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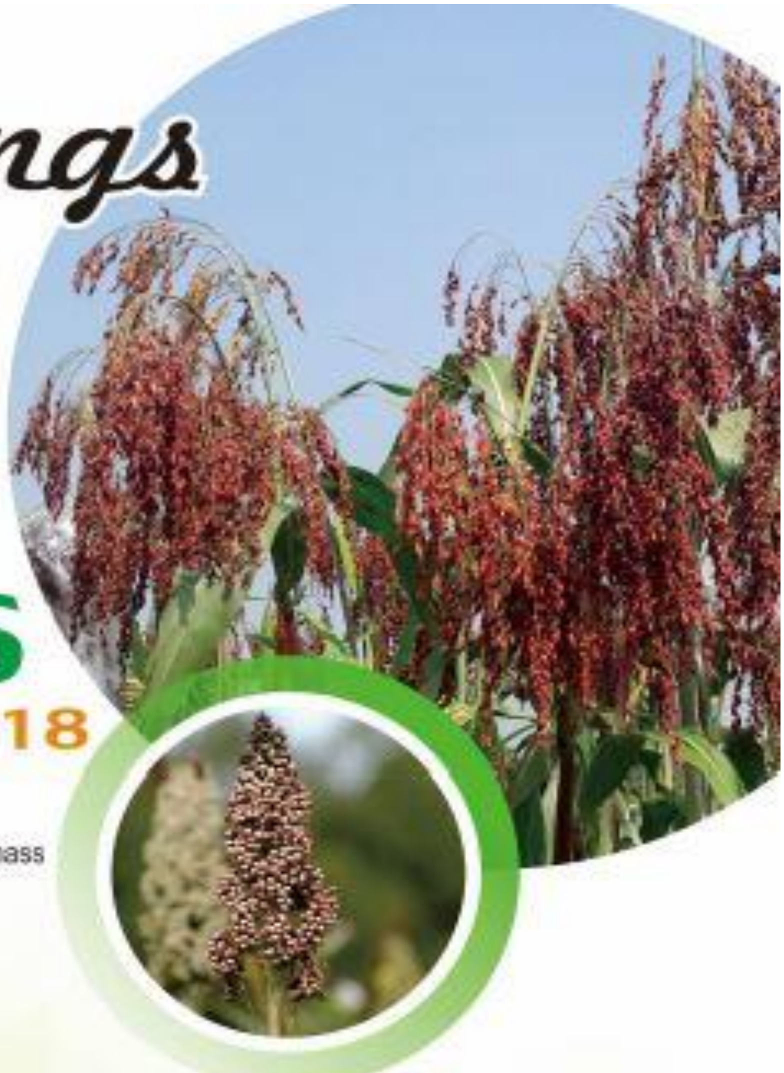

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The Project for Producing Biomass Energy and Material Through Revegetation of Alang-alang (*Imperata cylindrica*) Fields

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Increased Growth and Production of Shallot Plant (*Allium ascalonicum L*) with Application of Rhizobacteria

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Abstract

The low production of shallot plants in rainy season can decreased income of farmers. Thus, efforts should be made to increase production in the rainy season. The objective of this research was to know the growth and production of shallot to the application of rhizobacteria. This research was conducted from February to April 2018 at production center of Kediri Regency, East Java. Randomized Block Design with two factors was applied in this research. The First factor was a rhizobacteria that consisted of three levels: P0 (Without *Pseudomonas fluorescens*), P1 (Pseudomonas fluorescens with 5ml/l of concentration)and P2 (*Pseudomonas fluorescens* with 10 ml/l of concentration) and the second factor wasa rhizobacteria that consisted three levels: B0 (Without *Bacillus subtillis*), B1 (*Bacillus subtillis* with 5ml/l of concentration) and B2 (*Bacillus subtillis* with 10ml/l of concentration).The Combination treatment as nine treatments, each treatment was repeated three times to obtain 27 units of trial. Application of rhizobacteria was watered at the root with an interval of seven days. The results suggested that there were a significant difference in plant height, number of leaves, number of tubers, tuber diameter, fresh weight and dry weight of tubers between plants applied rhizobacteria and without applied rhizobacteria.

Keywords: *shallot, Rhizobacteria, Pseudomonas fluorescens and Bacillus subtillis*

1. Introduction

Indonesia is an agrarian country with a majority of people living in agriculture. Agriculture consists of several sub-sectors including the food crops sub-sector, the horticultural crops sub-sector, the forestry sub-sector, the fisheries subsector and the livestock sub-sector. One of the sub-sectors that gets the most attention from the government today is the horticulture sub-sector. Horticultural Subsector consists of vegetable plants, fruit plants, family medicinal plants and ornamental plants. Horticultural plants are the most in demand because they are profitable. In addition it can be sold directly, the plants also have a way of processing that many results were varied [2].

One of the horticultural commodities which have many benefits and high economic value and have the exciting prospect that plant shallots (*Allium ascalonicum* L). The need for consumption of shallots is still relatively high. The high demand indicates that the potential for developing shallots is still wide open, not only for domestic needs but also

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abroad [9]).

Are harvested of shallots in Indonesia in 2015 was 122.126 ha with a production of 1.229.184 tons. While the harvest area for East Java is 30.783 ha with a total production of 277.121 tons. Based on the Ministry of Agriculture's *roadmap* performance, 2018 will export 10,000 tons of shallots [5]. Shallots plants can provide high yields if followed by adequate technology, is a technology applied accordance with the nature of the commodity itself and the agro-ecosystem conditions in which these commodities are grow. Therefore, to achieve these targets is necessary to increase production and yield qualiy results shallots through intensification and extension [19].

East Java is the second largest shallots producer in Indonesia. The shallot cultivation center in East Java is scattered in several districts. One of the regencies which is the center of shallots is Kediri Regency. Plemahan Subdistrict is one sub-district in Kediri which produces shallots. Plemahan Subdistrict is about 17 km from Kediri City with a height of 68 m above sea level. The main problems experienced by farmers in the cultivation of shallots in the district of which is the low production of shallots in the rainy season and the high dose of inorganic fertilization and level of attack of pests/diseases. Shallots productivity in the rainy season only reaches around 3.5 tons/ha, while the potential yield can reach 7 tons/ha for the rainy season and 18 tons/ha for the dry season so, farmers income is decreased. During this time pest and disease control tends to use chemical pesticides [16]. The Intensive use of chemical pesticides can cause high residues in crop yields and environmental damage . The high pesticide residue in shallots causes the harvest cannot be exported, even though this export opportunity is very promising so that it can affect the increase of local farmers' income [7].

One efforts to overcome the low production in the rainy season and high use of inorganic fertilizers and chemical pesticides, it is necessary to study the application of biological agents in the form of Rhizobacteria to replace chemical pesticides. Rhizobacteria application has been proven as a potential substitute for pesticides as well as efficient nutrient uptake in plants [3].

