



Science

UTILIZATION OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) IN DISEASE CONTROL IMPORTANT IN PLANTS ONION (ALLIUM ASCALONICUM L.)

Francisco Fernandes ^{*1}, Abdul Latief Abadi ², Luqman Qurata Aini ²

^{*1} Graduate School, Faculty of Agricultural, University of Brawijaya, Malang, Indonesia

² Lecturer, Agricultural, University of Brawijaya, Malang, Indonesia

Abstract

Red onion (*Allium ascalonicum* L.) is one of many horticultural crops consumed by humans as a mixture of spices. For household consumption of about 635 700 tonnes, non-household consumption such as the manufacturing industry amounted to 719 200 tonnes, the sum total of 1.35 million meaning that the deficit for the onion. The purpose of this study was to gain insight about PGPR in increasing the growth and yield of onion, PGPR role in controlling the disease in onions, PGPR concentration in controlling the disease in onions and certain PGPR concentration in the application to control diseases in onion. Using a randomized block design (RAK) factorial 5 x 3 and repeated 3 times. The first factor is the concentration of PGPR with 5 levels ie: p0 (control), P1 (5 ml / liter of water / 2 plants), P2 (10 ml / liter of water / 2 plants), P3 (15 ml / liter of water / 2 plants) and P4 (20 ml / liter of water / 2 plants) and the second factor is the interval provision of PGPR with 3 levels namely: I1 (1 week, 1 x application until the age of 60 days, I2 (2 weeks, 1 x application until the age of 60 day) and I3 (3 weeks, 1 x application until the age of 60 days). the results showed that the onion crop by PGPR could increase plant height (21, 67 cm), number of leaves (32.70 cm), the number of tubers per plant (17.69 g), the wet weight of tuber per plot highs (3460.00 g) and dry weight of tuber per plot (3010.20 g). the provision of PGPR can control fusarium wilt on the red onion. the higher concentration of PGPR with intervals of 3 weeks administration can suppress disease. fusarium wilt PGPR concentration of 20 ml/liter of water with intervals of 3 weeks administration can suppress disease attacks fusarium wilt the lowest (5.22%).

Keywords: PGPR; Diseases of the Onion.

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1. Introduction

Red Onion (*Alliums calonicum* L.) is one of many horticultural crops consumed by humans as a mixture of spices. As seasoning shallots are also sold in the form of processed products such as extracts of onion, powder, essential oils, fried onions even as medicine for lowering cholesterol, blood sugar, prevent blood clots, lower blood pressure and improving blood flow (Istina, 2016) , As many horticultural commodities consumed by the public, the potential for the development of the onion is still wide open not only for the domestic but also overseas (Suriani, 2012).

In 2013, although the national production of onion has been excessive (Rusono *et al.*, 2013), but productivity is still low (10:22 tons/ha) compared to the potential that they may reach up to 20 tonnes/hectare, in 2015 productivity is still low 10.60 ton ha (BPS 2014). In general, red onion suitable to be planted in the lowlands and some are cultivated in the highlands. The Central Statistics Agency (BPS) recorded production of horticultural crops of onions throughout 2014-2016, red onion for household consumption of about 635 700 tonnes, non-household consumption such as the manufacturing industry amounted to 719 200 tonnes, the sum total of 1.35 million meaning that the deficit for the onion.

Diseases that normally occur in onion plants including root rot disease caused by *Fusarium oxysporum* f. sp. *Cepae*, anthracnose diseases caused by fungi *Colletotrichum gloeosporioides* and purple or total spot disease caused by the fungus *Alternaria* pores. The third attack this disease usually at the age of 0-35 HST (Isniah and Widodo, 2015).

Control of the disease in onion plants caused by the fungus, *Fusarium* mildew *Colletotrichum gloeosporioides*, and fungus *Alternaria* porri, it is generally recommended is a physical or chemical treatment and the use of resistant varieties. Some resistant varieties are already known to be an alternative to the control of this disease in Iran (Esfahani *et al.*, 2012). Chemically, the use of sodium fluoride and sodium metabisulfite can suppress the development of pathogens by treatment of the embedding medium (Turkkan and Erper, 2014).

