seeds. The treatment of the two types of liquid biofertilizer produces tangible growth and yield, but there was no significant difference between the two kinds of liquid organic fertilizer.

Keywords: Bulbs, liquid biofertilizer, shallot, Tuktuk variety, true shallot seeds

INTRODUCTION

Cultivation of shallots has long used bulbs as material for plant propagation. Repeated use of bulbs as planting material can cause transmission of the virus and other disease pathogens i.e *Fusarium* sp., *Colletotrichum* sp., *Alternaria* sp., which can decrease production of bulb weights up to 45%. This problem can be overcome by using planting material from seeds. Shallot seeds called true shallot seed (TSS) is an alternative to improve productivity. Besides the seed material considerably produce healthy plants since it is mostly free viruses. From an economic perspective, the price of seeds is cheaper so that it can reduce production costs to get higher yields (Dianawati et al. 2019; Wati and Sobir 2019).

To increase the productivity of shallot crop yields, various methods had been proposed, one of them is by using healthy plant material, namely true shallot seeds (TSS). Cultivation of Tuktuk variety onions using TSS produced tuber dry weight per clump of 19.30 g (Wati and Sobir 2019). The use of seeds has its own advantages that can save the purchase of seeds 30-50% (Sumarni et al. 2012). Tuktuk is a superior variety of shallots, and its production is able to give a yield increase of 10-15 tons.ha-1. Tuktuk variety has black seeds, small size with the number of seeds 350 seeds/gram, round bulb shape, bulb pink to brownish-red color, has a number of leaf clumps of 7-14 strands, results of fresh bulbs 1-2 tillers, and can be harvested 85 days after planting (Sitepu et al. 2013; Dianawati et al. 2019).

Soil biological fertility is declining due to the low use of organic matter. One way to restore soil fertility is to use organic biofertilizers (Purba et al. 2018). 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 (Kafrawi et al. 2017).

One type of biological fertilizer is beneficial and fertilizing bacteria such as the PGPR group of bacteria. PGPR has a vital role in increasing plant growth, yields, and land fertility. Previous studies were suggesting that bacteria of the genus Pseudomonas, *Azotobacter*, Bacillus, and Serratia were identified as PGPR producing phytohormone that is able to increase plant growth and yield (Purba et al. 2019). These bacteria are known to actively colonize plants in the root area and have three leading roles for plants namely: (i) as a biofertilizer, PGPR is able to accelerate the process of plant growth through

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Character count: 27961

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Soil biological fertility is declining due to the low use of organic matter. One way to restore soil fertility is to use organic biofertilizers (Purba et al. 2018). 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 (Kafrawi et al. 2017).

One type of biological fertilizer is beneficial and fertilizing bacteria such as the PGPR group of bacteria. PGPR has a vital role in increasing plant growth, yields, and land fertility. Previous studies were suggesting that bacteria of the genus Pseudomonas, *Azotobacter*, Bacillus, and Serratia were identified as PGPR producing phytohormone that is able to increase plant growth and yield (Purba et al. 2019). These bacteria are known to actively colonize plants in the root area and have three leading roles for plants namely: (i) as a biofertilizer, PGPR is able to accelerate the process of plant growth through

accelerated nutrient absorption, (ii) as biostimulant, PGPR can spur plant growth through phytohormone production and (iii) as bioprotectant, PGPR protects plants from pathogens. Some bacteria from the PGPR group are nitrogen-fixing bacteria such as the genus *Rhizobium, Azotobacter, Azospirillum*, and phosphate solvent bacteria such as the genera *Bacillus, Pseudomonas, Arthrobacter, Bacterium,* and *Mycobacterium*. *Rhizobium, Azotobacter, Azospirillum*, and phosphate solubilizing bacteria have roles and functions, such as decomposition of organic matter, mineralization of organic compounds, nutrient fixation, nutrient solvents, nitrification, and denitrification (Biswas et al. 2000; Prasad et al. 2019).

