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Role of biological agents *Trichoderma* sp. at growth three garlic varieties (*Allium sativum*)

S Yani^{1,*}, T Opik^{1,2}, N Belinda¹ and P Epa¹

¹ Department of Biology, Faculty of Science and Technology, UIN Sunan Gunung Djati, Bandung, Jl. AH. Nasution No. 105 Bandung, Indonesia

² Department of healthy Analys, Sekolah Tinggi Analisis Bakti Asih, Jl Padasuka No 233 Bandung, Indonesia

*yani.suryani@uinsgd.ac.id

Abstract. Recently, the national garlic productivity is very low because of pathogens, especially fungi. Efforts can be made to increase the productivity of garlic through the reduction and prevention of pathogenic attacks by using biological control agents. Microorganisms are one of the best biological agents. One type of microorganism is *Trichoderma* sp. This research was conducted at the Plant and Vegetable Research Institute (BALITSA) Bandung. The experimental design used was a completely randomized design with the type of treatment of garlic varieties. The varieties consist of varieties 1, 2 and 3. The parameters of the observations carried out in this study were the growth rate of garlic which included garlic height, root length and tuber garlic weight. *Trichoderma* sp. the optimal role is to increase the high rate of garlic plants by 0.8%, increase root length by 9 - 23%, and increase the weight of tuber weight by 21 - 51%.

1. Introduction

Garlic (*Allium sativum*) is a seasoned herbaceous plant that has a plant height of 60 cm. Usually these garlic plants are planted in areas that have sufficient sunlight such as highland or mountainous regions [1]. The types of garlic that are widely grown in Indonesia are green spices, yellow spices and white spices. These three varieties are known to be superior. Other garlic varieties are modified varieties of the three varieties and the onion varieties are then given the name of the area of planting, including lanang onion varieties, sanur onion varieties, bagor varieties, onion varieties, Cirebon onion varieties, onion varieties and so on. In Indonesia garlic is an ingredient that is always needed, usually used as a kitchen spice, although not a few use it as medicine.

At present the national garlic productivity is very low, this is indicated by only 5% of national white bottom needs that can be fulfilled by national garlic farmers, to cover the lack of Indonesia 23 imported ributons of garlic [2]. One of the main causes of low national garlic productivity is the presence of pathogenic attacks on garlic mainly by fungi such as wilt (*Fusarium oxysporum*), leaf spot (*Cercospora duddiae*), late blight (*Peronospora destructor*) and high number of weeds that reach 80% [3]. Efforts can be made to increase the productivity of garlic through the reduction and prevention of pathogenic attacks by using biological control agents. Microorganisms are one of the best biological agents. One type of microorganism is *Trichoderma* sp.

Trichoderma sp. Included in the group of molds from the Ascomycetes class. This mold is an endophytic mold that can increase the growth rate and control the growth of plant pathogens. The use



of biological agents with the aim of controlling diseases in plants is one of the promising alternatives to reduce the negative impact of the use of chemical pesticides. Based on the description above, it is necessary to test the role of *Trichoderma* sp. on the growth of garlic in an effort to increase the productivity of garlic.

2. Material and methodology

2.1. Location and time of research

This research was carried out at the Plant and Vegetable Research Institute (BALITSA) located on Jl. Tangkuban Perahu No.517 Cikole Village, Lembang District, West Bandung Regency, West Java Province. Propagation of *Trichoderma* sp. conducted at the Integrated Laboratory of Vegetable Crops Research Center. Whereas plant observations are carried out in the screen garden of the Plant and Vegetable Research Institute. This research was conducted from October 2016 to February 2017.

2.2. Tools and materials

The tools used in this study include hoes to loosen woody soil which functions for stakes, stationery, rulers, cameras, buckets for dissolving *Trichoderma* sp., Analytic balance, 30 mL measuring cup to measure the amount of water in *Trichoderma* sp. solution. and water liter. While the ingredients used were *Trichoderma* sp. Isolates, Garlic bulbs which consisted of three new local varieties identified by the Balitsa and had not been given so that in this study mentioned varieties 1, 2 and 3. Other ingredients used were water.

2.3. Experimental design

The experimental design used was a completely randomized design with the type of treatment of garlic varieties. This type of variety consists of varieties 1, 2 and 3.