PGPR is an aggressive group of beneficial bacteria menkolonisasi rhizosphere. Activities PGPR benefit for plant growth because of its ability to provide and mobilize or facilitate the absorption of various nutrients in the soil as well as synthesize and changing the concentration of various fitohormon spur growth and can suppress the activity of a pathogen by producing various compounds or metabolites such as antibiotics and siderophore (Rosyidah *et al.*, 2013). Choiruddin. (2010), indicates that the application of the formulation rhizobacteria indigenous on the seed followed at ages 2 and 4 WAP effectively control fusarium wilt more than 60% and increase the production of tomato plants.

2. Materials and Methods

This study was conducted from August to October 2017, located in the garden farmer in the village Donowarih Karangploso subdistrict, Malang, East Java, Indonesia. The village is geographically located on the plains Donowarih medium with an altitude of \pm 700 m above sea level and the average temperature - average at 22°C.

2.1. Samples

The material used in this study include red onion seed tuber varieties Kramat 1, PGPR, organic fertilizers (chicken manure), manure namely inorganic fertilizer P (SP-36) with a dose of 200-250 kg / ha (70-90 kg P₂O₅ / ha, as much as 150-200 kg N / ha and K as much as 50-100 kg K₂O / ha or 100-200 kg of KCl / ha.

2.2. Research Design

This study used a randomized block design (RAK) factorial 5 x 3 and repeated 3 times. the first factor is the concentration of PGPR with 5 levels ie: P0 (control), P1 (5 ml / liter of water), P2 (10 ml / liter of water), P3 (15 ml / liter of water) and P4 (20 ml / liter of water) and the second factor is the interval provision of PGPR with 3 levels namely: I1 (1 week, I2 (2 weeks,) and I3 (3 weeks).

2.3. Statistical Analysis

The analysis of data was facilitated by the 2010 version of Microsoft Excel using analysis of variance (F-test with a 5% standard error) Followed by a least significant difference (LSD) approach.

3. Results and Discussion

3.1. Results

Treatment concentration of PGPR with intervals of administration showing the interaction of the high (Table 1), the number of leaves (Table 2), the results of onion bulbs per panicle (Figure 1), the wet weight of tuber per plot (Figure 2), Weight dried tubers per plot (Figure 3), under a red bulb Results per hectare (Figure 4), attack percentage Disease *FusariumI Wilt* (Figure 5).

Table 1: High Concentration Treatment Plant Onions Due PGPR By Giving Time Interval At Age 4 WAP, 6 WAP, 8 WAP and 10 WAP.

Perlakuan	Tinggi Tanaman (cm)			
	4 WAP	6 WAP	8 WAP	10 WAP
P0I1	17,44 b	26,01 a	29,06 b	29,74 bc
P0I2	18,17cde	27,40 c	30,63 fg	30,77 efg
P0I3	16,38 a	30,22 ijk	32,82 no	32,88 m
P1I1	19,88 hi	26,70 b	28,31 a	28,35 a
P1I2	18,61 fg	28,29 e	30,19 ef	30,21 d
P1I3	18,57 efg	30,28 jk	32,00 klm	32,15 jkl
P2I1	20,41 ijklm	28,24 de	29,89 de	29,92 cd
P2I2	19,00 g	29,92 ghij	31,52 hij	31,57 hi
P2I3	18,35 de	30,42 k	32,44 mn	32,50 lm
P3I1	20,81 jklmn	29,75 efg	30,79 g	30,86 fg
P3I2	20,99 mno	30,93 l	31,70 jk	31,72 ij
P3I3	20,92 imno	31,31 mn	32,33 lm	32,40 kl