Azospirillum and *Azotobacter* are non-symbiotic bacteria that are associated with various plants. *Azospirillum* besides being able to tether nitrogen and produce growth hormones, is also able to remodel organic matter (cellulose, amylose, and organic matter which contains several numbers of fats and proteins) in the soil. The three types of PGPR bacteria can produce growth hormones such as IAA. Indirectly PGPR bacteria can inhibit pathogens through the synthesis of antibiotic compounds, as biological controls. Other bacteria that can produce IAA are phosphate solvent bacteria (BPF) such as the genera *Pseudomonas, Bacillus,* and *Cerratia*. Phosphate solubilizing bacteria are the only group of bacteria that can dissolve P that is absorbed by the surface of iron oxides and aluminum as Fe-P and Al-P compounds (Novatriana 2020; Tuhuteru et al. 2017). With this background, a field experiment was conducted to identify (i) the differences in the propagation of plants from seeds and bulbs of shallot Tuktuk varieties, and (ii) the effect of liquid biofertilizer maxigrow and rhizobacteria.

MATERIALS AND METHODS

Study area

This research was conducted on April-July 2019 in Bungkulan Village, Buleleng District, Bali Province, Indonesia (8° 04'31"S 115°09'48" E), with an altitude of 10 m asl., Temperature of 28-33°C and an average annual rainfall of 1,127 mm at the height of ± 10 m asl. The experimental design used was a randomized block design (RCBD) single factor consisting of 18 (eighteen) treatments as shown in Table 1.

Procedures

The treatment was replicated three times so there were 3 x 18 = 54 experimental units. Data were analyzed with analysis of variance (ANOVA) and Least Significant Difference (LSD) test at 5% level. The implementation of experiments included: (i) soaking the seeds in a liquid biofertilizer solution, the seeds soaked with a solution of biological fertilizer (rhizobacteria or maxigrow) according to the treatment ie concentrations of 1%, 2%, and 2.5% for 12 hours; (ii) seed germination and seedbed, The seeds are placed in containers coated with litmus paper that has been soaked in water. Within ± 2 (two) days, if it has germinated, the seeds are transferred to the nursery in the tray. Nursery media is a mixture of compost, husk, and soil with a ratio of 1: 1: 1. After 21 days after planting the seeds are transplanted into the field; (iii) soaking bulbs is done when the seeds from seeds that are growing are aged 20 days after planting. So that after soaking the bulbs for 12 hours, planting is done simultaneously, both seeds from seeds and seeds from the bulbs; (iv) treatment of plants, biological fertilizer (rhizobacteria or maxigrow) concentrations of 1% (10 $mL.L^{-1}$ solutions), 2% (20 $mL.L^{-1}$ solutions) and 2.5% (25 $mL.L^{-1}$ solutions) is given by watering the plant roots with a volume of 100 ml of solution for each plant according to treatment. It was given only once when the plants were 7 days after planting.

Table 1. List of treatments

Symbol	Descriptions
B0	Without the application of liquid biofertilizer in bulbs
BR1	Rhizobacteria-soaked seeds and watered on land with a concentration of 2%
BR2	Seeds immersed in rhizobacteria and given in fields with a concentration of 2.5%
BM1	Seeds immersed in liquid biofertilizer maxigrow and given in fields with a concentration of 1%
BM2	Seeds immersed in liquid biofertilizer and given in field 2 %
U0	Without the application of liquid biofertilizer in true shallot seeds
UR1	Rhizobacteria-soaked bulbs and given in 2% concentration fields
UR2	Rhizobacteria-soaked bulbs and given in 2.5% concentration fields
UM1	Bulbs soaked in liquid biofertilizer maxigrow and given in fields of 1% concentration
UM2	Bulbs soaked in liquid biofertilizer maxigrow and given in fields of 2% concentration
BR2M1	Seeds soaked in rhizobacteria in concentrations of 2.5% and given liquid biofertilizer maxigrow in land concentration of 1%
BR2M2	Rhizo-soaked seeds bacteria 2.5% concentration and given liquid biofertilizer maxigrow in 2% concentration land
BM1R1	Seeds soaked liquid biofertilizer maxigrow concentration 1% and given Rhizobacteria in 2% concentration land
BM1R2	Seeds soaked liquid biofertilizer maxigrow concentration 1% and given rhizobacteria in 1% concentration land concentration of 2.5%
UR2M1	Rhizobacteria bulbs soaked in concentrations of 2.5% and given liquid biofertilizer maxigrow in land concentrations of 1%
UR2M1	Rhizobacteria soaked bulbs in 2.5% concentration and given liquid biofertilizer maxigrow in land concentrations of 2%
UR2M1	Liquid biofertilizer maxigrow soaked bulbs with a concentration of 1% and given rhizobacteria in a 2% concentration field
UR2M1	Liquid biofertilizer maxigrow soaked bulbs with 1% concentration and rhizobacteria in a field with a concentration of 2.5%

