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The Effort of Increasing Growth And Harvest of Local Variety Red Onion With Applications of Some Dose of Indigenous Mycorrhizal And Bioactivator Trichoderma Spp. in Dry Land.

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Abstract: *This study aims to determine the increase of local variety red union harvesting which is treated with dosage of indigenous mycorrhizal and bioactivator Trichoderma spp in dry land. This research was designed by using Randomized Block Design experiment with Split Plot treatment. The main factor is dose of indigenous michoriza consisting of 4 treatment levels, the dose are: 0 g / plant, 10 g / plant, 20 g / plant and 30 g / plant, while sub plot consists of 5 treatment levels, the dose are: 0 g / plant , 5 g / plant, 10 g / plant, 15 g / plant and 20 g / plant. The treatment was a combination of two repeated factors 3 times to obtain 60 experimental units. The results showed that the application of indigenous mycorrhizal and bioactivator Trichoderma spp were able to increase the growth of onion crops in comparison with the control. The application of indigenous mycorrhizal and Bioactivator Trichoderma spp were able to increase the yield of onion crops in comparison with the control of dosage treatment of 30 g / plant indigenous mycorrhizal with increased wet bulb weight 55,10%, increase of dry bulb 63,95%, and treatment dose of 20 g /plant Trichoderma spp bio-activator which increases the weight of wet bulb 34,43%, increase of dry bulb 40,21%.*

Keywords: *Local Variety of Red Onion, indigenous mycorrhizal, Bioactivator Trichoderma spp.*

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I. Introduction

Red onion consumption generally tends to increase year to year. Based on Kementan (2016), in the last two years (2014-2015), consumption of red onion per capita has increased from 2.49 kg to 2.71 kg, it means that there is an increase of 8.84% consumption. This indicates that the onion demand will continue to increase in the future. The high public consumption of onion has not been accompanied by adequate production, so that domestic demand is still filled with import. According to Kementan (2016), in the last four years (2012-2015) imports of onion remain high, reaching: 122,190 tons, 96,139 tons, 74,019 tons and 17,429 tons. According to Schalau (2002), indigenous mycorrhizal based on how it is obtained are divided into two namely Mikofer and Indigenous. Mikofer is a indigenous mycorrhizal associated with plant roots with human intervention, whereas the indigenous mycorrhizal which is found in association with plant roots naturally without human intervention in the initial infection process between the indigenous mycorrhizal and its host plant is called the Indigenous Mikoriza. According to Sudantha (2010), Bioactivator Trichoderma spp. is an activator material which contains Trichoderma spp' inoculum which can be formulated in the form of liquid, tablets, and granules which is used in spurring growth and flowering of plants.

The ability of indigenous mycorrhizal in increasing crop production had also been reported by Astiko (2015), that indigenous mycorrhizal plus manure by using soil samples from dry land of North Lombok can increase the yield of soybean (dry weight per plant) by 41%. As a Bioactivator Sudantha and Abadi (2011) reported that the use of T. harzianum isolate Sapro-07 and T.koningii isolate Endo-02 bioactivator can stimulate growth and flowering of maize plants in experiments in greenhouses. Next Nubuwwah (2015), reported that the Bioactivator Trichoderma spp. gave a significant result on the weight of onion fresh bulbs and dry bulbs in greenhouse experiments at doses of 5 gram / pot bioactivator or equivalent to 1.25 tons / ha. Based on some of the descriptions above about the ability of indigenous mycorrhizal and Bioactivator Trichoderma spp. in improving crop growth and improving soil aggregation, it is also expected to contribute to increased production of red onion crops, especially the local varieties in dry land. In addition, the consideration in this study is that there is no study on dosage (Mikoriza Indigenus and Bioaktivator Trichoderma spp.) which is needed to increase the growth and yield of local onion plants in dry land. Therefore, it is necessary to do a study on "The Efforts to Increase Growth and Yield of Onion Local Varieties by Application of Multiple Dosages of Indigenous mycorrhizal and Trichoderma spp. in Dry Land ".