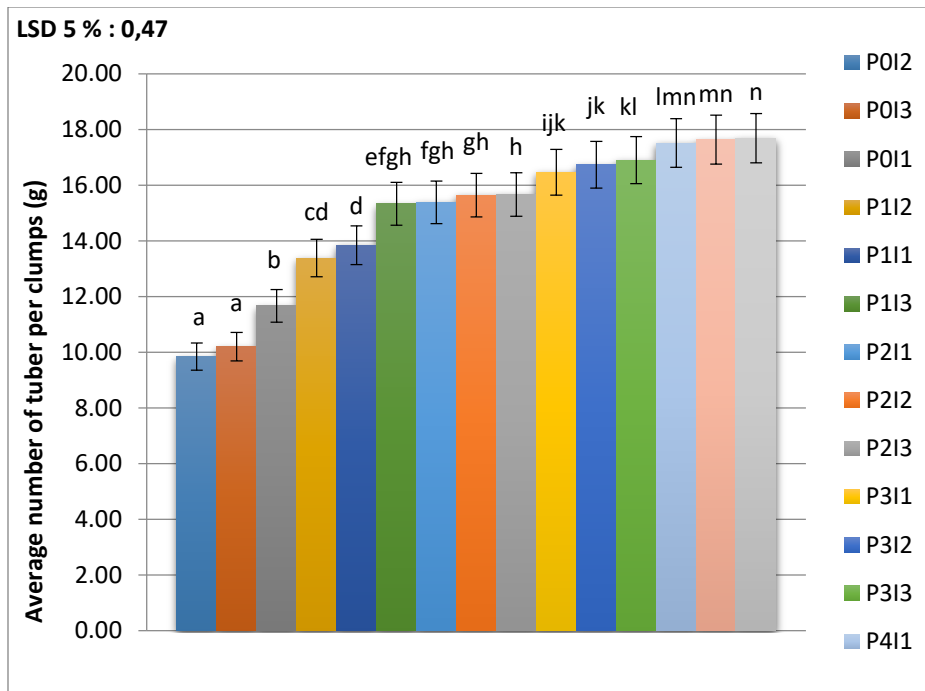
P4I1	20,82 klmno	29,95 hij	29,80 cde	31,02 g
P4I2	21,38 no	31,67 no	31,53 ij	33,65 n
P4I3	21,67 o	32,95 o	32,86 o	34,74 o
LSD	0,58	0,45	0,46	0,46

Description: Numbers are accompanied by the same letters in the same column are not significantly different shows based on LSD 5%; cm = centimeter, WAP = weeks after planting. P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Table 2: Number of Leek Due PGPR concentration Treatment With Giving Time Interval At Age 4 WAP, WAP 6, 8 and 10 WAP WAP.