Each treatment consisted of three replications. The number of plots used was 15 plots, each plot consisting of 12 plants and 9 of them were used as sample plants. The total number of plants was 60 plants. Variables observed were plant height (cm), number of leaves per clump (strands), number of tillers per clump, number of bulbs per clump, bulbs diameter, fresh bulbs weight per clump (g), total fresh weight of plants per clump, dry weight leaves per clump, dry weight per bulbs, and total dry weight per clump.

Data analysis

Data analysis using single factor randomized block design with a linear analysis model, namely: $Yij = \mu + \tau i + kj + \varepsilon ij$. Yij = the j^{th} replicate observation at the i^{th} level of the factor, μ = population mean, τi = represents the effect of treatment i^{th}, kj = represents the effect of block j^{th}, εij = individual random error associated with observation Yij (Nelson *et al*. 2003). If the results of analysis of variance there are treatments that have a significant effect on the observed parameters then proceed with the least significant difference (LSD) test at 5% level.

RESULTS AND DISCUSSION

The results of the analysis of the effect of treatment on the variables showed that it had a significant effect ($p < 0.05$) on all parameters. The Fisher method was used to determine different treatments. In Table 2 it can be seen that the highest plant height was obtained in the treatment of plant propagation material from bulbs and was significantly different from the plant propagation material from seeds (Figure 1). Among the plants that were propagated with bulbs, there was no significant difference in plant height even though different liquid biofertilizers were given. The same occurs in parameters of number of leaves, number of tillers, and number of bulbs.

In Table 2 it can be seen that there significant difference between the diameter of the shallot bulbs derived from seed and bulbs propagation. The age of harvest in shallots propagated by seeds was significantly different from shallot plants propagated by bulbs. Plants that are propagated with bulbs are harvested 11 days faster than plants that are propagated from seeds. The weight of the root which is propagated from the bulbs is significantly heavier than the weight of the root of the shallot which is propagated from the seeds. Likewise, the bulbs fresh weight, the bulbs fresh weight derived from bulbs propagation material is significantly heavier than that propagated from seeds.

Growth and yield of plants derived from bulbs are better than plants derived from seeds, making farmers reluctant to use the source of plant propagation from seeds, although seedlings from bulbs make the cost of production facilities more expensive than seeds (Idris 2016).

