

The Effect of *Trichoderma* Biourine Application on Growth, Occurrence of Fusarium Wilt Disease and Yield of Several Shallot Varieties

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Abstract— *Biourine* is a liquid fertilizer that contains complete elements, namely nitrogen, phosphorus, and potassium in small amounts as well as zinc, iron, manganese, and copper. *Biourine* can provide an increase in plant yields that is almost the same as plant fertilizers, besides that it can control *Fusarium* wilt disease. This study aims to determine the effect of *Trichoderma biourin* application on plant growth, *Fusarium* wilt disease and onion yield. The research was conducted using an experimental method in Senteluk Village, Batu Layar District, West Lombok Regency, West Nusa Tenggara using a Split Plot Design consisting of 2 factors. As the main plot, the shallot varieties consist of three levels, namely Bali Karet, Ampenan and Keta Monca, while as a sub-plot, the *Trichoderma biourin* application method consists of four levels, namely: without *biourine*, spraying the soil surface, spraying seed tubers, and spraying on plants 21 days after planting. The treatment was a combination of shallot varieties and *Trichoderma biourine* application method, each of which was repeated three times, so there were 36 experimental units. The results showed that: (a) The application of liquid *biourine* by spraying the soil surface, spraying seed tubers and spraying on plants 21 days after planting could increase the growth and yield of shallot bulbs. (b) The Bali Karet shallots varieties are more resistant to *Fusarium* wilt disease when compared to Ampenan and Keta Monca varieties.

Keywords— *Biourine*, *Trichoderma*, *Fusarium* wilt disease, shallot, Bali Karet.

I. INTRODUCTION

Shallots (*Allium cepa* var. *ascalonicum*). is a tuber vegetable that is quite popular among the public, in addition to its high economic value, red onion also functions as a flavoring and can also be used as an ingredient in traditional medicine or other pharmaceutical raw materials [1].

The province of West Nusa Tenggara or NTB is one of the centers of shallot production after Central Java, East Java and West Java. Shallot production in NTB from 2015-2019 has increased. NTB shallot production in 2015 was 160,201 tons with a harvested area of 14,524 ha, in 2016 as many as 211,804 tons with a harvested area of 19,275 ha, in 2017 as many as 195,458 tons with a harvested area

of 17,904 ha, in 2018 as many as 212,885 tons with a harvested area of 19,341 ha, and in 2019 as many as 188,255 tons with an area of 16,688 ha. In 2017 the productivity of shallots in NTB decreased to 10.92 tons/ha whereas previously it was 11.03 tons/ha [2]. The productivity of shallots is still relatively low compared to the results of the study, which reached 15 tons/ha [3].

One of the causes of a decrease in the productivity of shallots in NTB is *Fusarium* wilt disease caused by the fungus *Fusarium oxysporum* f. sp. *cepae*, the use of shallot seeds that are susceptible to *Fusarium* and poor quality seeds, as well as *Fusarium* wilt disease control techniques that still rely on the use of fungicides [3].

The varieties of shallots grown by farmers in NTB vary depending on the area where they are planted, for example, in Sembalun Bumbung Village, East Lombok Regency, farmers mostly plant the Bali Karet variety, in Senteluk Village, West Lombok Regency, farmers plant Ampenan and Super Philip varieties, in Santong Village, Lombok Regency. In the north, farmers plant Ampenan and Super Philip varieties, in Rada Village, Bima district, farmers plant Keta Monca and Super Philip varieties. The results of field observations turned out that all shallot varieties planted by farmers were attacked by the fungus *F. oxysporum* which causes wilt disease [3].

Fungal attack *F. oxysporum* f. sp. *cepae* can cause shallots to wilt quickly, leaves turn yellow and twist and the base of the stem rots. Fusarium wilt disease has caused damage and reduced tuber yield by up to 50% [4]. Attacks on plants if symptoms like this are found, then the plants are removed and destroyed [5]. Fusarium wilt disease develops in shallot planting centers in NTB starting from West Lombok, East Lombok, Sumbawa, and Bima which causes damage and reduces the yield of tubers by more than 45% [6].

Fusarium wilt disease on shallots is very difficult to control, because this fungus has *chlamydospores* which are structures that can survive in the soil as a saprophyte for about three to four years even without a host plant [7]. Thus, it is necessary to find an alternative to control Fusarium wilt that is effective and environmentally friendly. One control technique that has good prospects is biological technology using biourine fermented with *Trichoderma* fungus and the use of shallots varieties that have induced resistance to Fusarium wilt disease.