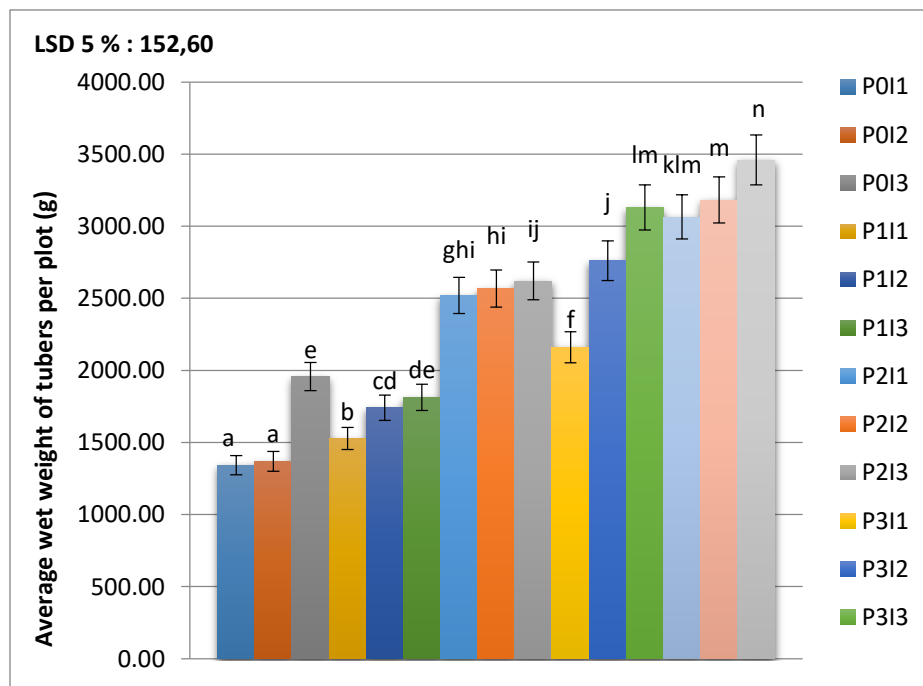
Perlakuan	Jumlah Daun (helai)			
	4 WAP	6 WAP	8 WAP	10 WAP
P0I1	21,92 a	30,59 a	35,26 bc	35,29 a
P0I2	21,74 a	31,72 bc	36,0c c	36,72 bc
P0I3	22,05 a	32,00 cde	37,00 de	37,57 de
P1I1	22,62 a	30,28 a	33,95 a	34,65 a
P1I2	22,18 a	32,51 e	37,85 f	38,02 e
P1I3	22,82 a	34,49 ij	40,42 klm	40,50 ijk
P2I1	24,67 bc	32,33 de	37,33 ef	37,43 cde
P2I2	24,90 c	34,90 jk	38,90 ghi	39,13 fgh
P2I3	26,56 de	35,56 lm	40,92 mn	41,54 mn
P3I1	26,67 ef	33,67 g	39,00 hi	39,57 gh
P3I2	27,87 g	33,54 fg	39,54 ij	39,89 hijk
P3I3	32,51 i	35,85 mn	40,58 lmn	40,65 kl
P4I1	27,77 fg	34,44 hij	40,10 jklm	40,52 jk
P4I2	29,92 h	35,26 klm	41,26 no	41,33 lmn
P4I3	32,70 j	36,36 n	42,03 o	42,07 n
LSD	1,10	0,61	0,83	0,78

Description: Numbers are accompanied by the same letters in the same column are not significantly different shows based on test BNT 5%; WAP = weeks after planting. P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.



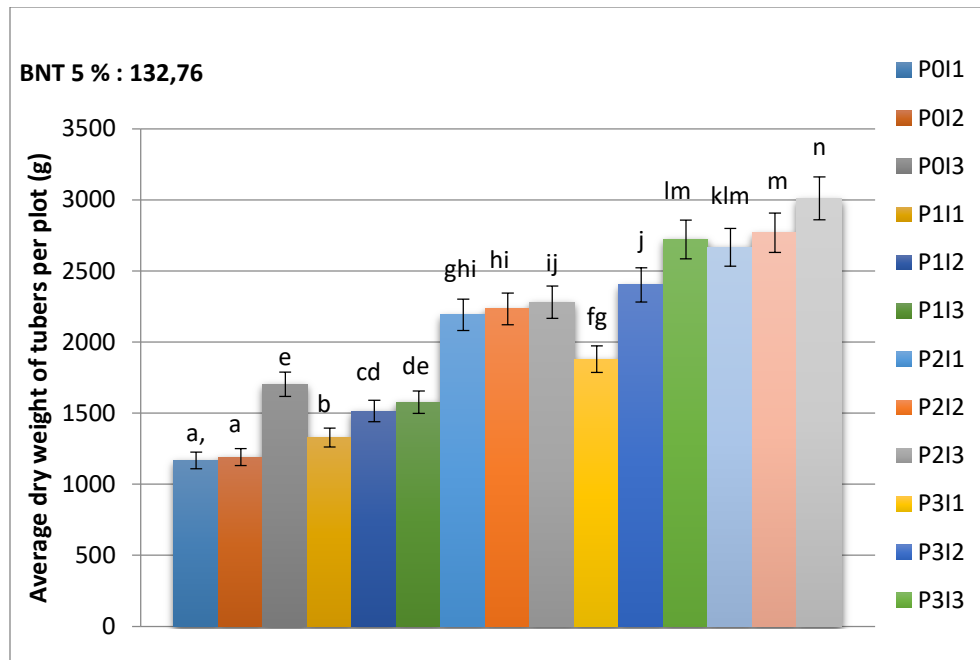
Description: P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Figure 1: Results of onion bulbs per panicle



