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The Effect of *Trichoderma* sp on the Intensity of Fusarium Disease and Production of Shallot

Pengaruh Pemberian Trichoderma sp Terhadap Intensitas Serangan Penyakit Layu Fusarium dan Produksi Tanaman Bawang Merah

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ABSTRAK

Serangan penyakit layu fusarium dapat menimbulkan kerusakan dan menurunkan hasil bawang merah. *Trichoderma* sp merupakan agen hayati yang dapat digunakan untuk menekan kejadian penyakit layu fusarium pada bawang merah. Penelitian bertujuan untuk mengetahui pengaruh pemberian *Trichoderma* sp terhadap intensitas serangan penyakit layu fusarium dan produksi tanaman bawang merah. Penelitian ini dilaksanakan di Desa Salodik, Kecamatan Luwuk Utara Kabupaten Banggai, dengan menggunakan rancangan acak kelompok (RAK) non faktorial yang terdiri dari lima perlakuan dengan empat ulangan yaitu: P_0 (Kontrol), P_1 (10 gr *Trichoderma* sp./liter air), P_2 (12 gr *Trichoderma* sp./liter air), P_3 (14 gr *Trichoderma* sp. /liter air) dan P_4 (16 gr *Trichoderma* sp./liter air). Hasil penelitian menunjukan bahwa pemberian *Trichorderma* sp berpengaruh sangat nyata terhadap rata-rata intesitas serangan penyakit layu fusarium dan berpengaruh nyata terhadap rata-rata produksi tanaman bawang merah. Pemberian 10 gr *Trichorderma* sp /liter air merupakan perlakuan terbaik untuk menguragi intesitas serangan penyakit layu fusarium dan meningkatkan rata-rata produksi tanaman bawang merah.

Kata Kunci: *Trichoderma,* intensitas, layu fusarium, produksi, bawang merah

ABSTRACT

Fusarium wilt disease can cause damage and reduce the yield of shallot. Trichoderma sp is a biological agent that can be used to reduce the incidence of fusarium wilt disease in shallot. This study aims to determine the effect of Trichoderma sp on the intensity of fusarium wilt attack and shallot production. This research was conducted in Salodik Village, Luwuk Utara District, Banggai Regency, using a non-factorial randomized block design consisting of five treatments with four replications, namely: P_0 (Control), P_1 (10 gr Trichoderma sp./liter of water), P_2 (12 gr Trichoderma sp./liter of water), P_3 (14 gr Trichoderma sp./liter of water) and P_4 (16 gr Trichoderma sp./liter of water). The results showed that giving Trichorderma sp had a very significant effected on the average intensity of fusarium wilt disease and had a significant effected on the average production of shallot. The provision of 10 gr Trichorderma sp /liter of water is the best treatment to reduce the intensity of fusarium wilt attack and increased the average production of shallot.

Keywords: Trichoderma, intensity, fusarium wilt, production, shallot.

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INTRODUCTION

Shallots (*Allium ascalonicum* L.) is one of the most important commodities cultivated in several countries (Sintayehu *et al*, 2011) and is a vegetable plant that has many benefits for human life. This caused the demand for shallots to continue to increase (Santoso et al, 2007). The production of shallots in Indonesia continues to be increased to meet the needs of the community. Based on the data of Balai Penyuluhan Pertanian of North Luwuk Sub-District (2020) shows that the area of shallot planting, especially Salodik Village in 2019 is 10.5 ha and the production reaches 84 tons / ha, resulting in productivity of 8 tons / ha. This value can certainly be increased again if the cultivation technology is applied more maximally, one of which is the prevention of disease attacks that can decrease the productivity of shallots.

Disease attack is one of the obstacles often faced in the cultivation of shallots. One of the diseases often found in shallot plants is moler disease or also known as fusarium disease caused by the fungus *Fusarium oxysporum* (Santoso *et al*, 2007). The onerous disease fusarium can cause damage and decrease the yield of coated tubers by up to 50% (Ramadhina *et al*, 2013). According to Alfizar *et al*, (2011) *Fusarium oxysporum* life cycle undergoes pathogenesis and saprogenesis phases. In the pathogenesis phase, fungi live as parasites on the host plant. If there is no host plant, the pathogen lives in the soil as a saprofit on the rest of the plant and enters the saprogenesis phase, which can be a source of inokulum to cause disease in other plants.