Biourine is a liquid fertilizer that contains complete elements, namely nitrogen, phosphorus, and potassium in small amounts as well as zinc, iron, manganese, and copper. Biourin can provide an increase in plant yields that is almost the same as plant fertilizers [8]. One of the microbes used for biourin fermentation is *Trichoderma* spp. Biourine containing *Trichoderma* spp. able to stimulate the growth of mustard greens when compared to mustard plants without being given biourine, besides that biourine containing *Trichoderma* spp., has the potential to protect mustard plants from clubroot disease (*Plasmodiophora brassicae*), this disease is an important disease in mustard and cabbage plants [9].

Trichoderma fungi isolated from the *rhizosphere* of shallot plants were reported to be effective in controlling the fungus *F. oxysporum* f. sp. *cepae* in vitro with inhibition percentage of 45% [10]. The fungus *T. harzianum* in suppressing the growth of the fungus *F. oxysporum* f. sp. *cepae* through the mechanism of competition for space and

nutrients, mycoparasites and antibiosis [11]. In a greenhouse experiment, it was reported that the fungus *T. harzianum* was able to inhibit the incidence of Fusarium wilt disease in shallots up to 75% [12].

Several reports explain that the *Trichoderma* fungi is not only used for biourine fermentation, but also for the fermentation of other materials. The fungus *T. harzianum* used to ferment liquid biocompost from cow dung applied to vanilla plants can control Fusarium wilt disease [10]. The fungus *T. harzianum* applied to soybeans could inhibit the development of Fusarium wilt disease [13]. The fungus *T. harzianum* can control Fusarium wilt disease on banana plants [10]. Fusarium wilt disease in maize can be inhibited by the fungus *T. harzianum* [14]. The fungus *T. harzianum* is effective in controlling Fusarium wilt disease in soybeans [15]. The fungus *T. harzianum* was able to suppress Fusarium wilt disease in shallots [16]. The use of the fungus *T. harzianum* in the form of a tablet bioactivator formulation of 15 g/pot effectively controlled the fungus *F. oxysporum* f.sp. *cepae* on shallots reached 42.26% [17] and was able to increase plant growth and yield of shallots [18].

Induced resistance is the resistance of plants to pathogen infection because plants have been infected by other microorganisms before, both of the same type or of other types. Induced resistance can also occur after plants are inoculated early with biotic elicitors (avirulent, non-pathogenic, saprophytic microorganisms) [19]. Fusarium wilt control using onion varieties that have induced resistance have good prospects. The results of the preliminary study showed that the varieties of Bali Karet, Ampenan varieties, Keta Monca varieties, Bima Brebes and Super Philip varieties induced with the fungus *T. harzianum* caused immunity to Fusarium wilt disease [12] and induced resistance to Fusarium wilt disease [16].

The effect of *Trichoderma* biourine application in increasing growth and yield of several varieties of shallots in the field has never been studied. Therefore, a research was conducted on "The Effect of *Trichoderma* Biourine Application on the Growth and Yield of Three Shallot Varieties".

II. METHOD

1. Experimental Design

The study used an experimental method in Senteluk Village, Batu Layar District, West Lombok Regency, West Nusa Tenggara using a Split Plot Design consisting of 2 factors. As the main plot, the shallot varieties consist of three levels, namely Bali Karet, Ampenan and Keta Monca, while as a sub-plot, the

Trichoderma biourine application method consists of four levels, namely: without biourine, soil surface spraying, seed tuber spraying, and spraying on plants 21 days after planting. The treatment was a combination of shallot varieties and *Trichoderma* biourine application method, each of which was repeated three times, so there were 36 experimental units.

2. Experiment Execution

The production of *Trichoderma* biourine is carried out as follows: cow urine is collected in a holding tank. Furthermore, the standard solution of *Trichoderma* was put into a urine reservoir, then closed the fermentation container, and incubated for 4 weeks. Open the lid of the container once a week and stir for 15 minutes. After 4 weeks, the circulation was carried out using a ladder for 24 hours to remove the ammonia element which is pathogenic for plants. *Trichoderma* fermented biourin is ready to be applied to shallot plants.

The shallot seeds used were the Bali Karet, Keta Monca and Ampenan varieties purchased from seed breeders. Shallot seeds that are good to use are healthy and quality seeds with a shelf life of 2 months and there are visible growing points on the roots. The day before planting the seeds are cut off about part.