Rhizobacteria is a bacterium that actively colonizes plant roots. Rhizobacteria has three main roles for plants is as biofertilizer, biostimulant and bioprotektan. Rhizobacteria can affect plants directly and indirectly. Directly by fixing nitrogen, dissolving phosphate, producing siderophore and growth hormone. While indirectly by improving growth conditions by suppressing the activity of pathogens that produce various compounds or metabolites such as antibiotics [22]. Rhizobacteria a beneficial bacteria that live around the roots of plants and can increase plant growth by various mechanism. The main benefits of Rhizobacteria are plant growth boosters which produce antibacterial compounds that are effective against certain plant pathogens and pests. Based on this, growth-stimulating Rhizobacteria are use as biological control agent by inducing plant resistance [3].

The rhizobacteria are also able to produce growth hormones such as IAA and dissolve P nutrient for plant [20]. Indirectly Rhizobacteria can inhibit pathogens through the synthesis of antibiotic compounds, as biological controls [21]. Other bacteria that can produce IAA (*Indole Acetate Acid*) are phosphate solvent bacteria such as the genera *Pseudomonas, Bacillus*, and *Cerratia* [21]. The purpose of this study was to determine the effect of the application of Rhizobacteria as an effort to boost the growth and production of shallots varieties Bauji.

2. Materials and Methods

This research was carried out in the Puhjarak Village Land, District of Plemahan, Kediri Regency. Laboratory analysis was carried out at the Biotechnology Laboratory of Agricultural Extension colleague Malang. This research activity was carried out from February to April 2018.

The materials used in this study were the shallots seeds of Bauji variety, manure, *Rhizobacteria Pseudomonas fluorescens* and *Bacillus subtillis*, planting media samples, chemicals for laboratory analysis. The tools used are scales, buckets, rulers, tools for laboratory analysis.

This research was carried out using Factorial Randomized Block Design. The first factor is the Rhizobacteria type consisting of Pseudomonas fluorescens and Bacillus subtillis. While the second factor is the concentration of Rhizobacteria application consisting of fife (5) ml/l and ten (10) ml/l. The combination of treatment was 9 treatments, each repeated three times to obtain 27 experimental units. The stages of the implementation of the study began with: selection of Bauji variety shallots seeds, making beds with a size of 200 cm x 100 cm. Each bed is given basic fertilization with 2 kg/m^2. Before planting shallots seeds given seed treatment was first done by dipping the seeds in Rhizobacteria solution. Planting uses a spacing of 20 cm x 20 cm. The application of Rhizobacteria is carried out every seven days according to the prescribed treatment. Maintenance was conducted on the activities of watering, weeding, fertilizing, pest and disease control and harvesting shallots at the age of 60 days.

Observations were made on the growth and onion yield. Observation of plant growth is carried out every seven days on plant height and number of leaf. While the observations of production using the number of tubers per plant, tuber diameter, fresh tuber weight per plant and the dry weight of tubers per plant. Observation data were analyzed using F test with 5% level and continued DMRT test.

3. Results and Discussion

3.1. Plant height Shallots

Table 1. Average of Shallot Crops After application of *Rhizobacteria*

Treatment	Sunday Observation															
	1		2		3		4		5		6		7		8	
B0P0	11,28	a	20.11	ab	28.07	ab	32.25	a	33.73	a	36,17	a	37,17	a	37.20	a
B0P1	11,64	ab	20.37	ab	27.40	ab	33.05	ab	36.07	ab	37.37	ab	38.60	ab	38.67	ab
B0P2	10.56	ab	18.97	a	26.37	a	29.79	ab	35,29	ab	37.47	ab	37.47	ab	38.47	ab
B1P0	13.00	ab	23.41	b	30,91	b	35,57	ab	38.43	ab	39.73	ab	40.87	ab	40.87	ab
B1P1	12,27	ab	21,16	ab	29.03	ab	33.05	ab	38.10	ab	38.10	ab	38,87	ab	38.90	ab
B1P2	9.81	ab	19,91	ab	29,17	ab	32.45	ab	37.07	ab	38.50	ab	39,17	ab	39.53	ab
B2P0	11.45	b	19,59	ab	27.13	ab	30.11	ab	34.47	ab	34.73	ab	35.93	ab	36.27	ab
B2P1	12,16	b	20.05	ab	26.67	ab	30.52	ab	34,22	ab	35,57	ab	35.66	ab	37.04	ab
B2P2	11.57	b	21.77	ab	28.03	ab	32.45	b	36.27	b	37.63	b	38.97	b	39.23	b

Description: The numbers followed by different letters indicate significantly different with the average growth of plants at the level of 0.05%

Table 1 shows that the Rhizobacteria application in the first observation gives a significant difference between treatment and control . This is because there is a difference between seed without treatment (Control) with seed treated. Before planting shallot seeds, first a solution *Rhizobacteria.* The function of seed immersion before planting is to stimulate plant growth and prevent the attack of plant pests when they grow. This is reinforced by the opinion of Sutariati [18] the treatment of seeds with Rhizobacteria significantly increasing germination capacity, maximum growth potential, Vigor index, growing spontaneity growth and relative growth rate. Whereas between Rhizobacteria *Pseudomonas fluorencens* and *Bacillus subtillis* which have a positive effect on the growth of chilli seeds do not give a real difference. This indicates that both types Rhizobacteria has the potential to increase vegetative growth of the plants.

The second and third observations showed that the application of Rhizobacteria in treatment B0P2 (*Pseudomonas fluorencens* 10ml/l) was not significantly different from the control, but the Rhizobacteria treatment was significantly different from the treatment B0P2 (*Pseudomonas fluorencens* 10ml/l). This is presumably because the function of Rhizobacteria which one can increase the absorption of some nutrients plants (N, P, Mn and Fe) are still not optimal. These nutrients are not fully absorbed by plants at the beginning of growth. This is in accordance with the opinion of Tambunan [19] stating that onion plants have their own food reserves to help the growth process in the early stages of growth. This explanation is reinforced by the statement Sutedjo (2001) in [19] which states that the ability of plants to absorb any nutrients for growth and development, especially in terms of the absorption of nutrients is not the same.

Observation of the 4th week until the 8th week gave a significant influence between treatment without treatment. It is presumed that the function of Rhizobacteria all run optimally so that the nutritional needs of plants be fulfilled and it is the balance in the absorption of plant nutrients. The impact of this is the increase in plant height with Rhizobacteria treatment both types of *Pseudomonas fuorencens* and *Bacillus subtillis*.

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The increase in plant height was significantly different from without Rhizobacteria treatment. The plant height ware significantly different with that of the untreated (control) is the treatment of *Pseudomonas fluorencens* and *Bacillus subtillis* with the concentration of each 10ml/l. This is consistent with the opinion of Van Look et al (1998) in [11] Rhizobacteria treatment on tomato plants capable of producing more rapid plant growth and larger.This is also supported by the results of research Khalimi [11] that Rhizobacteria can significantly increase the maximum plant height, number of branches of the maximum, the maximum number of leaves, wet and dry root weight and dry weight of soybean seeds. The same opinion was also expressed by Ningrum [14] that Rhizobacteria able to produce various growth hormones such as auxin, IAA, giberelin, cytokinin and ethylene.In addition to this Rhizobacteria is able to synthesize N, dissolve phosphate elements, and the ability to degrade and use a large number of organic and inorganic compounds that will interact with plants and associate in the rhizosphere. Based on this, Rhizobacteria used in the treatment can stimulate plant growth.