II. Methods

Places and Experimental Design

The experiment was conducted in Senteluk Village, Batulayar Sub-District. This research used Randomized Block Design (RAK) which was arranged in split plot design. Factor 1 was dosage of indigenous mycorrhizal consisting of 4 treatment levels: m0 = control (without indigenous mycorrhizal treatment), m1 = indigenous mycorrhizal induced dose 10 gram / plant, m2 = indigenous mycorrhizal dose 20 gram / plant, and m3 = indigenous mycorrhizal dose 30 gram / plant. Factor 2 was the dosage of Trichoderma Bioactivator consisting of 5 treatment levels: b0 = control (without treatment of Trichoderma Bioctivator), b1 = 5 gram / plant bioactivator dose, b2 = 10 gram / plant bioactivator dose, b3 = 15 gram / plant dose bioactivator, And b4 = 20 gram / plant dose bioactivator.

III. Results And Discussion

Plant Growth

Plant height

Further test results of onion plant height can be seen in **Table 1** and **Table 2**.

Table 1. The Average of Onion Crop's Height on Each Treatment of Indigenous mycorrhizal Dose at Age 7 to 35 hst.

Indigenous Mycorrhizal Dose (g / plant)	Plant Height (cm)				
	7 hst	14 hst	21 hst	28 hst	35 hst
0	11,15 d	21,25 d	28,27 d	35,14 d	38,98 d*)
10	12,83 c	22,90 c	29,87 c	36,73 c	40,10 c
20	13,52 b	23,52 b	30,60 b	37,47 b	40,80 b
30	14,26 a	24,34 a	31,40 a	38,26 a	41,57 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test.

Table 1 shows that the indigenous mycorrhizal treatment has significant effect on plant's height. This is seen in onion's height which is given indigenous mycorrhizal tends to be higher than the onion's height without indigenous mycorrhizal (control). The treatment indigenous mycorrhizal dose 30 g / plant gives the best effect to the increase of onion plant's height from 7hst to 35hst. Meanwhile, the highest onion plant height was at dose of 0 g / indigenous mycorrhizal plant (control). Increased plant height on red onion is caused by indigenous mycorrhizal infection at the root of the plant. As the results of observations and calculations, the average degree of root infection on red onion applied with indigenous mycorrhizal (57%) higher than without indigenous mycorrhizal application (33%). Mayerni and Hervani (2008), suggest that morphorous plants have higher height because nutrient uptake required by plants runs more effectively so that plant growth metabolism can be run well especially in the vegetation phase toward the generative phase. This is also supported by the opinion of Sastrahidayat (2011) which suggested that upland rice plants inoculated with Glomus mosseae have higher height than the controls. In addition, chili plants inoculated with Glomus mosseae were able to increase plant height and stem diameter better than the controls.

Increased growth of morphorous plants is caused by increased physiological activities of plants to take nutrients in soils such as K, Ca, Mg, and P. The main nutrient taking by indigenous mycorrhizal is Phosphor nutrient. In addition, indigenous mycorrhizal is also assumed to increase growth hormone in plants (Carling and Brown, 1982). Furthermore, Paul and Clark (1989), said that although the mechanism is difficult to know but the activity of hormones and photosynthesis will increase in plants associated with indigenous mycorrhizal.

Table 2. The Average of Onion's height on Each Treatment Dose of Trichoderma spp Bioactivator at Age 7 hst to 35 hst.

Dose of Bioactivator Trichoderma spp (g / plant)	Plant Height (cm)				
	7 hst	14 hst	21 hst	28 hst	35 hst
0	11,45 c	21,50 c	28,48 c	35,56 c	39,16 c*)
5	13,00 b	23,12 b	30,14 b	36,97 b	40,37 b
10	13,19 ab	23,28 ab	30,30 ab	37,16 ab	40,50 ab
15	13,42 ab	23,42 ab	30,51 ab	37,33 ab	40,77 ab
20	13,64 a	23,70 a	30,73 a	37,51a	41,00 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test.

Based on **Table 2**, it shows that the treatment of Trichoderma spp Bioactivator gives significant effect on the increase of plant height. This is seen in the height of onion crops given Trichoderma spp bioactivator tends to be higher than the the height of onion crops without Trichoderma spp Bioactivator (control). The effect of the best Trichoderma spp biopharmaceutical treatment on the increase of onion plant height from 7 to 35 hst was 20 g / plant (41cm), while the lowest onion was 0 g / plant Bioaktivator Trichoderma spp (control) (39.16 cm).