The onered disease fusarium attack on shallots often occurs on farmland in Salodik Village. However, the farmers of shallots in the village do not really understand the technique of controlling the disease. One of the elternatives in the management of fusarium disease is by utilizing trichoderma bioaagents. The treatment of *Trichoderma* sp mushrooms can suppress the incidence of fusarium disease (Ramadhina *et al*, 2013) and can increase the production of haring et al shallots, (2019). This research aims to determine the effect of the treatment of *Trichoderma* sp on the intensity of the oner disease attack fusarium and the production of shallot plants.

MATERIALS AND METHODS

This research was conducted in the Salodik Village Agricultural Area of Banggai Regency, starting from June – August 2020. The ingredients used in this study are shallot seed var Bima and *Trichoderma* sp. The study used a randomized design of non-factorial groups (RAK) consisting of five treatments with four replays: P_0 (Control), P_1 (10 gr *Trichoderma* sp./liter of water), P_2 (12 gr *Trichoderma* sp./liter of water), P_3 (14 gr *Trichoderma* sp. /liter of water) and P_4 (16 gr *Trichoderma* sp. /liter of water). The plots was created with a length of 2 meters and a width of 1 meter, as much as 20 plots. The seeds that have been prepared will be planted on each plots with a planting distance of 20 x 25 cm. Trichoderma fungal application is carried out by spraying into the soil at the appropriate dose of treatment at plant ages 2 MST, 3 MST and 4 MST. The observation parameters are as follows:

The intensity of the attack, addressed 3 times, i.e. at the age of plants 3 MST, 4 MST and 5 MST, is calculated using a scale of 0-10. The scale of damage caused by the OPT attack refers to Mirsam (2016), i.e. as follows ; 0 = 0% attack symptoms (no symptoms) , 1 = Attack symptoms 1 – 10%, 2 = Attack symptoms 11 – 20%, 3 = Attack symptoms 21 – 30%, 4 = Attack symptoms 31 – 40%, 5 = Attack symptoms 41 – 50%, 6 = Attack symptoms 51 – 60%, 7 = Attack symptoms 61 – 70%, 8 = Attack symptoms 71 – 80%, 9 = Attack symptoms 81 – 90%, 10 = Attack

symptoms 91 - 100%. To find out the percentage of fusarium disease that occur refers to Aulia *et al* (2016), use the formula:

$$I = \sum \frac{ni \; x \; vi}{V \; x \; Z} x \; 100\%$$

Description:
I = Damage intensity
ni = Number of wilted leaves
vi = Scale value of each category
V = Highest attack category scale value
Z = Number of leaves observed

The category of assessment of the intensity of fusarium attacks refers to the technical instructions of the Direktorat Perlindungan Tanaman Pangan (2018), namely as follows:

Light : when the attack rate is < 11%
Moderate : when the attack rate > 11 ≤ 25%
Weight : when the attack rate > 25 ≤ 85%
Puso : when the attack rate > 85%

Production of Shallots, done by harvesting shallots each map and then weighed to know the weight of fresh tubers per plots. The result is converted into ha-1 units with the production formula (ton/ha) referring to the Valentino *et al* (2020).

$$\frac{\mathbf{10000\ m^2}}{\boldsymbol{a}} \boldsymbol{x} \frac{\mathbf{b}}{\mathbf{1000}\ \boldsymbol{kg}}$$

Description:
a. = Plot area (m2)
b. = Production /plot (kg)

Before conducting the variety analysis, first carried out an examination of the assumptions of homogeneity of variety using bartlett test. If the result obtained is the homogenization of all observed mods (P > 0.05), then it is feasible to continue by conducting a fingerprint analysis. The data obtained is done by fingerprint analysis in accordance with the design used namely Random Design Group (RAK) using minitab 16 software. If the p-value < α 0.05 or p-value < α 0.01 , then tukey test is carried out to find out the difference between treatments.