3.2. Total leaf Shallots

Table 2. Average Number of Plants Leaf Shallots after Applications Rhizobacteria

Treatment	Sunday Observation															
	1		2		3		4		5		6		7		8	
B0P0	10.07	ab	14.73	a	18,33	a	26.20	a	35.20	a	32.67	a	33.93	a	32,33	a
B0P1	11.27	ab	16.87	ab	22,13	ab	30.40	ab	37.87	ab	37.60	ab	31.80	ab	38.27	ab
B0P2	8.60	a	16.13	ab	24.53	ab	27.33	ab	41.67	ab	39.13	ab	39.53	ab	37.67	ab
B1P0	10.13	ab	15.87	ab	20.93	ab	26.60	ab	37.53	ab	39.07	ab	40.40	ab	37.07	ab
B1P1	10.40	ab	15.00	ab	20.27	ab	24.73	ab	33.67	ab	35.80	ab	37.40	ab	37.53	ab
B1P2	9.27	ac	16,20	ab	24.73	ab	31,73	ab	42.53	ab	42.53	ab	42.00	b	41.67	ab
B2P0	10.20	ab	15,33	ab	24,60	ab	28.13	ab	34.07	ab	36.47	ab	37.00	b	33,33	ab
B2P1	10.33	ab	17.27	ab	27.13	ab	29.67	ab	39.00	ab	36,33	b	37.93	b	35.80	ab
B2P2	12.47	b	20.27	b	26,53	b	35,33	b	44.80	b	43.67	b	44.20	b	43.87	b

Description: The numbers followed by different letters indicate significantly different with the average growth of plants at the level of 0.05%

Based on Table 2 can be informed that their interactions were not significantly different between treatment application Rhizobacteria without (control) at the age 7 hst or on the observation of week 1. This is apparently due in week 1 Rhizobacteria amount that colonize the roots of shallot crop is still small. This opinion is supported by the results of Listihani's [12] study that Rhizobacteria has a significant effect starting at 2 weeks after planting. This is because the second application of the treatment is done when the plant is 2 MST so that the number of Rhizobacteria that are colonized is quite large.

The longer the bacteria colonize the root surface, the higher the ability of Rhizobacteria to stimulate plant growth and increase its protective power from pathogenic microbes. This relates to the protection of the roots of plant pathogenic microbes. The bacteria *Pseudomonas fluorencens* and *Bacillus subtillis* able to spur the growth and yield of antibiotic in crop cultivation. The opinion was strengthened by the results of counting the number of bacterial colonies in soil samples after harvest. Data from these calculations are shown in Table 3.

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Table 3. Number of bacterial colonies

Treatment	Number of Colonies
Without *Pseudomonas* and *Bacillus*	47×10^{-5}
Pseudomonas 5ml/l	34.5×10^{-5}
Pseudomonas 10 ml / liter	72×10^{-5}
Bacillus 5ml/l	77×10^{-5}
Bacillus 5ml/l and *Pseudomonas* 5ml/l	102.5×10^{-5}
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	104.5×10^{-5}
Bacillus 10 ml/l	136.5×10^{-5}
Bacillus 10 ml/l and *Pseudomonas 5* ml/l	156×10^{-5}

Interaction between Rhizobacteria treatment with no treatment (controls) on the observation week 2 to week-8 shows the real effect. The more number of Rhizobacteria (double) is balanced by the higher concentration of Rhizobacteria administration, the more the number of shallots leaves. otherwise the fewer the number of Rhizobacteria (single) with a low concentration of Rhizobacteria then, the average number of leaves are also less and less. The results of the research (demonstration plot) showed that the application of Rhizobacteria was significantly different from without treatment (control).

This is in accordance with the opinion of Iswati (2012) in [13] states that the higher the concentration of Rhizobacteria administration then, is directly proportional to plant growth. it is also reinforced by the opinions Widodo, et al (2018) found concentrations Rhizobacteria suspension 15 ml / l generating plant height and leaf length is greatest in nursery of papaya.

3.3. Number of Tubers

Table 4. Average Number of tubers Plants Shallot After Application Rhizobacteria

Treatment	Number of Tubers	
Without *Pseudomonas* and *Bacillus*	8,27	a
Pseudomonas 5ml/l	8.97	ab
Pseudomonas 10 ml/l	9.87	ab
Bacillus 5ml/l	9.33	ab
Bacillus 5ml/l and *Pseudomonas* 5ml/l	9.07	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	9.67	ab
Bacillus 10 ml/l	10.73	ab
Bacillus 10 ml/l and *Pseudomonas 5* ml	9.80	ab
Without *Pseudomonas* and *Bacillus*	11.40	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 4 it can be seen that the interaction between shallot plants applied by Rhizobacteria and without treatment (control) has a significant effect on increasing the number of shallot tubers. All treatments were significantly different from those without treatment (control). This means that the bacteria are *Pseudomonas fluorencens* and *Bacillus subtillis* have been shown to increase the number of tubers on shallots .

The number of tubers were significantly different in treatment of Rhizobacteria application also positively correlated with fresh weight and dry weight of shallot tubers. This is in accordance with the results of Marom's research [13] states that the number of peanut pods per clump and dry weight of pods per hill Rhizobacteria treatment with a concentration of 12.5 ml/l differed very significantly from Rhizobacteria *10* ml/l and 7.5 ml/l. This is apparently due to the concentration of 12.5 ml/l. Rhizobacteria administration can dissolve and increase the availability of phosphorus (P) for plants for the formation of generative organs especially seed filling. Sufficient needs for phosphorus (P) can increase the yield of peanuts.

According to Despita and Budianto [6] the number of onion bulbs is directly proportional to the number of leaves. The more number of leaves, the more number of tubers. This happens because every formation of seedlings or prospective tubers is followed by the formation of new leaves. This opinion was also strengthened by Janah [10] the number of tubers is closely related to the ability of plants to produce more leaves to carry out greater photosynthetic activity so that the resulting assimilation is also greater.

3.4. Tubers Diameter

Table 5. Average Diameter Shallot Plant Tubers After Application Rhizobacteria

Treatment	Diameter Tubers	
Without *Pseudomonas* and *Bacillus*	1.61	a
Pseudomonas 5 ml/l	1.9	bcd
Pseudomonas 10 ml/l	2.02	bcd
Bacillus 5ml/l	2.26	bcd
Bacillus 5ml/l and *Pseudomonas* 5ml/l	1.89	bcd
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	1.86	bcd
Bacillus 10 ml/l	2.01	cd
Bacillus 10 ml/l and *Pseudomonas 5* ml	2.01	cd
Without *Pseudomonas* and *Bacillus*	2,31	d

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 5 it can be seen that the application of Rhizobacteria on shallot plants is significantly different from that without treatment (control) on the indicator of tuber diameter observations. All treatments have significant effect without treatment (control). This means that the bacteria *Pseudomonas fluorencens* and *Bacillus subtillis* has been shown to increase the diameter of the bulb in the shallot crop.

The size of the tuber diameter is also influenced by plant genetic factors and its growing environment. This is in accordance with the opinion of Putrasemdja and Soedomo (2007) in [4] in addition to the environment, the size of tubers is also influenced by genetic factors. If various varieties are planted on the same land, the bulbs of each variety are also different. One of the environmental factors that affect the amount of shallot are used cultivated land elevation. The height of land used for cultivation is 68 m above sea level. This is in line with the results of Anshar's research [1] that locations with an altitude of 100 m above sea level produce bulb diameter and are significantly different from the location at an altitude of 800 m above sea level, but not significantly different from the location with an altitude of 400 m above sea level.