The increasing of plant's height in inoculated plants with Bioactivator Trichoderma spp allegedly due to the increase of hormones caused by the activity of the fungus Trichoderma spp. As Triyatno (2005) reported that Trichoderma harzianum which is inoculated in ginger plants can increase the height of ginger plants by 16.77%. Furthermore Wirastaningjati (2006), reported that Trichoderma sp fungus from banana rhizosphere which is inoculated two weeks before planting can increase plant height to 46,74 cm.

The number of leaves

Further test results of the number of leaves in red onion plants can be seen in **Table 3** and **Table 4**.

Table 3. The Average Number of Leaves of Red Onion on Each Treatment of indigenous mycorrhizal Dose at Age 7 hst to 35 hst.

Indigenous Mycorrhizal Dose (g / plant)	Number of Leaves (strands)				
	7 hst	14 hst	21 hst	28 hst	35 hst
0	13,81 c	20,67 c	27,95 c	34,84 c	40,91 c*)
10	15,40 b	22,32 b	29,32 b	36,45 b	42,68 b
20	15,75 b	22,97 ab	30,16 ab	36,93 ab	43,39 ab
30	16,46 a	23,66 a	30,91 a	37,62 a	44,07 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test.

Based on **Table 3**, it shows that the treatment has significant effect on the number of leaves of red onion plants. This is seen in the number of leaves of onion plants given indigenous mycorrhizal at age 7 hst to 35 hst tends to be higher than the number of leaves of onion plants without indigenous mycorrhizal (control). The highest number leaves at age 7 hst to 35 hst was dose of 30 g / plant while dose with lowest number of leaves was dose of 0 g / plant indigenous mycorrhizal.The increased number of leaves on red onion crops which given indigenous mycorrhizal is assumed due to increase in the availability of nutrients N in the soil by indigenous mycorrhizal. This is supported by the result of N-Total soil analysis of 0.17% without indigenous mycorrhizal, whereas N-Total soil after indigenous mycorrhizal applied was 0.28% greater 0.11% compared with control (Annex 2). This fact also supported by Hapsoh (2003) who reported that in addition to the nutrient elements P indigenous mycorrhizal can also absorb other nutrients such as N. Furthermore, Sastrahidayat (2011) suggests that the plant which is given indigenous mycorrhizal give significant effect on increasing the number of leaves compared to plants without giving indigenous mycorrhizal.

Wijaya (2008) reported that sufficient N supply can expand the leaf's blade and increase the amount of chlorophyll in the leaves, so that the plant can produce sufficient amounts of carbohydrate/assimilate for its growth. Furthermore, Sarief (1986) suggests that N nutrients are indispensable for plants in the formation and growth of vegetative parts of plants such as roots, stems, and leaves.

Table 4. The Average Number of Leaves in Red Onion on Each Treatment Dose of Bioactivator Trichoderma spp. At Age 7 hst to 35 hst.

Dosage of Bioactivator Trichoderma spp. (G / plant)	Number of Leaves (strands)				
	7 hst	14 hst	21 hst	28 hst	35 hst
0	14,17 b	21,01 b	28,28 b	35,09 b	41,25 b*)
5	15,36 a	22,40 a	29,58 a	36,50 a	42,76 a
10	15,57 a	22,58 a	29,79 a	36,71 a	23,00 a
15	15,70 a	22,86 a	29,99 a	36,88 a	43,29 a
20	15,97 a	23,17 a	30,29 a	37,12 a	43,59 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test.

Based on **Table 4** it shows that the Bioactivator Trichoderma spp. gives significant effect on the number of leaves of red onion plants. This is seen in the number of leaves of onion plants provided by Trichoderma spp. at the age of 7 hst to 35 hst tends to be higher the number of leaves of onion plants without Bioactivator Trichoderma spp. (control). The highest number of leaves at age 7 hst to 35 hst was dose of 20 g / plant while dose with lowest number of leaves was dose of 0 g / plant indigenous mycorrhizal.