In Table 2 it can be seen that the fresh weight of leaves of plants originating from bulbs propagation is significantly heavier than plants propagated from seeds. Likewise, total fresh weight, total dry weight, and dry weight of bulbs. Whereas the treatment of liquid biofertilizers had no significant effect. A significant difference in total dry weight in shallots propagated by bulbs and seeds is seen in Figure 2, and that was also seen in the field (Figure 3). The heaviest leaf fresh weight was found in the UM2 treatment, but it was not significantly different from the fresh weight of leaves originating from other bulbs. The fresh weight of the leaves in the UM2 treatment was significantly different from the fresh weight of the leaves in the treatment derived from seeds. Growth of plants that are given liquid organic fertilizer containing PGPR bacteria includes several bacteria such as *Rhizobium, Azospirillum, Azotobacter* (nitrogen-fixing), and phosphate solvent bacteria such as Pseudomonas. These bacteria can live freely in root nodules, rhizosphere, roots surface of plants, and in the soil. The activity of *Rhizobium, Azospirillum,* and *Azotobacter* bacteria is to provide N elements, and some are able to provide P elements for plants and can produce growth hormones such as indole acetic acid (IAA). The bacteria will tether N from the air and convert it to NH_3 by using nitrogenase, then NH_3 is converted to glutamine or alanine, so that it can be absorbed by plants in the form of NO_3 and NH^{4+}. N-fixing bacteria and phosphate solvents are effective, their population in the soil is only about 0.1-0.5% of the total microorganisms present (Goswami 2015; Sudewi et al. 2020; Sutariati 2020).

Significant differences in growth and yield of shallots from bulbs propagation by seed multiplication also occur in the parameters of the bulbs dry weight, root dry weight, and total dry weight as presented in Table 3. The results remain consistent that the yield parameters of the plants propagated from the bulbs were significantly fixed better than from seeds. As a comparison of the cost of using bulbs and seeds as a source of seeds, using shallot bulbs seeds in an area of 1 *bau* or equivalent to 7,000 square meters, it takes at least 1 ton of bulbs seeds. In other words, with a seed price of IDR 50,000/kg, capital needs IDR 50,000,000,-for the cost of seeds. While using seed sources from seeds, each hectare requires 6 kilograms of seedlings, with the price of every kilogram of IDR 1,000,000 (Idris 2016).

Farmers are reluctant to use seeds from seed for several reasons such as seedlings from seed must go through one-month seeding, longer harvest time can even reach a month longer than seedlings from bulbs. This adds to the production costs for maintaining plants, even though the lower yields as shown by the results of this study. The growth of seed origin plants is slower than the origin of the bulbs because the bulbs have nutrient reserves that can be absorbed by plants in their initial growth, while seedlings of seed origin plants do not have food reserves so they must look for themselves from the surrounding environment (Devy et al. 2020; Hantari et al. 2020).

Table 2. Growth and yield of shallots (*Allium ascalonicum* L. var. Tuktuk) of seeds and bulbs given liquid biofertilizers