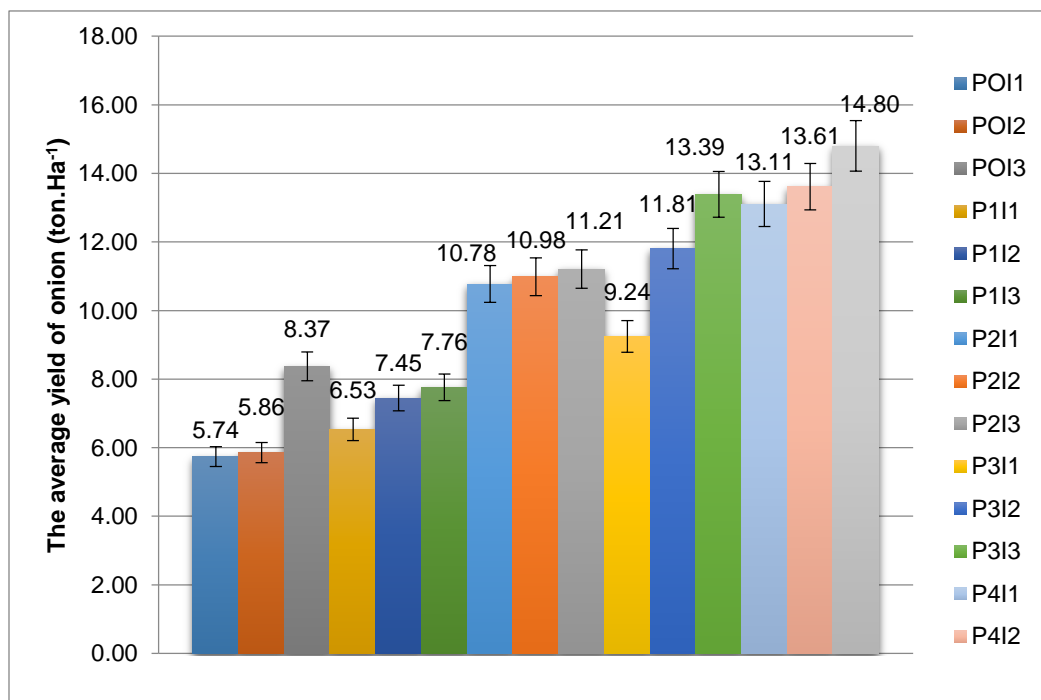
Description: P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Figure 2: Weight Wet tubers per plot



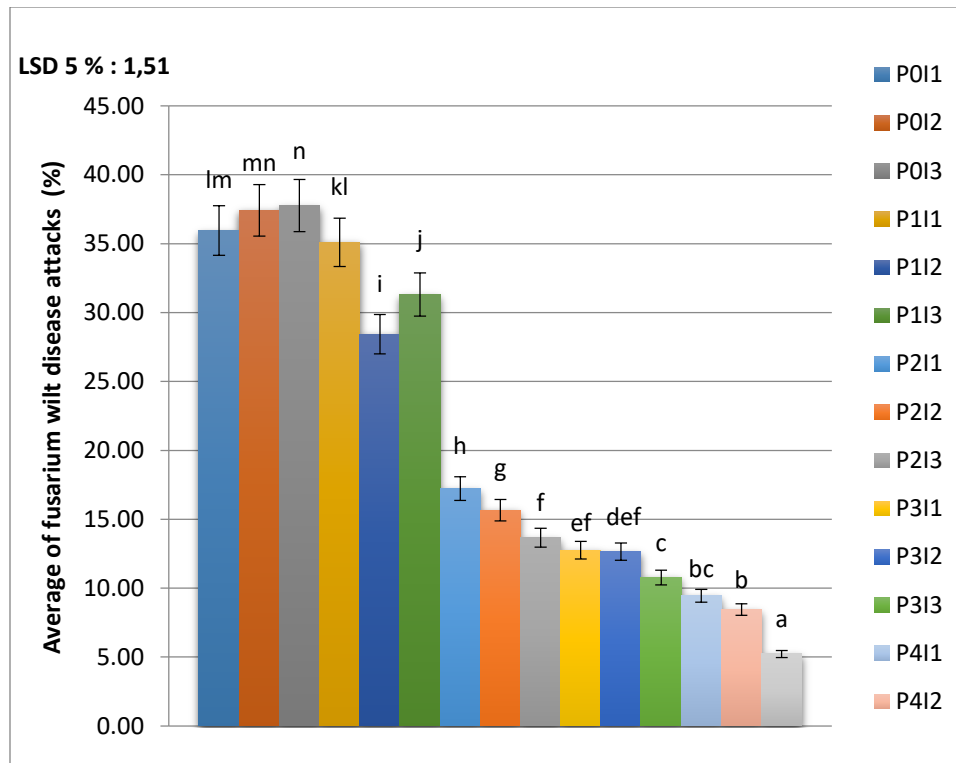
Description: P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Figure 3: Dry Weight Per plot Bulbs