Plant which is given Trichoderma spp. was able to increase the number of leaves on the plant because Trichoderma spp. can produce growth hormones such as auxin that can stimulate the growth of leaves. This is supported by Sudantha and Abadi (2006), that the presence of Trichoderma spp. can stimulate the formation of leaf buds / tendrils. The presence of Trichoderma in both plant tissue and population in the soil is very influential on plant growth. Based on the calculation the average population of Trichoderma in soil is 16,67 x 10-3 propagule / g soil (without application of Trichoderma), 30,00 x 10-3 propagule / g soil (Trichoderma application).

IV. Results

Further test results of the number of tillers, weight of wet bulb, weight of dried tubers, weights of wet trim, and weight of dry-cut red onion plant can be seen in **Table 5** and **Table 6**.

Table 5. The Average Number of Tillers, Weight of Wet Bulb, Weight of Dry Bulb, Red Onion on Each Treatment of indigenous mycorrhizal Dose at Age 7 hst to 35 hst.

Indigenous Mycorrhizal Dose (g/plant)	Number of Tillers /Clump	Wet Bulb Weight (kg/plot)	Weight of Dry Tub (kg/plot)	Weight of Wet Stretch (kg/plot)	Dry Standing Weight (kg/plot)
0	8,38 c	5,88 d	5,27 d	7,57 d	6,41 d*)
10	9,48 b	7,84 c	7,35 c	9,39 c	8,39 c
20	9,73 ab	8,47 b	7,99 b	9,94 b	8,96 b
30	10,12 a	9,12 a	8,64 a	10,60 a	9,62 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test

Table 5 shows that the treatment indigenous mycorrhizal has significant effect on the number of tillers, wet bulb weight, dried tuber, wet trim and dry-cut onion plants. This is seen in the number of tillers, wet tuber weight, dried tuber, wet and dry trimming of onion plants which is given indigenous mycorrhizal tend to be higher compared to the treatment of 0 g/ plants indigenous mycorrhizal (control). The dose indigenous mycorrhizal which gave the highest value in all variables was 30 g / plant dose that is the number of tillers (10,12 / clump), wet bulb weight (9.12 kg / plot), dried bulb (8.62 kg / plot) wet Trim (10.60 kg / plot) and dry Trim (9,62 kg / plot). This is in line with the opinion Sastrahidayat (2011) that the plants which is given indigenous mycorrhizal give significant effect on the number of tillers and weight of plants compared to plants without giving indigenous mycorrhizal. Furthermore, based on Kementan (2003) the number of tillers of varieties Keta Monca is 3-6 tubers, while based on the data above the number of tillers applied with indigenous mycorrhizal is 9-10 tuber, thus indigenous mycorrhizal although applied independently it can still increase the number of Onion's tillers variety of Keta Monca.

The increase of tuber weight in plants which is given indigenous mycorrhizal is assumed due to the increase of the amount of nutrients P which is available in the soil. Based on the analysis of soil samples, the amount of P-available on the treatment of indigenous mycorrhizal was 32.91 ppm greater than the treatment without the indigenous mycorrhizal (control) of 10.86 ppm. The nutrient elements P play a significant role in the formation of plant generative parts. As, Lingga (1989) suggests that the nutrients of P act in the formation of flowers, fruits, seeds and roots, especially root seeds and young plants.

The increase of weight of wet and dry Trim on red onion plant is caused by good symbiosis between plants and indigenous mycorrhizal in absorbing nutrients. As Purba (2005) suggested that symbiotic of crops with indigenous mycorrhizal have very important role in improving phosphorus uptake, plant growth, and yield. Drew (2003) also reported that the increase of plant weight is due to external hyphae activity from the indigenous mycorrhizal which is able to absorb water in the soil pores when the roots of the plant are no longer able to absorb water. The external hyphae diameter is much smaller than the root's diameter which allows them to penetrate the soil micro pore to obtain water and nutrients that cannot be reached by the roots.

Table 6. The Average Number of Tillers, Weight of Wet Bulb, Weight of Dry Bulb, Red Onion Plant at Any Treatment Dose of Bioactivator Trichoderma spp. At Age 7 hst to 35 hst.