Treatment	Plant height (cm)	Number of leaves	Number of tillers	Harvest age (dap)	Dry weight of roots (g)	Number of bulbs	Diameter of bulbs (cm)	Fresh weight of leaves (g)	Dry weight of leaves (g)	Fresh weight of bulbs (g)	Dry weight of bulbs (g)	Total fresh weight (g)	Total dry weight (g)
B0	45.11 a	8.50 a	1.00 a	85.00 b	0.11 a	1.33 a	2.92 a	8.90 a	1.48 a	18.61 a	1.78 a	27.82 a	3.38 a
BR1	46.00 a	8.72 a	1.00 a	85.00 b	0.12 ab	1.11 a	3.14 ab	8.70 ab	1.58 a	22.49 a	2.22 a	31.53 a	3.91 a
BR2	45.00 a	9.06 a	1.00 a	85.00 b	0.13 ab	1.28 a	3.17 ab	7.98 ab	1.61 a	22.76 a	2.60 a	31.12 a	4.34 a
BM1	44.83 a	8.83 a	1.00 a	85.00 b	0.09 a	1.39 a	3.09 ab	8.48 a	1.57 a	19.67 a	1.73 a	28.46 a	3.39 a
BM2	42.44 a	9.11 a	1.00 a	85.00 b	0.10 ab	1.44 a	3.13 ab	8.61 ab	1.63 a	21.93 a	2.20 a	30.92 a	3.93 a
U0	46.67 ab	55.72 b	7.00 b	74.00 a	0.38 c	10.50 b	2.59 ab	19.83 bc	3.77 b	89.48 b	15.19 b	110.34 b	19.33 b
UR1	51.50 b	53.06 b	7.94 b	74.00 a	0.49 c	12.83 b	2.66 b	20.83 cde	4.40 b	99.76 c	17.46 c	121.93 b	22.35 c
UR2	52.89 bc	56.56 b	7.61 b	74.00 a	0.44 c	9.83 b	2.73 b	20.85 cde	4.51 b	101.94 c	17.16 c	124.09 b	22.11 c
UM1	53.50 c	52.72 b	7.44 b	74.00 a	0.36 bc	11.22 b	2.67 ab	19.78 bcd	3.90 b	99.58 c	19.54 c	120.37 b	23.80 c
UM2	53.50 c	55.56 b	8.11 c	74.00 a	0.41 c	10.72 b	2.75 ab	21.48 cde	4.59 b	103.86 c	20.32 c	126.74 b	25.33 c
BR2M1	45.50 a	8.61 a	1.00 a	85.00 b	0.12 ab	1.17 a	3.19 ab	10.41 ab	1.90 a	22.92 a	2.10 a	33.69 a	4.13 a
BR2M2	42.00 a	8.83 a	1.00 a	85.00 b	0.14 ab	1.22 a	3.22 b	9.83 ab	1.66 a	22.74 a	2.46 a	32.93 a	4.26 a
BM1R1	41.39 a	8.22 a	1.00 a	85.00 b	0.17 ab	1.61 a	3.02 ab	13.92 ab	2.30 a	20.70 a	1.90 a	35.07 a	4.38 a
BM1R2	40.94 a	8.33 a	1.00 a	85.00 b	0.11 ab	1.39 a	3.16 ab	9.86 ab	1.81 a	20.73 a	2.16 a	30.92 a	4.07 a
UR2M1	50.22 b	51.94 b	7.28 b	74.00 a	0.47 c	10.11b	2.74 ab	20.91 cde	4.36 b	105.46 c	17.06 c	127.66 b	21.89 c
UR2M2	50.39 b	55.50 b	7.78 b	74.00 a	0.33 bc	10.78 b	2.70 ab	21.34 cde	3.91 b	102.17 c	16.11 bc	124.73 b	20.35 bc
UM1R1	51.06 b	54.56 b	7.50 b	74.00 a	0.45 c	9.78 b	2.68 ab	18.33 bce	3.73 b	94.21 bc	16.14 bc	113.84 b	20.32 bc
UM1R2	51.17 b	55.33 b	7.22 b	74.00 a	0.42 c	8.67 b	2.72 ab	19.29 bce	3.48 b	89.56 bc	12.68 bc	110.28 b	16.58 bc

Note: B: seed, U: bulbs, R_1: Rhizobacteria concentration 2%, R2: Rhizobacteria concentration 2,5%, M_1: MaxiGrow concentration 1%, M_2: MaxiGrow concentration 2%

Table 3. A side by side comparison of plant growth variables propagated by seeds and bulbs

Treatment	Fresh weight of bulbs (g)		Dry weight of bulbs (g)		Total dry weight (g)	
	Propagated by seed	Propagated by bulbs	Propagated by seed	Propagated by bulbs	Propagated by seed	Propagated by bulbs
Control	18.61	89.48	1.78	15.19	3.38	19.33
R_1	22.49	99.76	2.22	17.46	3.91	22.35
R_2	22.76	10194	2.60	17.16	4.34	22.11
M_1	19.67	99.58	1.73	19.54	3.39	23.80
M_2	21.93	103.86	2.20	20.32	3.93	25.33
R_2M_1	22.92	105.46	2.10	17.06	4.13	21.89
R_2M_2	22.74	102.17	2.46	16.11	4.26	20.35
M_1R_1	20.70	94.21	1.90	16.14	4.38	20.32
M_1R_2	20.73	89.56	2.16	12.68	4.07	16.58
Total	192.55	886.02	19.15	151.66	35.79	192.06
Mean	21.39	98.45	2.13	16.85	3.98	21.34