Description: P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Figure 4: Results Bulbs Per Hectare



Description: P0 = control; P1 = 5 ml / l; P2 = 10 ml / l; P3 = 15 ml / l; P4 = 20 ml / l; I1 = one application once a week; I2 = Two weeks once application; I3 = Three weeks once application.

Figure 5: Percentage of disease attacks *Fusarium wilt*

4. Discussion

Plant growth process is controlled by two factors, namely internal factors (genetic and hormonal) and external factors (environmental grow plants). Growth onion plants have responded differently to PGPR concentration and administration time interval. It is suspected that genetic factors as well as the amount of PGPR concentration and administration time interval spur plant growth components higher than without the provision of PGPR. Wachjadi (2013) states that genetic factors are more dominant on the characters displayed plant for genetic factors contribute greater than environmental factors. Plants that have a high genetic diversity will greatly help a population to adapt to the changes occurring in the surrounding environment (Lehar, 2012). Giving PGPR directly into the soil allegedly capable Pendergrass organic matter in the soil at the same time the organic material becomes food for microorganisms to reproduce themselves. Lehar *et al.*, (2016) state that plants treated with PGPR which there are biological agents *T.viride*, *P.fluorescens*, and *Streptomyces sp.* is able to decompose lignin, cellulose, and kithin of organic materials into food and provide nutrients are ready to be absorbed by plants. The organic material by microorganisms able to reproduce itself in accordance with the conditions of the organic material. This is in line by Lehar opinion, (2012) states that biological agents are given to organic fertilizer will be able to act as decomposers of organic matter and reproduce itself in such organic materials as well as providing nutrients to support plant growth.

Giving PGPR function as decomposers of organic material and PGPR is able to stimulate the growth of the root system of plants and fungi hamper harmful bacteria. Lehar *et al.*, (2016) and Rosyida *et al.*, (2013) stated that the decomposed organic matter biological agents *T. viride* and combined with *P. fluorescent* and *Streptomyces* sp, as well as PGPR is able to stimulate high, the number of stems, number of leaves and leaf area plant. Ningrum *et al.*, (2017) and Hollywood and Nehra (2011) suggested that the administration of PGPR on plant capable of replacing chemical fertilizers, pesticides and hormones that can be used in plant growth so as to increase, plant height, root length and dry weight of plants.

PGPR Award allegedly capable mengkloni per Karan plant roots so that the plant can absorb nutrients freely available that tersedi soil. Ningrum *et al.*, (2017) stated that the administration of active PGPR colonize plant roots by having three main roles for the plant is as biofertilizer, biostimulant, and bioprotectants. PGPR is able to function properly if the availability sufficient organic matter as nutrients for PGPR so that the microorganisms in the PGPR is able to survive in the rhizosphere environment and perform its functions (Widyati, 2013). Giving PGPR can increase metabolic processes in the body of the plant, in line with the opinion of Saharan and Nehra (2011) which states that the metabolic processes in the plant body to function normally when microorganisms in PGPR can multiply inorganic materials and the availability of enough nutrients thereby affecting the process of photosynthesis and respiration.

