International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 6, Issue 6
December, 2019
Pages: 509-525

Application of Liquid Bioactivator Contains Trichoderma Spp. and Elements of Boron (B) as Growth of Growth and Improvement of Red Onion (Allium Cepa L.) Results

Dwi Haryati Ningsih, I Made Sudantha, Suwardji

Land Dry Masters Program, Mataram University, Indonesia

http://dx.doi.org/10.18415/ijmmu.v6i1.1042

Abstract

The purpose of this study was to determine whether there is an interaction between the use of Trichoderma Bioactivator spp. with boron, see if the bioactivator Trichoderma spp. able to spur growth and be able to increase the productivity of onion yields, and see whether the addition of boron (B) can spur growth and can increase the productivity of onion yields. The method used in this study is an experimental method in the field. The research was carried out in the Pengangget Village, Senteluk Village, Batulayar Subdistrict, West Lombok and at the Microbiology Laboratory of the University of Mataram. The material used in this study was shallot (Allium cepa L.) type of Keta monca variety, Trichoderma spp. in the form of T. harzianum (SAPRO-07 isolate), and boron type di-Sodium Tetraborate Decahydrate. To find out the difference in growth and yield of shallots (Allium cepa L.) using biochemical activator Trichoderma spp. and boron, it is used a variety analysis test with a significance level of 5% using the application of Minitab 16, if the results of the analysis show a real difference then a further test using BNJ at the same level. The results showed that: 1) From the research carried out it was found that the administration of Trichoderma spp. and boron can stimulate plant growth and be able to increase the yield of onion productivity. 2) Provision of Trichoderma biopivator spp. and boron has a significant effect between each treatment, both in terms of the various dose doses that exist in each treatment. Provision of Trichoderma spp. and boron also have a significant effect on each variable of onion growth in the form of; plant height, number of leaves, number of tillers (tubers), wet weight and dry weight of onion, total population of Trichoderma spp., total boron content and an increase in the amount of nutrients in soil characteristics. 3) There is no interaction between the administration of Trichoderma spp. and boron as a trigger for the growth of shallots on various growth variables; plant height, number of leaves, number of tillers (tubers), wet weight and dry weight of onion, population of Trichoderma spp., and total boron content. 4) Bioactivator Trichoderma spp. with the highest dose of 20 ml and boron with a concentration of 0.238 g / cm3 can increase the amount of nutrients, including; organic C content as much as 0.83%, total N as much as 0.076%, P is available 110.76 ppm, K is exchanged by 77.73 meq%, soil pH is 7.21 and soil CEC is 14.12 meq%.

Keywords: Liquid Bioactivator; Trichoderma spp; Boron (B) Element; Shallot (Allium cepa L.)

Introduction

Shallot (Allium cepa L.) is one of the horticultural commodities that plays an important role in agriculture in Indonesia. Shallots are ranked second after chili plants which are always needed by the Indonesian people in processing various food preparations and as meeting food needs. Nurul (2017), revealed that shallots are included as a strategic commodity which is one of the biggest contributors to domestic inflation, besides rice, red chili, chicken, and beef.

The participation rate of shallot consumption at a low level of 84.21% and at a high level of 92.30% and with a population of Indonesia of approximately 265 million people causes the national demand for shallots to continue to increase. Participation of shallot consumption will continue to increase in line with the increasing population in Indonesia (Soedjana, 2013).

In West Nusa Tenggara (NTB) at present the production of shallots occupies the fourth position of the top ten producing regions of shallots. According to the Central Statistics Agency (BPS, 2017) noted that the NTB Province in 2015 produced 117.51 tons / ha of shallots from the harvested area of 11,518 ha. The highest production was achieved by Bima Regency with a total of 89.07 tons / ha, mostly 13 of 18 districts in Bima Regency were the centers of onion production in Indonesia. Potential land that can be used for the development of shallots consists of 12,644 ha of paddy fields and dry land with a potential yield ranging from 98-130 tons / ha per year. So far, only 5,311 ha of land have been utilized with yields reaching 63.7 tons / ha per year, or around 50% of the potential yield. (BPS, 2015). In 2016, the onion productivity data in NTB, namely 109.9 tons / ha, decreased by 0.38% compared to 2015, while the average productivity data of shallots in Indonesia reached 96.77 tons / ha per year. Onion productivity data in NTB is still below the national standard or its productivity is still relatively low (BPS, 2017).

The causes of low onion productivity in NTB are; 1.) low soil quality factors (low nutrients) and limited water availability. 2.) environmental factors: such as climate change (rainfall and temperature), 3.) biological factors: in the form of pests and diseases onions, 4.) socio-economic conditions both internally (human resource constraints) and externally (input and output marketing, and institutional development), 5.) the final factor affecting land conditions (land type and land slope) (Maryam, 2014).