In addition to the height of the place, the environment (land) applied by Rhizobacteria also plays a role in the enlargement of onion tubers. This is consistent with the function of Rhizobacteria consisting of Pseudomonas fluorencens and Bacillus subtillis. It is similar to the opinions Pratiwi [15] The number of bulbs of onion crop is affected because of their fitohormon in Rhizobacteria such as auxin and gibberellin.

According to Sweet and Wareing (1966) in [17] states that auxin functions to stimulate the growth of plants by means of cell elongation. While Giberellin serves to increase the growth of side meristems in leaves and inter-plant books. This is in line with opinions [15]. Giberelin also have an important role in shallot tubers. Giberelin will stimulate lateral buds and increase the number of leaves. Similar thing also expressed by the Dewi (2008) in [15] that giberelin is also involved in the regulation process of plant development. Onion layer bulbs is a modification of the leaf midrib that is tightly arranged to form tubers. In line with the opinion of Dwi djoseputro (2005) in [15] that the more leaves then, stem leaves are also increasingly making modifications leaf midrib become bulbs also will be the more.

While the research results Maskar et al (1999) in Azmi, et al (2011) that the seed tuber size does not affect vegetative growth and production components onion Local varieties Palu. However, according to Azmi [4] Although not significantly different, the diameter of tubers increases with the increasing size of the seeds used.

3.5. Fresh weight

Table 6. Average Observation of Wet Weight of Shallots after Application Rhizobacteria

Treatment	Fresh weight	
Without *Pseudomonas* and *Bacillus*	48,53	A
Pseudomonas 5ml/l	53,73	ab
Pseudomonas 10 ml/l	62.67	ab
Bacillus 5ml/l	75.47	b
Bacillus 5ml/l and *Pseudomonas* 5ml/l	58.80	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	68.00	b
Bacillus 10 ml/l	59.67	ab
Bacillus 10 ml/l and *Pseudomonas 5* ml	77.60	b
Without *Pseudomonas* and *Bacillus*	72.13	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 6 known that the application of *Rhizobacteria* the Shallot plants is significantly different from without treatment (control) on the indicator of the fresh weight of the tuber. fresh weight is the weight of tubers whiched shortly after harvest. All treatments have significant effect without treatment (control). However, BIP0 is not significantly different from B1P2, B2P1 and B2P2. This is presumably because the amount of water content similar to tubers B1P2, B2P1 and B2P2.

This is supported by the opinion of Beukema et al (2001) in [15] stated that the increase in weight of fresh tubers is affected by the amount of water absorption and accumulation of photosynthesis in the leaves for translocated to tuber formation. The difference in water content will greatly affect the weight of the wet tubers produced. Besides this, the application Rhizobacteria on shallot plants seem to increase the fertility of the soil so that the onion crop can grow and produce well. Similarly, it seems to an increase in the microbial population from giving Rhizobacteria. This is consistent with research Marom [13] that Rhizobacteria can improve the availability of P in the soil. Nutrient P functions to improve flowering, fruit formation and seed formation and can reduce fruit bumps. The presence of P available in the soil ultimately contributes to increasing fresh weight.

According to Pratiwi [15] the difference in fresh weight is inseparable from the role of the root which serves to absorb nutrients from the soil to be transported to all parts of the plant. The more and more Rhizobacteria that colonizes the roots, the more optimal the performance of the roots so that it has an impact on increasing the fresh weight of shallot tubers. Fresh weight gain is also influenced by the cell elongation process followed by cell enlargement. This process is the result of auxin hormone performance. Thus, auxin also affect the wet weight gain.

3.6. Dry weight

Table 7. Average Weight of Dry Shallots Bulbs After Rhizobacteria Application

Treatment	Dry weight	
Without *Pseudomonas* and *Bacillus*	42.73	a
Pseudomonas 5ml/l	50.00	ab
Pseudomonas 10 ml/l	52.87	ab
Bacillus 5ml/l	63.93	b
Bacillus 5ml/l and *Pseudomonas* 5ml/l	48,93	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	59.00	ab
Bacillus 10 ml/l	66.67	b
Bacillus 10 ml/l and *Pseudomonas 5* ml	49.80	ab
Without *Pseudomonas* and *Bacillus*	64.53	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Table 7 above shows that the application of Rhizobacteriaa have a significant effect on increasing the weight of dried tubers per clump. The dry weight of shallots bulbs is the weight of the tuber after being dried until it reaches the dry consumption of shallots bulbs. The achievement of the dry weight shallots consumption is marked by the collapse of the outer bulb of onion skin. The results of the analysis showed that all treatments were significantly different with no treatment (control). However, treatment of *Bacillus subtilis* with a concentration of 5ml/l (BIP0) was not significantly different from the *Bacillus subtilis* with a concentration of 10 ml/l (B2P0) and *Pseudomonas fluorencens* and *Bacillus subtillis* with the concentration of each 10ml/l (B2P2).

This is in line with the research of Irfan (2013) in [13] that Rhizobacteria application can increase the dry weight of onion tubers. This happens because Rhizobacteria is able to produce IAA (*Indole Acetic Acid*) and can be associated with plants and assist in the decomposition of organic materials in the soil so that the absorption of nutrients by plants is more perfect. The impact of this is the increased productivity of shallots.

The impact of that is increasing the productivity of onion plants. The same thing also expressed by Rahni (2012) in [10] IAA for plant hormone functions including increased cell growth, inducing flowering, stimulating root formation and increasing the activity of enzymes other so that the IAA is able to improve the quality and yields. The better the plant growth, the better fruit will be produced. Because of crop production is largely determined by the vegetative growth phase of the plant.

This statement is supported by the opinion of Gholami et al (2009) in [8] that Bacillus and Pseudomonas as the most widely studied and high potential genus Rhizobacteria as plant disease control agents. Both are able to suppress pathogens directly by removing antibiotic compounds and inducing systemic resistance in plants.

3.7. Shallot Production

Shallots production is meant in this case that the conversion of the wet weight of onion bulbs according to treatment were converted into hectares area. The average yield of fresh weight presented in Table 6 is the weight per clump. While the total population of onion plants per hectare with total area of 20 x 20 cm and the effectiveness of the land used by 80% 250,000 plants. So it could be assumed that shallot production that is obtained by multiplying the fresh weight per clump multiplied by the total population of plants per hectare. The following is a breakdown of the conversion table for shallot production presented in Table 8.