Wet weight of tuber per plot highest in P4I3 treatment and the lowest for the treatment or there is a difference P0I1 2117.67 g. The high plant fresh weight per plot on P4I3 treatment allegedly because the role of PGPR to stimulate plant growth besides being able to suppress the pathogen. Gholami (2009) Declare that the granting of PGPR produces siderophores, antimicrobial compounds, and growth hormones, so as to stimulate plant growth. The granting of PGPR is able to improve plant growth and increase the weight of the wet and dry weight of plants and weight of tubers per hectare. This is in line with the results of the research of Mary (2010) which showed that PGPR generally can produce pepper fruit weight and weight per hectare which is higher than that of the untreated PGPR pepper plants. Khalimi and Gnass (2009) states that the granting of significantly PGPR is able to increase the maximum plant height, number of branches of the maximum, the maximum number of leaves, fresh weight and dry weight of plant seeds and soybeans.

Plants that colonize the microorganisms present in the PGPR antagonistic against a pathogen can induce resistance response in plants. PGPR generally have a system response resistance in plants because it can produce some of the phenols which can be used to produce pathogen so as to provide a plant's immune to a disease (Rosyida *et al.*, (2013). This is consistent with the results of the study (Susanto *et al.*, 2013; Susanto *et al.*, 2012; Sari *et al.*, 2012; Chamzurni *et al.*, 2011; Alfizar *et al.*, 2011; Susanto *et al.*, 2010) which states that the biological agent is able to suppress the pathogen so that plants can grow and develop without the attack of pathogens and as a producer of growth hormone or known as plant growth Promoting Rhizobacteria (PGPR), which can stimulate the growth of plants.

According to Wachjadi *et al.*, (2013) stated that the content of phenolic compounds in plants is directly related to the level of plant resistance to infectious disease. Granting that PGPR contained in the biological agents *T. viride* and combined with *P. fluorescent* and *Streptomyces*

sp able to control the disease fusarium wilt and *Ralstoniasolanacearum*, it is supported by the opinion Lehar *et al.*, (2016), Hidayat *et al.*, (2013) and Suprpta, (2012) which states that the granting of PGPR which there are biological agents biological agents *P. fluorescence* capable of controlling the disease fusarium wilt and *Ralstonia solanacearum* and other pathogenic fungi in potato plants. The results showed that the application of PGPR can reduce the intensity of the disease curling up to 61.20% and the intensity of *P. capsici* can be reduced to 47.79% (Mustikawati, 2014).

HCN compounds are secondary metabolites, which are generally produced by the bacterium *P. fluorescens* and toxic to the fungal pathogen (Lehar *et al.* 2016). PGPR indication of the mechanism of action to support plant growth is at the time of the strains of bacteria promoting growth indirectly by altering the balance of microbes in the rhizosphere. HCN, antibiotic compounds, chelating siderophores produced by some PGPR Feyang associated with its ability to reduce plant pathogens and toxic rhizobacteria (Salamiah and Wahdah, 2015). PGPR utilized in life processes of bacteria and as a support in doing activities that suppress the growth of pathogenic bacteria that attack plants (Diarta *et al.*, 2016; Febriyanti *et al.*, 2015; Hidayat *et al.*, 2013; Ashrafuzzaman, 2009).

5. Conclusion

onion plants by PGPR could increase plant height (21.67 cm), number of leaves (32.70), the number of tubers per hill (17.69 g), the wet weight of tuber per plot highs (3460.00 g) and dry weight of tuber per plot (3010.20 g) Results of tuber per hectare (14.80ton.Ha.1). Giving PGPR can control fusarium wilt on red onions. The higher concentration of PGPR with intervals of 3 weeks administration can suppress disease. Fusarium wilt PGPR concentration of 20 ml/liter of water with intervals of 3 weeks administration can suppress disease attacks fusarium wilt the lowest (5.22%).

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*Corresponding author.

E-mail address: laurensiusl@ yahoo.co.id