Therefore it is necessary to conduct research aimed at increasing the productivity of shallots, one of which is to increase the availability of seed sources, especially by using superior seeds / seeds that have gone through a selection process that is protected from pests and diseases and efforts to improve the application of production technology (Soetiarso , 2009).

The application of technology that is easy, inexpensive and locally available material on dry land has been widely applied in several previous studies, for example;Effect of Boron Dose and Determination of Correct Plant Segments for Production of Hybrid Melon Seeds by Sarah Fadila (2015), Effectiveness of Trichoderma spp. Against Chili Growth (Capsicum annum L.) by Setyadi Dedy (2017), and other studies. But the fact of the field shows that farmers still do not take advantage of the application of existing technology. The cause of the less optimal application of these technologies is because; 1) lack of understanding in the application of technology due to the low level of education of farmers, 2) limited capital, 3) weak guidance from related institutions, 4) lack of access to information, especially in remote areas. Therefore, efforts to increase the productivity of shallots can be done by using engineering of several biological technologies at a cost that is more affordable, easy and relatively inexpensive. One of the biological engineering technology is by making biocompost and bioactivators. Biocompost and bioactivators themselves can be made by utilizing parts of living things such as plants and animals. Biocompost and bioactivator can be processed by utilizing one of the types of fungi (fungi) namely Trichoderma spp. Fungus, and the provision of borate micro boron type nutrients (di-Sodium Tetraborate Decahydrate) to increase the productivity of shallots (Sumarni & Hidayat, 2005).

Trichoderma mushroom spp. is a type of fungus that is included in the Deutromycetes class. Usually commonly found in forests or on agricultural land or on woody substrates. Trichoderma spp. also known as biofungicides and bioactivators (Cartika et al., 2016). Trichoderma mushroom spp. can also be used as a compound that can spur growth in plants. As stated by Sudantha and Suwardji (2013), the fungus Trichoderma spp. which can function as a source of nutrients for plants and a source of energy for soil microorganisms, can improve soil properties, increase the binding capacity of sandy soils, improve soil structure so that the clay is lighter, enhance the ability of the soil to bind water, improve drainage and air conditioning on the soil weight, so the soil temperature is more stable, helping plants grow and develop better.

Sudantha et al. (2011), said that the use of rice straw biocompost and leaf litter of fermented T. koningii isolates ENDO-02 and T.harzianum isolates SAPRO-07 can spur soybean flowering time faster and increase the number of filled pods. Boron is one of the essential micro nutrients for plants because of its role in the development and growth of new cells in the maristematic tissue, flowering and fruit development. Because the presence of boron in the soil is small, increasing the onion productivity of boron fertilizer is needed in addition (Syukur, 2005).

According to the results of Sudaryono's research (2017), boron fertilization affects vegetative growth (plant height and number of leaves) at 30 and 45 HST, whereas at 15 HST it has no effect. At 30 HST and 45 HST, the increasing dose of boron fertilizer, the growth of onion plants indicated by plant height is higher. At a dose of 6 kg / ha boron fertilizer, the highest yield of shallots, both at 30 DAP and 45 DAP. That fact shows that boron nutrients have a specific function in sustaining plant growth and development. But on the contrary, boron deficiency in plants can cause stunted germination, stunted root growth, sclorosis and necrosis in shoots (Utami, 2015).

Based on some of the problems mentioned above, it is very important to conduct research on "Application of Liquid Bioactivators Containing Trichoderma spp. and Boron (B) as a Booster for Growth and Increasing of Shallots (Allium cepa L.) ".

Methodology

The method used in this study is an experimental method in the field. The study was conducted on 10 November 2018 - 10 February 2019. The research site was conducted in the Pengangget Hamlet of Senteluk Village, Batulayar Subdistrict, West Lombok and at the Microbiology Laboratory of the University of Mataram. The material used in this study was shallot (Allium cepa L.) type of Keta monca variety, Trichoderma spp. in the form of T. harzianum (SAPRO-07 isolate), and boron type di-Sodium Tetraborate Decahydrate. Other research preparation materials in the form of; PDA medium, streptomycin antibiotics, agar, aluminum foil, alcohol, plastic, aquadest, cotton, and others. While the research tools used are; erlenmeyer, petri dish, Laminar Air Flow cabinet, concise, measuring cup, autoclave, test tube, oven, ent needle, microwave, hoe, polybag size 35 x 35 cm, hand spatula, rope, ruler, sprayer, water hose and others- other.