Tillage was carried out using a hoe to level the soil and making experimental plots with a size of 2 m × 4 m for each treatment plot. After processing the soil, basic fertilization is carried out using Phonska fertilizer of 100 kg/ha (50% of the recommendation). Basic fertilizer application was carried out by immersing it next to the planting hole, then the experimental plot was covered with plastic mulch.

The application of biourine was carried out according to the treatment, namely: by spraying the soil surface before installing plastic mulch, spraying shallot bulbs for 30 minutes, and spraying shallot plants after 21 days. Planting is done by inserting shallot seed bulbs into a hole with a depth of 2 cm and the hole is covered again with soil. Planting is done with a spacing of 20 × 20 cm.

3. Variable Observation

Observation of disease incidence was carried out by counting the number of wilted plants, observations were made from the age of 7 days after planting (DAP) until the

shallots plants were 35 DAP. Disease incidence (%) is calculated using the following formula:

$$I = \frac{a}{b} \times 100 \%$$

where :

I = Percentage of disease incidence

a = Number of plants showing disease symptoms

b = Total number of plants observed

Observations of growth components, namely plant height and number of leaves of shallot plants were carried out from the age of 7 DAP to 35 DAP. Observations of yield components were carried out at harvest, namely at the age of more than 70 DAP. Observation of harvested dry shallot bulb weight was carried out by weighing the weight of bulbs at harvest per plot and then converted to hectares. Observation of the weight of stored dry shallots was carried out by weighing all parts of the plant in a dry state or after being stored in a wind-dried state for one month.

4. Data Analysis

Observational data were analyzed using Diversity Analysis with a significance level of 5% and further tested using the Honest Significant Difference test or HSD at the same significant level.

III. RESULT AND DISCUSSION

The results of the analysis of variance showed that the treatment of *Trichoderma* biourine application and shallot varieties were significantly different, while the interactions did not show significant differences in the incidence of Fusarium wilt disease, plant height growth and the number of shallots and shallot yields, namely the number of tillers, dry shallot bulb weight, harvest and weight of dry shallot bulbs stored.

1. Occurrence of Fusarium Wilt Disease on Shallots

The results of further tests on the effect of *Trichoderma* biourine application on the incidence of Fusarium wilt disease at the age of 7 DAP to 35 DAP using the 5% BNJ test are presented in Table 1.

Table 1. The Effect of *Trichoderma Biourine* Application on the Occurrence of *Fusarium Wilt Disease* in Shallots at the age of 7 DAP to 35 DAP

No.	How to Apply <i>Trichoderma Biourine</i>	Occurrence of <i>Fusarium Wilt Disease</i> (%)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Without biourine	18.40 a ¹⁾	41.40 a ¹⁾	46.00 a ¹⁾	49.00 a ¹⁾	50.00 a ¹⁾
2.	Ground surface spraying	0.00 b	3.80 b	7.20 b	9.60 b	10.00 b
3.	Spraying of seed tubers	0.00 b	3.80 b	8.30 b	9.20 b	9.50 b
4.	Spraying plants aged 21 days	0.00 b	3.90 b	7.60 b	9.10 b	9.40 b

Notes: ¹⁾ The numbers in each column followed by the same letter are not significantly different.

In Table 1, it can be seen that the application of *Trichoderma biourine* significantly affected the incidence of disease in shallot plants at the age of 7 DAP to 35 DAP. *Trichoderma biourine* which was applied by spraying the soil surface, spraying seed tubers and spraying on plants after 21 days could reduce the incidence of *Fusarium wilt disease*, while in control or without *Trichoderma biourine* treatment the incidence of *Fusarium wilt* at 35 DAP reached 50%.

The low incidence of *Fusarium wilt disease* in shallots after the application of *Trichoderma biourine* was due to the population of *Trichoderma* spp. in the rhizosphere increased markedly. The results of observations of the population of *Trichoderma* fungi in the rhizosphere showed an increase in the population in all biourine treatments, namely an average of 43.00×10^3 propagules/g soil, while in the control there was no *Trichoderma* spp. [20]. The fungus *Trichoderma* in soil

is able to inhibit the development of disease-causing pathogens by means of competition both in terms of space and nutrients. The fungus *Trichoderma* can use various nutrient sources for growth by destroying cellulose, starch, lignin, and other soluble compounds such as protein and sugar [21]. In addition, *Trichoderma* can also inhibit the growth of pathogenic spores and hyphae with its ability to produce furanone group antibiotics [22]. The use of biofungicides fermented with *Trichoderma* spp. a minimum of 5 ml/plant can control *Fusarium wilt disease* through the mechanism of space competition, mycoparasites and antibiosis. [16].