Dosage of Bioactivator Trichoderma spp. (G / plant)	Number of Tillers /Clump	Wet Bulb Weight (kg / plot)	Weight of Dry Tub (kg/plot)	Weight of Wet Stretch (kg/plot)	Dry Standing Weight (kg/plot)
0	8,64 b	6,39 c	5,77 c	8,09 c	6,93 c*)
5	9,45 a	7,80 b	7,31 b	9,36 b	8,32 b
10	9,60 a	8,05 ab	7,57 ab	9,57 ab	8,58 ab
15	9,66 a	8,31 ab	7,83 ab	9,81 ab	8,82 ab
20	9,77 a	8,59 a	8,09 a	10,05 a	9,08 a

*) The numbers followed by the same letter in the same column are not significantly different in the 5% BNJ test.

Based on **Table 6** it is shown that the Bioactivator Trichoderma spp. gives significant effect on the number of tillers, weight of wet bulb, dried tuber, wet trim and dry-cut onion plants. This is seen in the number of tillers, weight of wet bulb, dried tuber, wet and dry trim onion plants which is given bioactivator Trichoderma spp. tends to be higher than the 0 g / plant indigenous mycorrhizal (control). The dose indigenous mycorrhizal which gave the highest value on all variables was dose of 30 g/plant, the number of tillers (9.77 / clump), weight of wet bulb (8.59 kg / plot), dried bulb (8.09 kg / plot) wet trim (10.05 kg / plot) and dry trim (9.08 kg / plot).

The presence of Trichoderma spp. in plant tissue has an important role in improving the weight of trim because Trichoderma is able to stimulate plants to produce growth hormones. As Roco and Perez (2001) suggest, Trichoderma harzianum fungus is able to stimulate plants to produce certain hormones such as gibberellin acid (GA3), indolacetic acid (IAA), and benzylaminopurin (BAP) in large quantities. Gibberellin hormone and auxin hormone in plants act in root and stem elongation, stimulate flowering, fruit growth and promote plant growth.

Based on the above data, the highest yield of fresh onion‘s bulb variety of Keta Monca indigenous mycorrhizal effect of 15.2 tons / ha (dose 30 g/plant indigenous mycorrhizal) and the lowest yield of 9.8 ton/ha (dose 0 g /plant indigenous mycorrhizal), while the highest yield of fresh onion bulb varietiy of Keta Monca is the influence application of Bioactivator Trichoderma spp. of 14.32 ton/ha (dose 20 g/plant bioactivato Trichoderma spp.) and lowest yield of 10.65 ton/ha (dose 0 g/plant bioactivator Trichoderma spp). On dry bulb the highest yield of onion variety of Keta Monca of application of indigenous mycorrhizal by 14,44 ton/ha (dose 30 g/plant indigenous mycorrhizal) and lowest yield 8,78 ton / ha (dose 0 g /plant indigenous mycorrhizal), while highest yield of dried onion bulb variety of Keta Monca influence of application of bioactivator Trichoderma spp. of 13.48 ton/ha (dose 20 g/plant Trichoderma spp.) and the lowest yield was 9.62 (dose 0 g/plant Trichoderma spp biofactor). Based on Kementan (2003), the potential of dried onion’s root yield variety of Keta Monca per hectare is 10.7 tons / ha, thus the application of indigenous mycorrhizal fertilizers and bioactivators Trichoderma spp. independently still able to increase yield of onion variety of Keta Monca on dry land.

The effects of bioactivators Trichoderma spp. to the Number of indigenous mycorrhizals’ spores and Root Infections on Plants However, the amount of indigenous mycorrhizals’ spores and root infections that were applied with the bioactivator Trichoderma spp. tends to be higher compared to application without the Bioactivator Trichoderma spp. Amount of indigenous mycorrhizals’ spores and root infections due to the effect of applying Bioactivator Trichoderma spp. can be seen in **Figures 1** and **2**.