This research uses a completely randomized design (CRD) with 2 (two) level factorial experiments. The first factor, boron has 2 (two) levels:

D0 = without Boron
D1 = with Boron (concentration as much as 0.238 g / cm3, if using the standard calculation of 6 kg / ha). (Calculations can be seen in the appendix).

The second factor is the bioactivator dose of Trichoderma spp. (liquid form) that has been fermented with Trichoderma spp. with 5 (five) levels;

T0 = without bioactivator
T1 = 5 ml bioactivator, with a population of 6.5 x 107 / ml.
T2 = 10 ml bioactivator, with a population of 13 x 107 / ml.
T3 = 15 ml bioactivator, with a population of 19.5 x 107 / ml.
T4 = 20 ml bioactivator, with a population of 26 x 107 / ml.

Making PDA (Trichoderma spp. Mushroom media) is done by preparing ingredients such as potatoes, agar, dextrose. Furthermore, potatoes are cut into small sizes and boiled and taken water, weighing agar and dextrose as much as 4 g each. Then the three ingredients are placed in an erlenmeyer and covered with cotton and aluminum foil and put into the oven leave for 2-3 days until the media hardens. After a few days, the media material is diluted again by microwave and poured on a petri dish, then the media is ready for use. Propagation of Trichoderma spp. done by isolating Trichoderma spp. which has been in previous research. Propagation is done by taking a small part of the fungus and put it on the PDA growing media.

Use of Trichoderma spp. carried out in liquid or suspension form, as for how to change Trichoderma spp. in the form of suspension as follows: insert sterile water (aquadest) into a petri dish containing Trichoderma spp., taken by Trichoderma spp. by using a brush to mold spores Trichoderma spp. release, then do the filtering and put into a container. Trichoderma spp. Suspension density used 107. If suspension Bioactivator Trichoderma spp. was ready, then the thing to do was to calculate the population density of the Trichoderma spp suspension. according to the formula as follows;

Population Density = Average Number of Spores x 2,5 x 10^5

Then from the population density formula above will produce the final density that will be used is the suspension density 10^7. The formulation used in this research is boron type di-Sodium Tetraborate Decahydrate (molecular weight 381.37 ml / mol), with the formulation of the boron requirement formula as follows (personal communication with Suwardji, 2018);

Total Boron per Ha = 100 x 100 m (Size Per Ha) x 0.01 m (topsoil soil depth) x 1.26 (Soil Volume Weight)

Then, $\frac{\text{Weight of land used}}{\text{The weight of boron union Ha}}\ x$ Boron standard used

The research was conducted at the screenhouse, the preparations made were clearing the land from weeds and remnants of previous planting, making a screenhouse, screenhouse area adjusted to the planting land, sifting the soil to be used in growing plants in polybags, then preparing tools and materials that are used. used in planting, namely polybags measuring 35 x 35 cm, varieties of red Keta monca, Trichoderma spp. solution, boron in the form of liquid borate that has been in the form of suspension. Sterilization and solarization are carried out on the soil that will be used for planting in polybags with the aim that the soil is not contaminated with harmful fungi and bacteria. To find out the difference in growth and yield of shallots (Allium cepa L.) using biochemical activator Trichoderma spp. and boron, then it is used a variety analysis test with a significance level of 5% using the application of Minitab 16, if the analysis results show a real difference then a further test using BNJ at the same level.

Result and Discussion

Effect of Trichoderma Bioactivator spp. and Boron Against Plant Height

The results of observations and analysis of the diversity of the influence of the administration of Trichoderma spp. and boron administration to plant height can be seen in Appendix 7. The results of the diversity analysis show that there is no interaction between the administration of Trichoderma spp. bioactivators. and administration of boron at the age of 7 days after planting (HST) to the age of 35 HST. The results of further tests giving Trichoderma spp. on the average plant height using BNJ at 5% level can be seen in Tables 1 and 2.

Table 1. Results of ANOVA analysis on plant height parameters by giving biochivator Trichoderma spp.