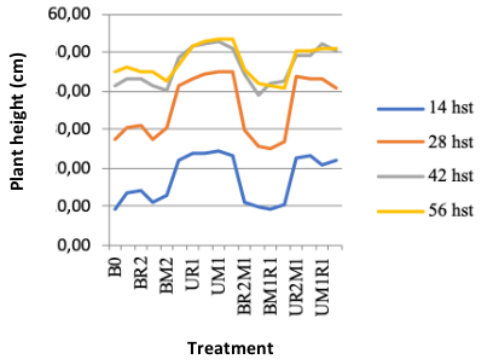

Figure 1. Plant height growth at various treatments at different ages

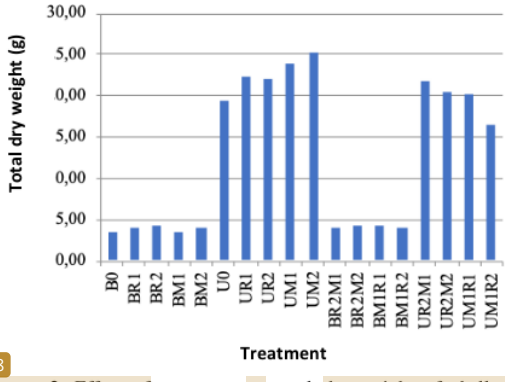

Figure 2. Effect of treatment on total dry weight of shallot (standard deviation 1.24)

Figure 3. Performance 56 days after planting shallot which propagated by bulbs (left); true shallot seed (right) which soaked in 2% Rhizobacteria and given Rhizbacteria in the field

Discussion

Based on statistical results showed that the response of growth and yield of shallots from planting materials of seeds and bulbs that were given biological fertilizer Rhizobacteria (R) and MaxiGrow (M) had a significant effect ($p < 0.05$) on all observed variables.

Growth and yield of shallots from planting seeds and bulbs

Growth and yield of shallot from bulbs planting material were better than seeds. This was found in all observed variables except the root length. In Table 3 it can be seen that the bulbs fresh weight in the treatment of bulbs planting material sources was 98.45 g per clump, significantly heavier than the bulbs fresh weight derived from seed planting material, which was 21.39 g.

The dry weight of the bulbs, which was sourced from bulbs planting material, was also heavier than the seed planting material (Table 2). The average dry weight of the bulbs from the treatment of bulbs planting material was 16.85 g heavier than the average dry weight of the bulbs from the treatment of seed planting material, which was 2.13 g. The heaviest bulbs dry weight of all treatments was found in the MaxiGrow-soaked bulbs treatment and was given the field with a concentration of 2% (UM2) of 20.32 g (Table 3). The total dry weight of plants in the treatment of bulbs planting material sources was also consistently heavier than the total dry weight of plants from sources of seed planting material. This can be seen in Table 3, where the total dry weight of plant sources of bulbs planting material was 21.34 g while the total dry weight from seed sources was 3.98 g. The difference in growth and yield of shallots from bulbs planting material was better than seeds in this study, due to bulbs containing food reserves for the growth of red bowls at an early stage. Whereas seeds do not have as much food reserves as contained by bulbs. As a result, the growth of seeds will experience slowness compared to bulbs (Roessali et al. 2019). The number of fibrous roots that grow around the bottom of the disc was very much ± 40 root hairs at 1 day after planting (dap). Food reserves in bulbs affect the initial process of bulb growth until root growth which makes it able to absorb nutrients from the rhizosphere (Hudaib 2019; Purba et al. 2019; Setyawan et al. 2020).

In the treatment of bulbs planting material sources, photosynthate translocation process from source (leaf) to sinc (bulbs) runs more optimally because the average number of leaves ± 40 strands, in addition to the element of potassium (K) was very high (soil analysis data in appendix 1) causes bulbs growth more quickly, but the average bulbs diameter was the same as the diameter of the bulbs in the seed planting material. The difference was the bulbs weight due to the higher number of tillers resulting in the formation of more bulbs, i.e. ± 12 bulbs per clump (Table 3).