Table 8. Average Shallot Production per hectare After Rhizobacteria Application

Treatment	Average / clump (gram)	Conversion / ha (tons)
Without *Pseudomonas* and *Bacillus*	48,53	12,13
Pseudomonas 5ml/l	53,73	13.43
Pseudomonas 10 ml/l	62.67	15.66
Bacillus 5ml/l	75.47	18.86
Bacillus 5ml/l and *Pseudomonas* 5ml/l	58.80	14.70
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	68.00	17, 00
Bacillus 10 ml/l	59.67	14.91
Bacillus 10 ml/l and *Pseudomonas 5* ml	77.60	19.40
Bacillus 10 ml/l and *Pseudomonas* 10 ml/l	72.13	18.03

The potential yield of Bauji variety shallot is 18 tons / ha. If this is compared with the results of shallots given Rhizobacteria treatment, the treatment gets what is produced over the potential outcome as *Bacillus subtillis* with a concentration of 5ml/l, *Bacillus subtillis* with a concentration of 5ml/l and *Pseudomonas fluorencens* 10ml/l and *Bacillus subtillis* with a concentration of 10 ml/l and *Pseudomonas fluorencens* 10ml/l. While that has the highest average results as *Bacillus subtillis* with a concentration of 5ml/l and *Pseudomonas fluorencens* with a concentration of 10 ml/l. This is consistent with the opinion of Viveros, et al (2010) in [14] that Rhizobacteria indirectly have the ability to provide essential plant nutrients such as nitrogen, fospat, sulfur and potassium and iron ions. The availability of nutrients for plants, the growth and development of plants will increase so that it can increase yields.

4. Conclusion

Based on the observations that have been carried out showed that the increased growth Rhizobacteria production growth and shallot with *Bacillus subtillis* best treatment with a concentration of 5ml/l and *Pseudomonas fluorencens* with a concentration of 10ml/l.

5. Acknowledgements

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Increased Growth and Production of Shallot Plant (*Allium ascalonicum L*) with Application of Rhizobacteria

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Abstract

The low production of shallot plants in rainy season can decreased income of farmers. Thus, efforts should be made to increase production in the rainy season. The objective of this research was to know the growth and production of shallot to the application of rhizobacteria. This research was conducted from February to April 2018 at production center of Kediri Regency, East Java. Randomized Block Design with two factors was applied in this research. The First factor was a rhizobacteria that consisted of three levels: P0 (Without *Pseudomonas fluorescens*), P1 (Pseudomonas fluorescens with 5ml/l of concentration)and P2 (*Pseudomonas fluorescens* with 10 ml/l of concentration) and the second factor wasa rhizobacteria that consisted three levels: B0 (Without *Bacillus subtillis*), B1 (*Bacillus subtillis* with 5ml/l of concentration) and B2 (*Bacillus subtillis* with 10ml/l of concentration).The Combination treatment as nine treatments, each treatment was repeated three times to obtain 27 units of trial. Application of rhizobacteria was watered at the root with an interval of seven days. The results suggested that there were a significant difference in plant height, number of leaves, number of tubers, tuber diameter, fresh weight and dry weight of tubers between plants applied rhizobacteria and without applied rhizobacteria.

Keywords: *shallot, Rhizobacteria, Pseudomonas fluorescens and Bacillus subtillis*

1. Introduction

Indonesia is an agrarian country with a majority of people living in agriculture. Agriculture consists of several sub-sectors including the food crops sub-sector, the horticultural crops sub-sector, the forestry sub-sector, the fisheries subsector and the livestock sub-sector. One of the sub-sectors that gets the most attention from the government today is the horticulture sub-sector. Horticultural Subsector consists of vegetable plants, fruit plants, family medicinal plants and ornamental plants. Horticultural plants are the most in demand because they are profitable. In addition it can be sold directly, the plants also have a way of processing that many results were varied [2].

One of the horticultural commodities which have many benefits and high economic value and have the exciting prospect that plant shallots (*Allium ascalonicum* L). The need for consumption of shallots is still relatively high. The high demand indicates that the potential for developing shallots is still wide open, not only for domestic needs but also

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abroad [9]).

Are harvested of shallots in Indonesia in 2015 was 122.126 ha with a production of 1.229.184 tons. While the harvest area for East Java is 30.783 ha with a total production of 277.121 tons. Based on the Ministry of Agriculture's *roadmap* performance, 2018 will export 10,000 tons of shallots [5]. Shallots plants can provide high yields if followed by adequate technology, is a technology applied accordance with the nature of the commodity itself and the agro-ecosystem conditions in which these commodities are grow. Therefore, to achieve these targets is necessary to increase production and yield qualiy results shallots through intensification and extension [19].

East Java is the second largest shallots producer in Indonesia. The shallot cultivation center in East Java is scattered in several districts. One of the regencies which is the center of shallots is Kediri Regency. Plemahan Subdistrict is one sub-district in Kediri which produces shallots. Plemahan Subdistrict is about 17 km from Kediri City with a height of 68 m above sea level. The main problems experienced by farmers in the cultivation of shallots in the district of which is the low production of shallots in the rainy season and the high dose of inorganic fertilization and level of attack of pests/diseases. Shallots productivity in the rainy season only reaches around 3.5 tons/ha, while the potential yield can reach 7 tons/ha for the rainy season and 18 tons/ha for the dry season so, farmers income is decreased. During this time pest and disease control tends to use chemical pesticides [16]. The Intensive use of chemical pesticides can cause high residues in crop yields and environmental damage . The high pesticide residue in shallots causes the harvest cannot be exported, even though this export opportunity is very promising so that it can affect the increase of local farmers' income [7].

One efforts to overcome the low production in the rainy season and high use of inorganic fertilizers and chemical pesticides, it is necessary to study the application of biological agents in the form of Rhizobacteria to replace chemical pesticides. Rhizobacteria application has been proven as a potential substitute for pesticides as well as efficient nutrient uptake in plants [3].

Rhizobacteria is a bacterium that actively colonizes plant roots. Rhizobacteria has three main roles for plants is as biofertilizer, biostimulant and bioprotektan. Rhizobacteria can affect plants directly and indirectly. Directly by fixing nitrogen, dissolving phosphate, producing siderophore and growth hormone. While indirectly by improving growth conditions by suppressing the activity of pathogens that produce various compounds or metabolites such as antibiotics [22]. Rhizobacteria a beneficial bacteria that live around the roots of plants and can increase plant growth by various mechanism. The main benefits of Rhizobacteria are plant growth boosters which produce antibacterial compounds that are effective against certain plant pathogens and pests. Based on this, growth-stimulating Rhizobacteria are use as biological control agent by inducing plant resistance [3].

The rhizobacteria are also able to produce growth hormones such as IAA and dissolve P nutrient for plant [20]. Indirectly Rhizobacteria can inhibit pathogens through the synthesis of antibiotic compounds, as biological controls [21]. Other bacteria that

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can produce IAA (*Indole Acetate Acid*) are phosphate solvent bacteria such as the genera *Pseudomonas, Bacillus*, and *Cerratia* [21] . The purpose of this study was to determine the effect of the application of Rhizobacteria as an effort to boost the growth and production of shallots varieties Bauji.

2. Materials and Methods

This research was carried out in the Puhjarak Village Land, District of Plemahan, Kediri Regency. Laboratory analysis was carried out at the Biotechnology Laboratory of Agricultural Extension colleague Malang. This research activity was carried out from February to April 2018.

The materials used in this study were the shallots seeds of Bauji variety, manure, *Rhizobacteria Pseudomonas fluorescens* and *Bacillus subtillis*, planting media samples, chemicals for laboratory analysis. The tools used are scales, buckets, rulers, tools for laboratory analysis.