2. The Effect of *Trichoderma Biourine* Application on Shallot Plant Growth

The results of further tests on the effect of *Trichoderma biourine* application on plant height and number of shallots at the age of 7 DAP to 35 DAP using 5% BNJ are presented in Tables 2 and 3.

Table 2. The Effect of *Trichoderma Biourine* Application on Shallot Plant Height at the age of 7 DAP to 35 DAP

No.	How to Apply <i>Trichoderma Biourine</i>	Shallot Plant Height (cm)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Without biourine	3.50 a ¹⁾	15.50 a ¹⁾	18.80 a ¹⁾	20.10 a ¹⁾	24.30 a ¹⁾
2.	Ground surface spraying	7.80 b	21.60 b	30.80 b	36.10 b	37.00 b
3.	Spraying of seed tubers	7.90 b	22.50 b	31.30 b	36.30 b	38.00 b
4.	Spraying plants aged 21 days	8.20 b	23.30 b	31.40 b	36.60 b	38.40 b

Table 3. The Effect of *Trichoderma Biourine* Application on the Number of Leaf Shallots at the age of 7 DAP to 35 DAP

No.	How to Apply <i>Trichoderma Biourine</i>	Number of Leaves (strands)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Without biourine	4.30 a ¹⁾	13.60 a ¹⁾	18.80 a ¹⁾	20.50 a ¹⁾	23.23 a
2.	Ground surface spraying	7.80 b	20.70 b	28.70 b	33.70 b	35.00 b
3.	Spraying of seed tubers	7.90 b	20.80 b	28.80 b	33.90 b	35.40 b
4.	Spraying plants aged 21 days	7.90 b	20.90 b	29.10 b	34.40 b	35.60 b

From Tables 2 and 3 it is known that the method of application of *Trichoderma* biourine significantly affected plant height and number of shallots. The plant height and the highest number of scallions began to be seen in all *Trichoderma* biourine applications.

From the results of this study, it can be said that all methods of biourin application can increase plant height and the number of leaves of shallot plants. The growth of plant height and number of leeks after the application of *Trichoderma* biourine is suspected because the *Trichoderma* fungus contained in the biourin has a role in stimulating ethylene in plant tissues so as to stimulate plant vegetative growth [11]. The fungus *T. harzianum* can stimulate seed germination and plant growth [23]. Ethylene is a hormone produced by the fungus *Trichoderma* spp. can stimulate plant flowering [24]. Treatment of the fungus *T. harzianum* on soybean

plants can stimulate plant growth so as to increase plant height and number of plant leaves [21]. *Trichoderma* spp. able to stimulate plants to form the hormones gibberellin acid (GA3), Indolasetic acid (IAA), and benzylaminopurine (BAP) so that plant growth such as plant height and number of leaves is more and is healthy, tough and affects plant resistance to disease. Furthermore, gibberellins and auxin hormones also play a role in root and stem elongation, tuber formation and increase plant development [22].

3. The Effect of *Trichoderma* Biourine Application on Shallot Yield

The results of further tests on the effect of the application of *Trichoderma* biourine on the number of tillers of shallots, the weight of harvested dried shallots and the weight of stored dried shallots using BNJ 5% are presented in Table 4.

Table 4. The Effect of *Trichoderma* Biourin Application on Number of Tillers, Weight of Harvested Dried Shallot Bulbs and Dried Shallot Bulbs Weight of Stored

No.	How to Apply <i>Trichoderma</i> Biourine	Number of tillers (tubers)	Weight of Harvested Dried Bulbs (tons/ha)	Dry Bulbs Weight Save (tons/ha)
1.	Without biourine	6.70 a ¹⁾	6.80 a ¹⁾	4.50 a ¹⁾
2.	Ground surface spraying	11.80 b	13.90 b	12.30 b
3.	Spraying of seed tubers	11.90 b	14.20 b	12.40 b
4.	Spraying plants aged 21 days	12.20 b	14.40 b	12.60 b

Table 4 shows the number of tillers, the weight of harvested dry shallots, and the lowest weight of harvested dried shallots in the control or without using biourine. This indicates that the application of *Trichoderma* biourine can increase the number of tillers of shallot, the weight of harvested dry shallots, and the weight of harvested dry shallots.