RESULTS AND DISCUSSIONS

Intensity of Fusarium attack

Based on observations at the research site, the intensity of fusarium attacks in observations of 3 MST, the highest attack intensity in P_2 treatment (15.28), then at 4 (14.51) and 5 MST (14.16) with the highest attack intensity in P_0 treatment (Table 1). Attacks look different to the light attack intensity category.

Based on the results of the study on the first to third observations, the treatment of giving *Trichoderma* sp is effective in suppressing the intensity of the attack of fusarium disease on shallot plants. This is shown based on the category of intensity of disease attacks. There is a noticeable difference between a swath of shallots given *Trichoderma* and a swath of shallots that *Trichoderma* does not. The results of Deden and Umiyati research (2017) also showed that there was a high outbreak of fusarium disease in shallot swaths without the treatment of *Trichoderma* compared to the swaths of plants given by *Trichoderma* at plant ages 4, 5 and 6 weeks after planting.

Based on the results of the attack fusarium intensity (Table 2) showed that the treatment of *Trichoderma* has a very real effected on the intensity of disease attacks. Tukey test results showed that the treatment of P_1 (10 gr *Trichoderma* sp./liter of water), P_3 (14 gr *Trichoderma* sp./liter of water) and P_4 (16 gr *Trichoderma* sp. /liter of water) differed very noticeable with the P_0 (control) treatment. Plots that were not given *Trichoderma* (P_0) significantly showed higher rates of fusarium disease attacks compared to other treatments.

This result is in accordance with Rusita and Sasongko research (2020) which showed that *Trichoderma* is effective in suppressing the intensity of fusarium disease. From the first observation to the third observation showed

that P_1 treatment (10 gr *Trichoderma* /liter of water) is the best treatment, this is shown with a very low attack intensity value compared to other treatments and belongs to the category of intensity of mild disease attack.

Although in the first observation, the P_2 treatment (12 gr of *Trichoderma* /liter of water) showed a higher attack intensity value compared to the P_0 treatment (without *Trichoderma*). However, in the second and third observations, *Trichoderma* treatment (P_1, P_2, P_3 and P_4) showed a lower attack intensity value compared to P_0 treatment. It can be said that *Trichoderma* is a biocontrol agent that effectively controls fusarium disease in shallots.

Table 1. Intensity of fusarium attack in plant age 3, 4 and 5 MST

Age of Plants	Treatment	Number of leaves observed	Number of wilted leaves	Attack Intensity (%)	Attack Category
3 MST	P_0	37.67	13.00	13.81	Moderate
	P_1	39.00	9.33	7.81	Light
	P_2	29.67	11.33	15.28	Moderate
	P_3	43.33	14.00	12.92	Moderate
	P_4	41.67	12.33	8.88	Light
4 MST	P_0	37.67	13.67	14.51	Moderate
	P_1	39.00	8.00	6.15	Light
	P_2	29.67	10.33	13.93	Moderate
	P_3	43.33	10.33	7.15	Light
	P_4	41.67	11.00	7.92	Light
5 MST	P_0	37.67	13.33	14.16	Moderate
	P_1	39.00	7.33	3.76	Light
	P_2	29.67	9.67	13.03	Moderate
	P_3	43.33	9.00	4.15	Light
	P_4	41.67	12.33	8.88	Light

Table 2. The average intensity of fusarium disease attacks on shallots

Treatments	Attack Intensity (%)	Notation	*p-value*
P_0	14.16	a	0.002
P_1	5.91	b	
P_2	14.08	a	
P_3	8.07	b	
P_4	8.56	b	

Description : The numbers followed by different letters mean different very real based on tukey test (p-value < α 0.01).

Trichoderma species acts as a biological agent based on its antagonistic mechanisms (Bukhari and Safridar, 2018) and also as a biocontrol agent of many plant pathogens (Bunbury-Blanchette and Walker, 2020) including *Fusarium oxysporum* fungus causing fusarium disease in shallot plants (Safitri *et al*, 2019). Chemical compounds and enzymes produced by *Trichoderma* sp. may inhibit the development of pathogens because it serves as anti fungal (Ningsih *et al*, 2016). According to (Harman 2006) that *Trichoderma* produces the enzymes kitinase and β-1,3 glukanase which are useful for disease-resistant plants and those enzymes are beneficial for biological control.