This research was carried out using Factorial Randomized Block Design. The first factor is the Rhizobacteria type consisting of Pseudomonas fluorescens and Bacillus subtillis. While the second factor is the concentration of Rhizobacteria application consisting of fife (5) ml/l and ten (10) ml/l. The combination of treatment was 9 treatments, each repeated three times to obtain 27 experimental units. The stages of the implementation of the study began with: selection of Bauji variety shallots seeds, making beds with a size of 200 cm x 100 cm. Each bed is given basic fertilization with 2 kg/m^2. Before planting shallots seeds given seed treatment was first done by dipping the seeds in Rhizobacteria solution. Planting uses a spacing of 20 cm x 20 cm. The application of Rhizobacteria is carried out every seven days according to the prescribed treatment. Maintenance was conducted on the activities of watering, weeding, fertilizing, pest and disease control and harvesting shallots at the age of 60 days.

Observations were made on the growth and onion yield. Observation of plant growth is carried out every seven days on plant height and number of leaf. While the observations of production using the number of tubers per plant, tuber diameter, fresh tuber weight per plant and the dry weight of tubers per plant. Observation data were analyzed using F test with 5% level and continued DMRT test.

3. Results and Discussion

3.1. Plant height Shallots

Table 1. Average of Shallot Crops After application of *Rhizobacteria*

Treatment	Sunday Observation															
	1		2		3		4		5		6		7		8	
B0P0	11,28	a	20.11	ab	28.07	ab	32.25	a	33.73	a	36,17	a	37,17	a	37.20	a
B0P1	11,64	ab	20.37	ab	27.40	ab	33.05	ab	36.07	ab	37.37	ab	38.60	ab	38.67	ab
B0P2	10.56	ab	18.97	a	26.37	a	29.79	ab	35,29	ab	37.47	ab	37.47	ab	38.47	ab
B1P0	13.00	ab	23.41	b	30,91	b	35,57	ab	38.43	ab	39.73	ab	40.87	ab	40.87	ab
B1P1	12,27	ab	21,16	ab	29.03	ab	33.05	ab	38.10	ab	38.10	ab	38,87	ab	38.90	ab
B1P2	9.81	ab	19,91	ab	29,17	ab	32.45	ab	37.07	ab	38.50	ab	39,17	ab	39.53	ab
B2P0	11.45	b	19,59	ab	27.13	ab	30.11	ab	34.47	ab	34.73	ab	35.93	ab	36.27	ab
B2P1	12,16	b	20.05	ab	26.67	ab	30.52	ab	34,22	ab	35,57	ab	35.66	ab	37.04	ab
B2P2	11.57	b	21.77	ab	28.03	ab	32.45	b	36.27	b	37.63	b	38.97	b	39.23	b

Description: The numbers followed by different letters indicate significantly different with the average growth of plants at the level of 0.05%

Table 1 shows that the Rhizobacteria application in the first observation gives a significant difference between treatment and control . This is because there is a difference between seed without treatment (Control) with seed treated. Before planting shallot seeds, first a solution *Rhizobacteria.* The function of seed immersion before planting is to stimulate plant growth and prevent the attack of plant pests when they grow. This is reinforced by the opinion of Sutariati [18] the treatment of seeds with Rhizobacteria significantly increasing germination capacity, maximum growth potential, Vigor index, growing spontaneity growth and relative growth rate. Whereas between Rhizobacteria *Pseudomonas fluorencens* and *Bacillus subtillis* which have a positive effect on the growth of chilli seeds do not give a real difference. This indicates that both types Rhizobacteria has the potential to increase vegetative growth of the plants.

The second and third observations showed that the application of Rhizobacteria in treatment B0P2 (*Pseudomonas fluorencens* 10ml/l) was not significantly different from the control, but the Rhizobacteria treatment was significantly different from the treatment B0P2 (*Pseudomonas fluorencens* 10ml/l). This is presumably because the function of Rhizobacteria which one can increase the absorption of some nutrients plants (N, P, Mn and Fe) are still not optimal. These nutrients are not fully absorbed by plants at the beginning of growth. This is in accordance with the opinion of Tambunan [19] stating that onion plants have their own food reserves to help the growth process in the early stages of growth. This explanation is reinforced by the statement Sutedjo (2001) in [19] which states that the ability of plants to absorb any nutrients for growth and development, especially in terms of the absorption of nutrients is not the same.

Observation of the 4th week until the 8th week gave a significant influence between treatment without treatment. It is presumed that the function of Rhizobacteria all run optimally so that the nutritional needs of plants be fulfilled and it is the balance in the absorption of plant nutrients. The impact of this is the increase in plant height with Rhizobacteria treatment both types of *Pseudomonas fuorencens* and *Bacillus subtillis*.

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The increase in plant height was significantly different from without Rhizobacteria treatment. The plant height ware significantly different with that of the untreated (control) is the treatment of *Pseudomonas fluorencens* and *Bacillus subtillis* with the concentration of each 10ml/l. This is consistent with the opinion of Van Look et al (1998) in [11] Rhizobacteria treatment on tomato plants capable of producing more rapid plant growth and larger.This is also supported by the results of research Khalimi [11] that Rhizobacteria can significantly increase the maximum plant height, number of branches of the maximum, the maximum number of leaves, wet and dry root weight and dry weight of soybean seeds. The same opinion was also expressed by Ningrum [14] that Rhizobacteria able to produce various growth hormones such as auxin, IAA, giberelin, cytokinin and ethylene.In addition to this Rhizobacteria is able to synthesize N, dissolve phosphate elements, and the ability to degrade and use a large number of organic and inorganic compounds that will interact with plants and associate in the rhizosphere. Based on this, Rhizobacteria used in the treatment can stimulate plant growth.

3.2. Total leaf Shallots

Table 2. Average Number of Plants Leaf Shallots after Applications Rhizobacteria

Treatment	Sunday Observation															
	1		2		3		4		5		6		7		8	
B0P0	10.07	ab	14.73	a	18,33	a	26.20	a	35.20	a	32.67	a	33.93	a	32,33	a
B0P1	11.27	ab	16.87	ab	22,13	ab	30.40	ab	37.87	ab	37.60	ab	31.80	ab	38.27	ab
B0P2	8.60	a	16.13	ab	24.53	ab	27.33	ab	41.67	ab	39.13	ab	39.53	ab	37.67	ab
B1P0	10.13	ab	15.87	ab	20.93	ab	26.60	ab	37.53	ab	39.07	ab	40.40	ab	37.07	ab
B1P1	10.40	ab	15.00	ab	20.27	ab	24.73	ab	33.67	ab	35.80	ab	37.40	ab	37.53	ab
B1P2	9.27	ac	16,20	ab	24.73	ab	31,73	ab	42.53	ab	42.53	ab	42.00	b	41.67	ab
B2P0	10.20	ab	15,33	ab	24,60	ab	28.13	ab	34.07	ab	36.47	ab	37.00	b	33,33	ab
B2P1	10.33	ab	17.27	ab	27.13	ab	29.67	ab	39.00	ab	36,33	b	37.93	b	35.80	ab
B2P2	12.47	b	20.27	b	26,53	b	35,33	b	44.80	b	43.67	b	44.20	b	43.87	b

Description: The numbers followed by different letters indicate significantly different with the average growth of plants at the level of 0.05%

Based on Table 2 can be informed that their interactions were not significantly different between treatment application Rhizobacteria without (control) at the age 7 hst or on the observation of week 1. This is apparently due in week 1 Rhizobacteria amount that colonize the roots of shallot crop is still small. This opinion is supported by the results of Listihani's [12] study that Rhizobacteria has a significant effect starting at 2 weeks after planting. This is because the second application of the treatment is done when the plant is 2 MST so that the number of Rhizobacteria that are colonized is quite large.