Treatment	Age of Observation				
	7 hst	14 hst	21 hst	28 hst	35 hst
Without Trichoderma spp.	8,33 a*)	20,50 a*)	27,00 a*)	30,00 a*)	33,00 a*)
Trichoderma spp. (5 ml dose) / poly bag	10,50 ab	22,50 ab	29,50 ab	31,00 ab	34,67 ab
Trichoderma spp. (10 ml dose) / poly bag	11,33 ab	23,17 ab	29,50 ab	32,17 ab	36,67 ab
Trichoderma spp. (15 ml dose) / poly bag	11,33 ab	24,00 b	31,33 ab	34,50 ab	36,67 ab
Trichoderma spp. (20 ml dose) / poly bag	12,16 b	24,67 b	32,33 b	34,83 b	37,83 b
BNJ 5%	1,72	3,29	4,36	4,57	3,68

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of further test analyzes of the influence of Trichoderma spp. in Table 1 for plant height shows that the administration of Trichoderma spp. at various dosage levels can increase plant height ie without Trichoderma spp. (control), 5 ml (population 6.5 x 107 / ml), 10 ml (population 13 x 107 / ml), 15 ml (population 19.5 x 107 / ml) and 20 ml (population 26 x 107 / ml) ml) Trichoderma spp. per polybag. In general, at the age of 7, 14, 21, 28 and 35 days after the treatment of Trichoderma spp. doses of 5 ml, 10 ml, 15 ml and 20 ml can significantly increase plant height by 45.97% compared to control treatments. Whereas the treatment of Trichoderma spp. doses of 5 ml, 10 ml, and 15 ml were found to be plant height results that were not significantly different and were obtained with a percentage of 29.8%. However, the bioactivator treatment of Trichoderma spp. dose of 5 ml, 10 ml and 15 ml significantly affected plant height by 17.26% compared to the 20 ml dose of Trichoderma spp bioactivator.

Effect of Trichoderma spp. of plant height due to the fungus Trichoderma spp. has the nature as a growth booster. According to Sudantha (2011), that saprophytic mushroom Trichoderma spp. secrete chemical substance or hormone that is being dissused into plant tissue which can stimulate plant height growth. Trichoderma spp. secretes active substances such as auxin which can stimulate lateral root formation. Furthermore according to Suwahyono (2004) states that plant growth including its roots is the result of division of meristem cells and division of cells resulting from division. In addition according to Cornejo et al. (2009), explaining Trichoderma sp. able to produce auxins such as IAA. This hormone can increase lateral root growth, multiply shoots and increase biomass from shoots in plants. This is consistent with the opinion of Haryuni (2013), that Trichoderma sp. is a filamentous fungus that is mesophilic, not pathogenic, has the ability to hydrolyze cellulose and hemicellulose to glucose and xylose. This fungus is widely used to produce cellulase enzymes thereby increasing plant biomass.

Furthermore Barus (2017) research results, comparing the effect between Trichoderma harizianum, Trichoderma koningii, and Trichoderma viridiae on the height of potato plants at the age of 4, 6, 8 and 10 weeks after planting. The study showed that significantly different results on the height of potato plants were 36.94 cm, 49.00 cm and 62.05 cm, respectively (Nurahmi, 2012). This is consistent with the current research.

In the study of curly red chilli plants conducted by Pratama et al. (2015), showed that in all observation periods, the average height of chilli plants given Trichoderma spp. higher than those not given Trichoderma spp. Effect of Trichoderma spp. which occurred from the age of 9 weeks after observation of plant height due to the influence of Trichoderma spp. start happening at that age.

Effect of Trichoderma spp. more evident in the vegetative period before plants form flowers and bulbs on onions, the statement is in line with research by Sudantha (2010) which says that endophytic fungi in soybean plant tissue play a greater role in stimulating vegetative growth compared to generative. In contrast, saprophyte fungi play a greater role in stimulating generative growth compared to vegetative growth. In terms of the role of T. koningii endophytic fungi ENDO-02 isolates in soybean plant tissue stimulates ethylene in stimulating cell elongation so that plant height increases, whereas saprophyte T. harzainum isolate SAPRO-07 isolates in the rhizosphere or soybean root region release ethylene which is diffused into the plant plant body through xylem which has the role of spurring generative growth.

Table 2. Results of ANOVA analysis on plant height parameters by boron administration

Treatment	Age of Observation				
	7 hst	14 hst	21 hst	28 hst	35 hst
Without boron	9,53 a*)	21,20 a*)	28,00 a*)	30,87 a*)	33,60 a*)
Boron (0,238 g/ polybag)	12,13 b	24,73 b	31,87 b	34,13 b	37,93 b
BNJ 5%	1,06	1,42	0,42	1,98	1,57