The increase in the number of shallot tillers, harvested dry shallot bulb weight and stored dry shallot tuber weight after application of *Trichoderma* biourine was thought to be due to the role of this fungus in stimulating growth and increasing yield. It was reported that the fungus *T. harzianum* in the rhizosphere or plant root areas secretes ethylene which is diffused into the plant body through xylem which plays a role in promoting generative growth [11]. Treatment with conidia of *T. viride* and *T. koningii* fungi for controlling blight on strawberry plants was able to stimulate early flowering [25]. Ethylene is a hormone produced by the fungus *Trichoderma* spp. can stimulate

flowering in plants [24]. Treatment of the fungus *T. harzianum* on soybean plants can stimulate plant growth so as to increase yield components [21]. *Trichoderma* spp. can produce certain hormones to increase the weight and number of pods in soybean plants [26]. *Trichoderma* spp. can stimulate plants to produce hormones gibberellin acid (GA3), Indolasetic acid (IAA), and benzylaminopurine (BAP) so that plant growth becomes optimum, and affects plant resistance. Gibberellins and auxin hormones play a role in root and stem elongation, and fruit (tuber) growth and increase plant growth [27].

Several previous researchers reported the successful use of *Trichoderma* fungi in various formulations on various plants. The use of bioactivators fermented with *Trichoderma* spp. can increase the growth and yield of shallots in dry land [28]. The use of bioactivators fermented with *Trichoderma* spp. can increase the induced resistance of soybean plants to plant diseases and increase the growth and yield of soybean plants [29]. Tablet and liquid bioactivator fermented with *Trichoderma* spp. can increase soybean plant-induced resistance to wilt disease and increase soybean growth and yield [30]. Bioactivator

and biocompost fermented with *Trichoderma* spp. can increase the weight of shallot bulbs [17]. The use of *Trichoderma* spp. which is formulated in the form of a stimulator biocompost can increase the growth and yield of maize in dry land [31]. The use of *Trichoderma* spp. in the form of a liquid bioactivator formulation as much as 5 ml/plant can increase the growth and yield of shallots [32]. Furthermore, it was also reported that the fungus *Trichoderma* spp. which is formulated in the form of biocompost can increase the growth and yield of soybean plants [33]. The use of *Trichoderma* biochar can increase soybean yield [34]. The use of *Trichoderma* biocompost can increase the yield of shallots [35]. The use of *Trichoderma* biofungicide can control Fusarium wilt

disease and increase shallots yield [36]. The application of *Trichoderma* liquid biofungicide can increase the weight of harvested dried shallots bulbs [37]. The use of *Trichoderma* fungus can increase the resistance induced by banana seedlings to Fusarium wilt disease. The use of the saprophytic fungus *Trichoderma* antagonist causes shallots plants to become resistant to Fusarium wilt disease.

4. The Effect of Shallot Varieties on the Occurrence of Fusarium Wilt

The results of further tests using BNJ 5% the effect of shallot varieties on the incidence of Fusarium wilt disease at the age of 7 DAP to 35 DAP are presented in Table 5.

Table 5. The Effect of Shallot Varieties on the Occurrence of Fusarium Wilt Disease in Shallots at the age of 7 DAP to 35 DAP

No.	Shallot Varieties	Occurrence of Fusarium Wilt Disease (%)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Bali Karet	0.00	2.50 a ¹⁾	4.90 a ¹⁾	6.40 a ¹⁾	7.70 a ¹⁾
2.	Ampenan	0.00	3.50 b	5.60 b	9.50 b	10.70 b
3.	Keta Monca	0.00	3.70 b	5.90 b	9.70 b	10.90 b

Notes: ¹⁾ The numbers in each column followed by the same letter are not significantly different.

In Table 5 it can be seen that shallot varieties showed different effects on Fusarium wilt disease on shallots from 14 DAP to 35 DAP. Of the three varieties of shallots tested, it turned out that the Bali Karet variety showed a lower incidence of Fusarium wilt disease than the Ampenan and Keta Monca varieties.

The difference in the incidence of Fusarium wilt in the three varieties of shallot is thought to be because genetically these three varieties have different resistance. In addition, environmental factors such as sunlight, irrigation and soil conditions also affect resistance to Fusarium wilt disease. The Bali Karet, Ampenan and

Keta Monca varieties in environmental adaptation tests at different altitude locations showed different resistance reactions to Fusarium wilt disease. The Bali Karet varieties grown in the highlands of Sembalun, the medium plains of Santong and the lowlands of Senteluk are resistant to Fusarium wilt disease [3].