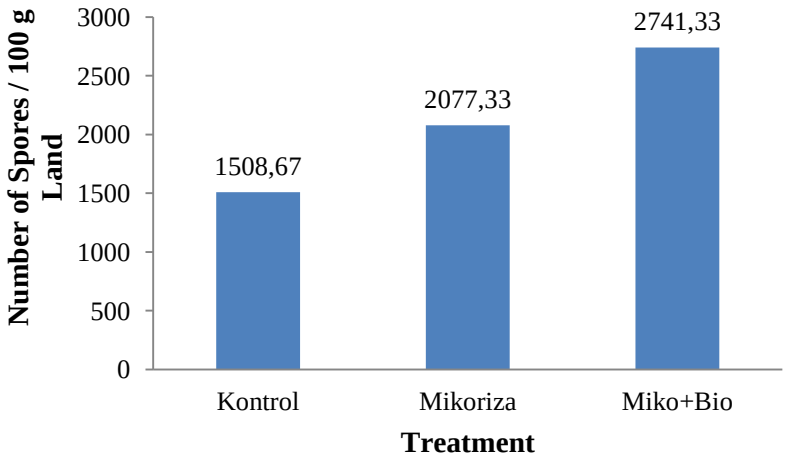


Figure 1. The Number of indigenous mycorrhizals’ Spores / 100g of Soil on the Treatment of Trichoderma spp.

Figure 1 shows that the amount of indigenous mycorrhizal/ 100 g of soil increases due to the treatment of Bioactivator Trichoderma spp. this means with the addition of the bioactivator Trichoderma spp. gives positive influence on the increase of the number of indigenous mycorrhizal' spores. It is suspected that the addition of bioactivator Trichoderma spp may trigger an increase in the amount of indigenous mycorrhizals' spores. It implies an indirectly increased indigenous mycorrhizal infection in plant's root. As Astiko (1997) suggests that the higher the number of indigenous mycorrhizals' spores in the soil will lead to higher degree of infection in plant's root.

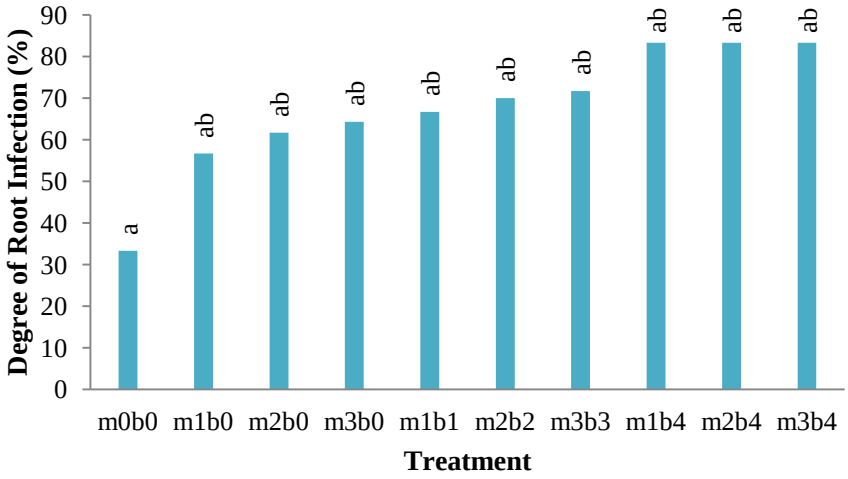
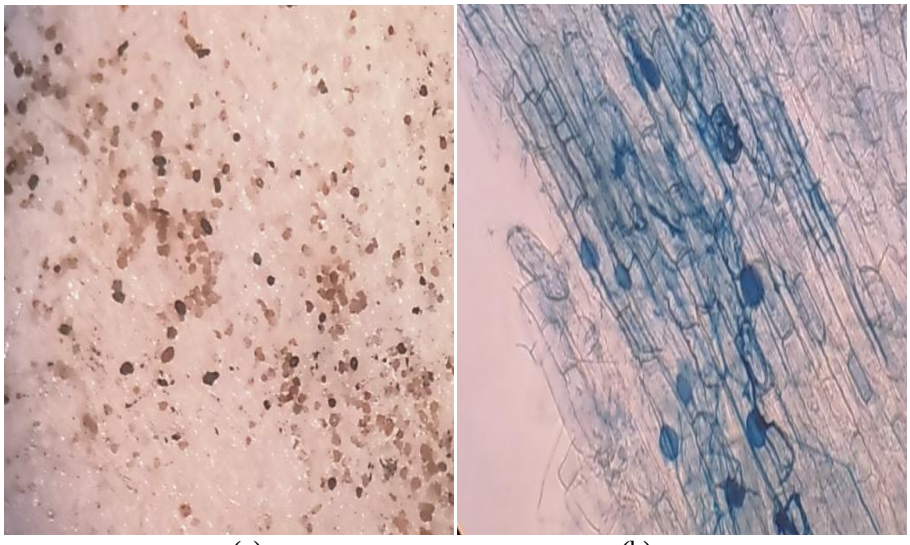


Figure 2. Degrees of Root Infection Due to the Effect of Bioactivator Trichoderma spp.