2.4. Observation parameters

The parameters of the observations made in this study are the growth rate of garlic which includes:

- a. Plant height; Measurements of plant height were carried out from the ground to the highest leaf tip using a ruler, carried out weekly for 14 weeks. The measurement data is then processed to obtain the growth rate value using a formula:

$$\text{Growth Rate} = \frac{\text{Final Plant High} - \text{Initial Plant High}}{\text{Length of Observation}}$$

- b. Root Length: The root length of each plant is measured from the end of the longest root using a ruler. Done during the harvesting process. Furthermore, the data obtained was obtained by the percentage increase in the root length of the plant by using the following formula

$$PP = \frac{P-K}{K} \times 100\%$$

Information:

PP: Percentage of Increase (%)

P: Plant root length by treatment (cm)

K: Control plant root length (cm)

- c. Fresh Weight of Garlic Bulbs; Calculation of fresh tuber weight per clump of the sample was carried out by weighing the tuber produced by each sample clump at harvest time. Then the data obtained is processed to get the percentage change in tuber weight using the formula:

$$PP = \frac{BP-K}{K} \times 100\%$$

Information:

PP: Percentage of Increase (%)

BP: Plant tuber weight by treatment (cm / week)

K: Control plant tuber weight (cm / week)

2.5. Data analysis

The data from the processing of the formula are then analyzed for variance with the SPSS version 16. If the results of the analysis of variance are significantly different, then proceed with the Duncan New Multiple Range Test (DNMRT) at the 95% confidence level (Dharmawati et al. in 2012).

3. Result and discussion

3.1. Growth rate

The results of the SPSS analysis of the variance of the white bottom high rate values showed that the treatment (variety) was significantly different ($P < 0.05$). Table 3.1. Display the DNMRT advanced test results.

Table 1. Result of Duncan analysis for garlic growth rate (cm/week)

Varieties	<i>Trichoderma</i> sp. (cm/week)	Control (cm/week)
1	5,00 ^f	4,00 ^{ef}
2	3,33 ^{de}	2,67 ^{cd}
3	2,33 ^{bc}	1,67 ^{ab}

Description: the same letters at the end of the numbers in columns A and B show no significant difference in the Duncan test (0.05).

Based on Table 1 the inoculation of *Trichoderma* is able to increase the high rate of garlic in all varieties. This is based on the comparison between the high rate values of the inoculation *Trichoderma* sp. with non-inoculated (controls). This ability to increase is thought to be due to *Trichoderma* sp affecting the secretion of hormone regulators which can increase the growth rate in this case the high rate of garlic varieties [4].

3.2. Garlic root length

Observation of the length of the root of the garlic plant is carried out at harvest. The measurement of root length is done by measuring the length of the roots of the newly harvested plants starting from the roots that attach to the bulbs to the tip of the longest roots using a ruler. Then the observational data from the root length is processed and analyzed statistically. The results of analysis of variance showed that the type of onion significantly affected root length ($P < 0.05$). The following are the results of the DNMRT advanced test.

Table 2. Result of Duncan analysis for garlic root length.

Varieties	<i>Trichoderma</i> sp. (cm)	Control (cm)
1	7,00 ^{def}	5,67 ^{cd}
2	8,00 ^{ef}	7,33 ^{def}
3	3,00 ^{ab}	1,33 ^a

Description: the same letters at the end of the numbers in columns A and B show no significant difference in the Duncan test (0.05).

Table 2. it can be seen that *Trichoderma* sp. active role in increasing the root length of all varieties. This is also supported by the research of Novandini and yedia in their second study *Trichoderma* sp. able to increase the root length of each research sample [5,6]. In another study Soesanto, reported that *Trichoderma. harzianum* can increase plant growth, increase absorption of active minerals, and other nutrients from the soil [7]. Furthermore, Subhan reported that *Trichoderma harzianum* and *Trichoderma koningii* were able to stimulate the growth of tomato and tobacco plants with dry weight each increasing by around 213-275% and 259-318% [8].

3.3. Garlic tuber weight

Based on the results of analysis of variance on the value of garlic tuber weight also showed a significant difference ($P < 0.05$) between the tested garlic varieties. The following is a table of DNMR advanced test results.

Table 3. Result of Duncan analysis for garlic tuber weight.

Varieties	<i>Trichoderma</i> sp. (gram)	Control (gram)
1	28,67 ^d	22,00 ^{cd}
2	29,67 ^d	15,33 ^{bc}
3	5,67 ^{ab}	1,67 ^a

Description: the same letters at the end of the numbers in columns A and B show no significant difference in the Duncan test (0.05)

Table 3 Duncan Test Results Weight of Garlic Bulbs (grams) able 3.2 shows all inoculated varieties *Trichoderma* sp has a large weight while non-inoculated (control) values are small. This shows that *Trichoderma* sp. work effectively on all varieties. According to Subhan et al., the potential yield of garlic depends on the rate of vegetative growth before forming tubers [8]. In another study Subhan stated that food produced during vegetative growth is stored in tubers, so that high yields are influenced by carbohydrates that can be stored in tubers [8]. This is supported by the role of *Trichoderma* sp which is able to improve the efficiency of nutrients absorbed [4].

4. Conclusion

- Trichoderma* sp. play an optimal role in increasing the high rate of all garlic plants
- Trichoderma* sp. optimal role increases the root length of garlic varieties
- Trichoderma* sp. optimally increase the weight of the bulbs of garlic varieties
- Trichoderma* sp. on garlic varieties so that productivity increases and the Indonesian people do not need to import
- Further research is needed regarding the identification of disease attacks on garlic to find out what types of pathogens infect garlic plants.

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