5. The Effect of Shallot Varieties on Plant Growth

The results of further tests on the effect of shallot varieties on plant height and number of shallots at the age of 7 DAP to 35 DAP using 5% BNJ are presented in Tables 6 and 7.

Table 6. Effect of Shallot Varieties on Shallot Plant Height at the age of 7 DAP to 35 DAP

No.	Shallot Varieties	Shallot Plant Height (cm)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Bali Karet	7.50 a ¹⁾	28.40 a ¹⁾	35.70 a ¹⁾	38.80 a ¹⁾	40.80 a ¹⁾
2.	Ampenan	6.70 b	22.70 b	31.80 b	35.80 b	37.50 b
3.	Keta Monca	6.50 b	22.50 b	31.70 b	35.60 b	37.30 b

Table 7. The Effect of Shallot Varieties on the Number of Leaves of Shallots at the age of 7 DAP to 35 DAP

No.	Shallot Varieties	Number of Shallots Leaves (pieces)				
		7 DAP	14 DAP	21 DAP	28 DAP	35 DAP
1.	Bali Karet	17.50 a ¹⁾	30.50 a ¹⁾	35.80 a ¹⁾	45.20 a ¹⁾	47.20 a ¹⁾
2.	Ampenan	7.50 b	22.70 b	28.80 b	38.70 b	41.50 b
3.	Keta Monca	7.40 b	22.50 b	28.60 b	38.50 b	39.90 b

From Tables 6 and 7 it is known that shallot varieties show different effects on plant height and the number of shallots on plants from the age of 7 DAP to 35 DAP. The Bali Karet variety showed higher plants than the Ampenan and Keta Monca varieties, while the Ampenan and Keta Monca varieties did not show a significant difference.

The occurrence of differences in plant height and number of leaves of shallot plants is thought to be due to genetic factors of each variety used, in addition to the adaptability of the variety to the environment such as sunlight, irrigation, rain intensity and soil conditions. Differences in plant growth are morphological adaptability, which in turn will affect the growth and yield of a plant [40]. The occurrence of variations in a plant can be caused by

environmental influences and genetic factors. Differences in environmental conditions cause variations that can determine the final appearance of a plant [41]. The average plant height of the Bali Karet variety was 50-60 cm higher than the Ampenan and Keta Monca varieties, namely 26-45 cm and 26-46 cm. The number of leaves of the Bali Karet variety is 50-55 more than the Ampenan variety, which is 45-50 and the Keta Monca variety is 17-47 strands [3]

6. Effect of Shallot Varieties on Yield

The results of further tests on the effect of shallot varieties on plant height and number of tillers, weight of harvested dried shallots and weight of stored dried shallots using HSD 5% are presented in Table 8.

Table 8. Effect of Shallot Varieties on Number of Tillers, Weight of Harvested Dried Shallot Bulbs and Weight of Dried Shallots Saved

No.	Shallot Varieties	Number of tillers (tubers)	Weight of Harvested Dried Bulbs (tons/ha)	Dry Bulbs Weight Save (tons/ha)
1.	Bali Karet	13.40 a ¹⁾	14.90 a ¹⁾	12.90 a ¹⁾
2.	Ampenan	10.20 b	10.40 b	8.50 b
3.	Keta Monca	9.90 b	10.10 b	8.30 b

In Table 8 it can be seen that the shallot varieties showed different effects on the number of tillers of shallots, the weight of harvested dry shallots, and the weight of stored dry shallots. The Bali Karet variety showed that the number of tillers, harvested dry onion bulbs, and stored dry shallot bulbs were higher than the Ampenan and Keta Monca varieties.

, the weight of harvested dry shallots and the weight of stored dry shallots. The difference in the effect of shallot varieties is thought to be due to genetic factors of each variety and the influence of environmental conditions of planting. Genetic factors are one of the factors that affect plant growth and yield [42]. The average number of tillers of the Bali Karet variety was 7 – 14 higher than the Ampenan variety, 7 – 12 and the Keta Monca variety, 5 -9. The average yield of harvested dry shallot bulbs for the

Bali Karet variety was 14-16 tons/ha, higher than the Ampenan variety, 12 tons/ha and the Keta Monca variety, 11 tons/ha [3]

IV. CONCLUSION

The results showed that:

1. The application of *Trichoderma* biourine by spraying the soil surface, spraying seed tubers and spraying on plants 21 days after planting can increase the growth and yield of shallot bulbs.
2. The Bali Karet shallots variety is more resistant to Fusarium wilt disease when compared to the Ampenan and Keta Monca varieties.

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