The longer the bacteria colonize the root surface, the higher the ability of Rhizobacteria to stimulate plant growth and increase its protective power from pathogenic microbes. This relates to the protection of the roots of plant pathogenic microbes. The bacteria *Pseudomonas fluorencens* and *Bacillus subtillis* able to spur the growth and yield of antibiotic in crop cultivation. The opinion was strengthened by the results of counting the number of bacterial colonies in soil samples after harvest. Data from these calculations are shown in Table 3.

Table 3. Number of bacterial colonies

Treatment	Number of Colonies
Without *Pseudomonas* and *Bacillus*	47×10^{-5}
Pseudomonas 5ml/l	34.5×10^{-5}
Pseudomonas 10 ml / liter	72×10^{-5}
Bacillus 5ml/l	77×10^{-5}
Bacillus 5ml/l and *Pseudomonas* 5ml/l	102.5×10^{-5}
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	104.5×10^{-5}
Bacillus 10 ml/l	136.5×10^{-5}
Bacillus 10 ml/l and *Pseudomonas 5* ml/l	156×10^{-5}

Interaction between Rhizobacteria treatment with no treatment (controls) on the observation week 2 to week-8 shows the real effect. The more number of Rhizobacteria (double) is balanced by the higher concentration of Rhizobacteria administration, the more the number of shallots leaves. otherwise the fewer the number of Rhizobacteria (single) with a low concentration of Rhizobacteria then, the average number of leaves are also less and less. The results of the research (demonstration plot) showed that the application of Rhizobacteria was significantly different from without treatment (control).

This is in accordance with the opinion of Iswati (2012) in [13] states that the higher the concentration of Rhizobacteria administration then, is directly proportional to plant growth. it is also reinforced by the opinions Widodo, et al (2018) found concentrations Rhizobacteria suspension 15 ml / l generating plant height and leaf length is greatest in nursery of papaya.

3.3. Number of Tubers

Table 4. Average Number of tubers Plants Shallot After Application Rhizobacteria

Treatment	Number of Tubers	
Without *Pseudomonas* and *Bacillus*	8,27	a
Pseudomonas 5ml/l	8.97	ab
Pseudomonas 10 ml/l	9.87	ab
Bacillus 5ml/l	9.33	ab
Bacillus 5ml/l and *Pseudomonas* 5ml/l	9.07	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	9.67	ab
Bacillus 10 ml/l	10.73	ab
Bacillus 10 ml/l and *Pseudomonas 5* ml	9.80	ab
Without *Pseudomonas* and *Bacillus*	11.40	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 4 it can be seen that the interaction between shallot plants applied by Rhizobacteria and without treatment (control) has a significant effect on increasing the number of shallot tubers. All treatments were significantly different from those without treatment (control). This means that the bacteria are *Pseudomonas fluorencens* and *Bacillus subtillis* have been shown to increase the number of tubers on shallots .

The number of tubers were significantly different in treatment of Rhizobacteria application also positively correlated with fresh weight and dry weight of shallot tubers. This is in accordance with the results of Marom's research [13] states that the number of peanut pods per clump and dry weight of pods per hill Rhizobacteria treatment with a concentration of 12.5 ml/l differed very significantly from Rhizobacteria *10* ml/l and 7.5 ml/l. This is apparently due to the concentration of 12.5 ml/l. Rhizobacteria administration can dissolve and increase the availability of phosphorus (P) for plants for the formation of generative organs especially seed filling. Sufficient needs for phosphorus (P) can increase the yield of peanuts.

According to Despita and Budianto [6] the number of onion bulbs is directly proportional to the number of leaves. The more number of leaves, the more number of tubers. This happens because every formation of seedlings or prospective tubers is followed by the formation of new leaves. This opinion was also strengthened by Janah [10] the number of tubers is closely related to the ability of plants to produce more leaves to carry out greater photosynthetic activity so that the resulting assimilation is also greater.

3.4. Tubers Diameter

Table 5. Average Diameter Shallot Plant Tubers After Application Rhizobacteria

Treatment	Diameter Tubers	
Without *Pseudomonas* and *Bacillus*	1.61	a
Pseudomonas 5 ml/l	1.9	bcd
Pseudomonas 10 ml/l	2.02	bcd
Bacillus 5ml/l	2.26	bcd
Bacillus 5ml/l and *Pseudomonas* 5ml/l	1.89	bcd
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	1.86	bcd
Bacillus 10 ml/l	2.01	cd
Bacillus 10 ml/l and *Pseudomonas 5* ml	2.01	cd
Without *Pseudomonas* and *Bacillus*	2,31	d

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 5 it can be seen that the application of Rhizobacteria on shallot plants is significantly different from that without treatment (control) on the indicator of tuber diameter observations. All treatments have significant effect without treatment (control). This means that the bacteria *Pseudomonas fluorencens* and *Bacillus subtillis* has been shown to increase the diameter of the bulb in the shallot crop.

The size of the tuber diameter is also influenced by plant genetic factors and its growing environment. This is in accordance with the opinion of Putrasemdja and Soedomo (2007) in [4] in addition to the environment, the size of tubers is also influenced by genetic factors. If various varieties are planted on the same land, the bulbs of each variety are also different. One of the environmental factors that affect the amount of shallot are used cultivated land elevation. The height of land used for cultivation is 68 m above sea level. This is in line with the results of Anshar's research [1] that locations with an altitude of 100 m above sea level produce bulb diameter and are significantly different from the location at an altitude of 800 m above sea level, but not significantly different from the location with an altitude of 400 m above sea level.

In addition to the height of the place, the environment (land) applied by Rhizobacteria also plays a role in the enlargement of onion tubers. This is consistent with the function of Rhizobacteria consisting of Pseudomonas fluorencens and Bacillus subtillis. It is similar to the opinions Pratiwi [15] The number of bulbs of onion crop is affected because of their fitohormon in Rhizobacteria such as auxin and gibberellin.

According to Sweet and Wareing (1966) in [17] states that auxin functions to stimulate the growth of plants by means of cell elongation. While Giberellin serves to increase the growth of side meristems in leaves and inter-plant books. This is in line with opinions [15]. Giberelin also have an important role in shallot tubers. Giberelin will stimulate lateral buds and increase the number of leaves. Similar thing also expressed by the Dewi (2008) in [15] that giberelin is also involved in the regulation process of plant development. Onion layer bulbs is a modification of the leaf midrib that is tightly arranged to form tubers. In line with the opinion of Dwi djoseputro (2005) in [15] that the more leaves then, stem leaves are also increasingly making modifications leaf midrib become bulbs also will be the more.

While the research results Maskar et al (1999) in Azmi, et al (2011) that the seed tuber size does not affect vegetative growth and production components onion Local varieties Palu. However, according to Azmi [4] Although not significantly different, the diameter of tubers increases with the increasing size of the seeds used.