Seeing the above facts, the use of shallot planting material from bulbs was better than seeds because the results obtained are more profitable, faster harvest time, and easier maintenance. This was what makes farmers more passionate about growing shallots from bulbs. In terms of several aspects, the use of seeds from bulbs was 40% more expensive, but from maintenance, it was much easier and cheaper, faster harvesting time and much higher production. Therefore, promotion or socialization efforts from the use of seeds as a breakthrough source of shallot plant propagation will experience obstacles in the field, especially around the research location (Haring et al. 2019).

In terms of productivity, the highest productivity in this study was obtained from seed planting material in the BR2M1 treatment of 22.92 g/clump (687.6 g/plot with 1.2 m2 plot area) or 5.73 tons.ha-1, the results of this study were 17.90% lower than the description (Appendix 2). The highest productivity of bulbs planting material was in the treatment of UR2M1 weighing 105.46 g/clump (3,163.8 g/plot with 1.2 m2 plot area) or 26.36 tons.ha-1, the results of this study are classified as higher compared to national shallot productivity which reaches 9.31 tons.ha-1. Differences in characteristics and potential of shallots propagated by seeds and bulbs are presented in Table 3.

Growth and yield response of shallots given by Rhizobacteria and MaxiGrow biofertilizers

Observation of bulbs fresh weight from seed planting material sources, the heaviest bulbs fresh weight produced in the application of biological fertilizer Rhizobacteri (22.63 g) followed by a combination of Rhizobacteri application with MaxiGrow (21.77 g), lightest by application of MaxiGrow biological fertilizer (20.80 g)). At the source of planting material, MaxiGrow biofertilizer produced the heaviest fresh weight (101.72 g, followed by Rhizobacteri (100.85 g), followed by a combination of Rhizobacteri with MaxiGrow (97.85 g) (Table 3). Observation of bulbs dry weight at source of planting material, heaviest bulbs dry weight was produced in the treatment of Rhizobacteri (2.41 g), followed by a combination of Rhizobacteri with MaxiGrow (2.16 g), followed by application of biological fertilizer MaxiGrow (1.97 g). Whereas in the source of planting material, the heaviest bulbs dry weight was produced in the MaxiGrow treatment (19.93 g), followed by Rizobacteri (17.31 g) biological fertilizer, and also followed by the combination of Rhizobacteri with MaxiGrow (15.50 g) (Table 3).

Total dry weight in the source of seed planting material, the heaviest total dry weight resulted in the treatment of Rhizobacteri combination with MaxiGrow (4.21 g), followed by Rhizobacteri biological fertilizer (4.13 g), and the lightest was produced by MaxiGrow treatment (3.66 g). Whereas at the source of planting material, the heaviest total dry weight was produced in the MaxiGrow treatment (24.57 g), followed by Rhizobacteri (22.23 g) biological fertilizer, and the lightest in the combined treatment of Rhizobacteri with MaxiGrow (19.79 g) (Table 3).

Application of biofertilizers individually or both of them does not give different results either in seeds or bulbs, each fertilizer has its own advantages. Rhizobacteria contain elements of carbon (organic) 5.08%, nitrogen (N) 1.19%, phosphor (P) 1.15%, potassium (K) 1.05% and PGPR bacteria. The content of the elements in Rhizobacteria which causes the bulbs fresh weight of seed propagation was heavier, this was due to the presence of food sources in the growth of seeds through the provision

of biological fertilizers in addition to phosphate (P) and Potassium (K) content in very high soils (Galland 2017).

Growth and yield of shallots propagated with bulbs are better than those propagated from seeds. Age of harvesting shallots which were propagated with bulbs 11 days faster than those propagated with seeds. Liquid biofertilizers can improve the growth and yield of shallots, but there was no significant difference between the two liquid biofertilizers on growth and shallot yield.

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