The effect of *Trichoderma* on the production of shallots

Based on the results of the shallots production of per plots (kg) (Table 3) showed that the treatment of *Trichoderma* has a real effect on the average production of shallots. Tukey test results showed that the treatment of P_1 (10 gr *Trichoderma* sp. /liter of water) and P_2 (12 gr *Trichoderma* sp. / liter of water) differed manifestly from the treatment of P_0 (control). The treatment of *Trichoderma* has a noticeable effect on the average production of shallots per plots (kg). Average production at P_0 (control) treatment is lower when compared to P_1, P_2, P_3 and P_4 treatments. Based on the results of Darsan *et al* research (2016) showed that the treatment of *Trichoderma* is effective in improving the growth and yield of shallots. P_1 treatment (10 gr *Trichoderma* /liter of water) is the best treatment in increasing the production of shallots per plots compared to other treatments both in the first observation to the third observation.

Based on production analysis showed that the treatment of P_0 (without *Trichoderma*), P_1 (10 gr *Trichoderma* /liter of water), P_2 (12 gr *Trichoderma* /liter of water), P_3 (14 gr *Trichoderma* /liter of water) and P_4 (16 gr *Trichoderma* / liter of water) shows different production results between treatments. The production of shallots converted into ha^{-1} (Table 6) showed that the highest production results are in P_1 (12.15 tons/ha) treatment followed by P_2 (11.4 tons/ha), P_3 (10.7 tons/ha), P_4 (10.4 tons/ha) and P_0 (7.25 tons/ha).

The treatment of 10 gr *Trichoderma* /liter of water is able to produce a production of shallots of 12.15 tons / ha. This result is very much different when compared to the average production of shallots in North Luwuk Sub-district. Based on data from BPS Banggai Regency, the productivity of shallots in North Luwuk Sub-district in 2018 amounted to 4.39 tons/ha, and in 2019 amounted to 3.87 tons/ha. This indicates that the treatment of *Trichoderma* is effective for increasing the production of shallots. Based on the results of Haring *et al*. research (2019) that *Trichoderma* treatment provides good shallot growth against the weight parameters of wet tubers per plot, the weight of dry tubers per plot, the production of tubers per plot, and the production of shallot bulbs per hectare. *Trichoderma* has the ability to increase plant growth and soil environmental improvement (Lorito *et al*, 2010; Brotman *et al*, 2010; Halifu *et al*, 2019). In addition, colonization of *Trichoderma* at the root can increase root development, resistance to abiotic deftness as well as nutrient absorption (Saba *et al*, 2012).

The role of *Trichoderma* sp applied at the highest dose of 16 gr *Trichoderma* sp /liter of water has not had a real influence on the fresh weight of shallots, this is due to competition between *Trichoderma* sp species to obtain nutrients, insufficient growing space for growth, as well as environmental influences can affect the growth of *Trichoderma* sp (Baihaqi *et al*, 2013).

Table 3. The average of shallot production per plot (kg)

Treatments	Average weight per plots (kg)	Notation	*p-value*
P_0	1.45	a	0.013
P_1	2.425	b	
P_2	2.275	b	
P_3	2.125	ab	
P_4	2.075	ab	

Description : The numbers followed by different letters mean real differences based on the tukey test (p-value < α 0.05).

Table 6. The average of shallots production converted into ha^{-1}

Treatments	Average weight per plots (kg)	Production (ton/ha)
P_0	1.45	7.25
P_1	2.425	12.15
P_2	2.275	11.4
P_3	2.125	10.7
P_4	2.075	10.4

CONCLUSION

The treatment of *Trichorderma* sp has a very noticeable effect on the average intensity of fusarium disease attacks, where the treatment of 10 gr *Trichorderma* sp /liter of water is the best treatment to reduce the intensity of fusarium disease attacks. The treatment of *Trichorderma* sp also has a real effect on the average production of shallots with the treatment of 10 gr *Trichorderma* sp./liter of water is the best treatment to increase the average production of shallots per plot of plants.

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