3.5. Fresh weight

Table 6. Average Observation of Wet Weight of Shallots after Application Rhizobacteria

Treatment	Fresh weight	
Without *Pseudomonas* and *Bacillus*	48,53	A
Pseudomonas 5ml/l	53,73	ab
Pseudomonas 10 ml/l	62.67	ab
Bacillus 5ml/l	75.47	b
Bacillus 5ml/l and *Pseudomonas* 5ml/l	58.80	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	68.00	b
Bacillus 10 ml/l	59.67	ab
Bacillus 10 ml/l and *Pseudomonas 5* ml	77.60	b
Without *Pseudomonas* and *Bacillus*	72.13	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Based on Table 6 known that the application of *Rhizobacteria* the Shallot plants is significantly different from without treatment (control) on the indicator of the fresh weight of the tuber. fresh weight is the weight of tubers whiched shortly after harvest. All treatments have significant effect without treatment (control). However, BIP0 is not significantly different from B1P2, B2P1 and B2P2. This is presumably because the amount of water content similar to tubers B1P2, B2P1 and B2P2.

This is supported by the opinion of Beukema et al (2001) in [15] stated that the increase in weight of fresh tubers is affected by the amount of water absorption and accumulation of photosynthesis in the leaves for translocated to tuber formation. The difference in water content will greatly affect the weight of the wet tubers produced. Besides this, the application Rhizobacteria on shallot plants seem to increase the fertility of the soil so that the onion crop can grow and produce well. Similarly, it seems to an increase in the microbial population from giving Rhizobacteria. This is consistent with research Marom [13] that Rhizobacteria can improve the availability of P in the soil. Nutrient P functions to improve flowering, fruit formation and seed formation and can reduce fruit bumps. The presence of P available in the soil ultimately contributes to increasing fresh weight.

According to Pratiwi [15] the difference in fresh weight is inseparable from the role of the root which serves to absorb nutrients from the soil to be transported to all parts of the plant. The more and more Rhizobacteria that colonizes the roots, the more optimal the performance of the roots so that it has an impact on increasing the fresh weight of shallot tubers. Fresh weight gain is also influenced by the cell elongation process followed by cell enlargement. This process is the result of auxin hormone performance. Thus, auxin also affect the wet weight gain.

3.6. Dry weight

Table 7. Average Weight of Dry Shallots Bulbs After Rhizobacteria Application

Treatment	Dry weight	
Without *Pseudomonas* and *Bacillus*	42.73	a
Pseudomonas 5ml/l	50.00	ab
Pseudomonas 10 ml/l	52.87	ab
Bacillus 5ml/l	63.93	b
Bacillus 5ml/l and *Pseudomonas* 5ml/l	48,93	ab
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	59.00	ab
Bacillus 10 ml/l	66.67	b
Bacillus 10 ml/l and *Pseudomonas 5* ml	49.80	ab
Without *Pseudomonas* and *Bacillus*	64.53	b

Description: The numbers followed by different letters indicate significantly different with the average result of plants at the level of 0.05%

Table 7 above shows that the application of Rhizobacteriaa have a significant effect on increasing the weight of dried tubers per clump. The dry weight of shallots bulbs is the weight of the tuber after being dried until it reaches the dry consumption of shallots bulbs. The achievement of the dry weight shallots consumption is marked by the collapse of the outer bulb of onion skin. The results of the analysis showed that all treatments were significantly different with no treatment (control). However, treatment of *Bacillus subtilis* with a concentration of 5ml/l (BIP0) was not significantly different from the *Bacillus subtilis* with a concentration of 10 ml/l (B2P0) and *Pseudomonas fluorencens* and *Bacillus subtillis* with the concentration of each 10ml/l (B2P2).

This is in line with the research of Irfan (2013) in [13] that Rhizobacteria application can increase the dry weight of onion tubers. This happens because Rhizobacteria is able to produce IAA (*Indole Acetic Acid*) and can be associated with plants and assist in the decomposition of organic materials in the soil so that the absorption of nutrients by plants is more perfect. The impact of this is the increased productivity of shallots.

The impact of that is increasing the productivity of onion plants. The same thing also expressed by Rahni (2012) in [10] IAA for plant hormone functions including increased cell growth, inducing flowering, stimulating root formation and increasing the activity of enzymes other so that the IAA is able to improve the quality and yields. The better the plant growth, the better fruit will be produced. Because of crop production is largely determined by the vegetative growth phase of the plant.

This statement is supported by the opinion of Gholami et al (2009) in [8] that Bacillus and Pseudomonas as the most widely studied and high potential genus Rhizobacteria as plant disease control agents. Both are able to suppress pathogens directly by removing antibiotic compounds and inducing systemic resistance in plants.

3.7. Shallot Production

Shallots production is meant in this case that the conversion of the wet weight of onion bulbs according to treatment were converted into hectares area. The average yield of fresh weight presented in Table 6 is the weight per clump. While the total population of onion plants per hectare with total area of 20 x 20 cm and the effectiveness of the land used by 80% 250,000 plants. So it could be assumed that shallot production that is obtained by multiplying the fresh weight per clump multiplied by the total population of plants per hectare. The following is a breakdown of the conversion table for shallot production presented in Table 8.

Table 8. Average Shallot Production per hectare After Rhizobacteria Application

Treatment	Average / clump (gram)	Conversion / ha (tons)
Without *Pseudomonas* and *Bacillus*	48,53	12,13
Pseudomonas 5ml/l	53,73	13.43
Pseudomonas 10 ml/l	62.67	15.66
Bacillus 5ml/l	75.47	18.86
Bacillus 5ml/l and *Pseudomonas* 5ml/l	58.80	14.70
Bacillus and 5ml/l *Pseudomonas* 10 ml/l	68.00	17, 00
Bacillus 10 ml/l	59.67	14.91
Bacillus 10 ml/l and *Pseudomonas 5* ml	77.60	19.40
Bacillus 10 ml/l and *Pseudomonas* 10 ml/l	72.13	18.03

The potential yield of Bauji variety shallot is 18 tons / ha. If this is compared with the results of shallots given Rhizobacteria treatment, the treatment gets what is produced over the potential outcome as *Bacillus subtillis* with a concentration of 5ml/l, *Bacillus subtillis* with a concentration of 5ml/l and *Pseudomonas fluorencens* 10ml/l and *Bacillus subtillis* with a concentration of 10 ml/l and *Pseudomonas fluorencens* 10ml/l. While that has the highest average results as *Bacillus subtillis* with a concentration of 5ml/l and *Pseudomonas fluorencens* with a concentration of 10 ml/l. This is consistent with the opinion of Viveros, et al (2010) in [14] that Rhizobacteria indirectly have the ability to provide essential plant nutrients such as nitrogen, fospat, sulfur and potassium and iron ions. The availability of nutrients for plants, the growth and development of plants will increase so that it can increase yields.

4. Conclusion

Based on the observations that have been carried out showed that the increased growth Rhizobacteria production growth and shallot with *Bacillus subtillis* best treatment with a concentration of 5ml/l and *Pseudomonas fluorencens* with a concentration of 10ml/l.

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6. References

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