Figure 2 shows that the degree of indigenous mycorrhizal infection is higher with the addition of Bioactivator Trichoderma spp., although it does not have significant effect. The indigenous mycorrhizal infection of plant's root determines the amount of propagule in the soil. As Astiko (1997), the increased degree of indigenous mycorrhizal infections in plant's root strongly correlates to the increased formation of indigenous mycorrhizals' propagules in the soil, which also determines the potential for inoculum in the soil.



(a) (b)

Figure 3.
a) Indigenous mycorrhizal period of screening results
b) Indigenous mycorrhizal on the roots of red onion plant variety of Keta Monca

The Influence of indigenous mycorrhizal toward Population Trichoderma spp. in the Land
Population of propagules Trichoderma spp. the effect of applying indigenous mycorrhizal can be seen in **Figure 4**
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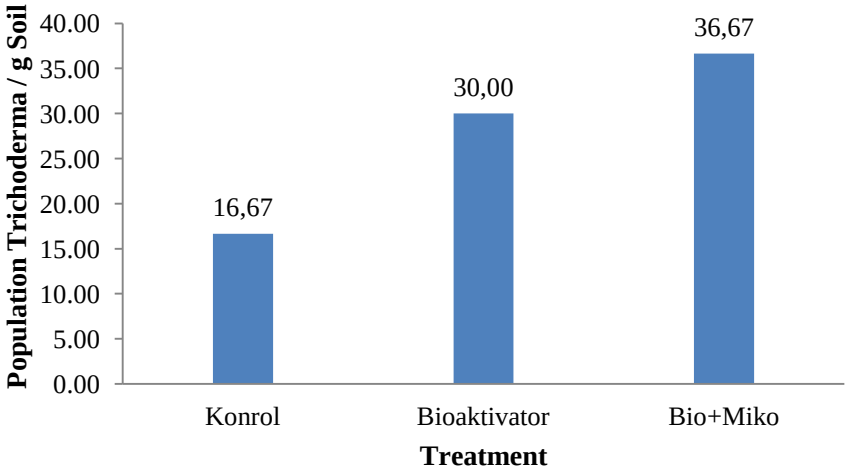

Figure 4. Population Trichoderma spp / g soil

Figure 4 shows that the amount of Trichoderma spp /g propagules of soil increases due to indigenous mycorrhizal application. This means that the addition of indigenous mycorrhizal has positive effect on increasing the amount of propagules of Trichoderma spp. It is surmised that the addition of indigenous mycorrhizal may trigger an increase in the amount of propagules of Trichoderma spp. This fact is in line with Astiko (2015) and Cruz (1990) that indigenous mycorrhizal is able to increase the activity of beneficial microbes to be better developed.

V. Conclusion

Conclusion

Based on the results of analysis and discussion that is limited to the scope of this study, it can be concluded that: Application of indigenous mycorrhizal and Bioactivator Trichoderma spp were able to increase the growth of onion plants in comparison with the control of the dose treatment of 30 g / plant indigenous mycorrhizal with increased of plant height 6, 64%, increase of number of leaves 7,72% and treatment of dose 20 g / plant bioactivator Trichoderma spp which is increase the plant's height 4,70%, increase number of leaves 5,67%. The application of indigenous mycorrhizal and Bioactivator Trichoderma spp was able to increase the yield of onion crops in comparison with the control in which dosage of treatment 30 g /plants indigenous mycorrhizal with 20,76% increase of tiller, increase weight of wet bulb 55,10%, increase of dry tuber 63,95 %, increase weight of wet trim 40.03%, increase weight of dry trim 50,08%, and dose treatment of 20 g / plant Trichoderma spp Bioactivator with 11.57% increase of tiller, increase weight of wet bulb 34.43%, increase of dry tuber 40,21%, increase weight of wet trim 24,23%, increase weight of dry trim 31,02%.

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