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

Table 2 above shows that the treatment of boron at the age of 7, 14, 21, 28 and 35 HST can significantly increase plant height by 16.23% compared to the treatment without boron (control). This is due to the role of boron as a growth booster. Boron is known to stimulate cell growth and stimulate increased levels of auxin in plants. As stated by Dordas (2006), boron is a micro-nutrient source that acts as a faster carbohydrate traffic booster, so that if in low boron levels it is necessary to add boron in order to increase the movement of assimilates for plant growth and development. In the research of Azza et al. (2006), the use of boron application as much as 2 kg per hectare was able to increase the height of shallot plants up to 21.78 cm, the highest compared to the control of 18.49 cm and other boron doses. Boron has an important role in cell elongation and division and transpiration. The same thing happened to the increase in sunflower plant height which increased due to boron doses of 8 kg per hectare, but the increase in sunflower plant height decreased with the addition of a boron dose of 12 kg per hectare. It is suspected that the use of too high a dose of boron causes poisoning and inhibits plant growth. From the results of several studies related to the above boron dose, the dose used in this study is in accordance with the internationally permitted range of 6 kg which can increase plant height and not cause a decrease in plant height (Oyinlola, 2007).

Effect of Trichoderma Bioactivator spp. and Boron Against the Number of Leaves

The results of observations and the results of the analysis of the diversity of the influence of the administration of Trichoderma spp. and boron on the number of plant leaves can be seen in Appendix 7. The results of the diversity analysis show that there is no interaction between the bioactivator

Trichoderma spp. and boron to the number of leaves at the age of 7 days after planting (HST) to age 35 HST. The results of further tests of the average number of leaves using BNJ at 5% can be seen in Tables 3 and 4.

Table3.Results of ANOVA analysis on the number of leaf parameters by giving biochivator Trichoderma spp.

Treatment	Age of Observation				
	7 hst	14 hst	21 hst	28 hst	35 hst
Without Trichoderma spp.	8,33 a*)	14,50 a*)	16,83 ab*)	18,67 a*)	15,33 a*)
Trichoderma spp. (5 ml dose) / poly bag	10,83 ab	15,17 ab	16,67 a	20,33 ab	`18,50 ab
Trichoderma spp. (10 ml dose) / poly bag	11,00 ab	16,17 bc	18,50 ab	21,67 ab	20,67 ab
Trichoderma spp. (15 ml dose) / poly bag	11,33 ab	17,50 bc	20,83 ab	23,00 b	20,33 ab
Trichoderma spp. (20 ml dose) / poly bag	11,83 b	18,17 c	21,83 b	24,00 b	22,33 b
BNJ 5%	3,16	2,31	5,47	3,93	5,90

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of the average analysis of the number of leaves in Table 3 show that, at the ages of 7, 14 and 35 HST, the bioactivator treatment of Trichoderma spp. doses of 5 ml, 10 ml and 15 ml and 20 ml can increase the number of leaves that differ markedly by 42.01% compared to control treatments. However, the bioactivator Trichoderma spp. doses of 5 ml, 10 ml and 15 ml were found to have no significant effect and were able to increase the number of leaves by 29.8%. Furthermore, bioactivator Trichoderma spp. dosages of 5 ml, 10 ml and 15 ml were significantly different by 18.03% of the number of leaves compared to the dose of 20 ml of bioactivator Trichoderma spp.

At the age of 21 HST, it was found that in the bioactivator treatment Trichoderma spp. at a dose of 5 ml can significantly increase the number of leaves by 29.07% compared to control treatments. But the bioactivator treatment of Trichoderma spp. doses of 10 ml and 15 ml had no significant effect with a percentage of 23.17% compared to control treatments. Likewise, the treatment of Trichoderma spp. doses of 10 ml and 15 ml significantly affected 15.65% of the number of leaves compared to the bioactivator Trichoderma spp. dose of 20 ml.

Another case occurred at the age of 28 HST, that the bioactivator treatment of Trichoderma spp. dose of 5 ml, 10 ml, 15 ml, can increase the number of leaves significantly by a percentage of 28.54% compared to the dose of 20 ml of Trichoderma bioactivator spp. In Trichoderma bioactivator spp. doses of 5 ml and 10 ml were not significantly different and were able to increase by 24.81% of the number of leaves, in the bioactivator Trichoderma spp. doses of 15 ml and 20 ml were also found to be not significantly different effects and were able to increase by 17.08% on the number of leaves.

The increase in results is in accordance with the results of Yudha's research (2016), that the treatment of Trichoderma spp. onion isolates and banana root isolates significantly affected the number of leaves compared to control and fungicide treatments. Trichoderma spp. onion isolates and banana root isolates were able to increase the number of plant leaves by 18.12% compared to controls. Trichoderma spp. as a biological agent able to increase the growth of caisin plants, according to another statement stated by Rahayuniati and Mugiastuti (2009), that if Trichoderma spp. able to decompose organic matter in the soil media, so that it is converted into a much simpler structure, easily dissolved and can be used by plants as a source of nutrition for plant growth. Another opinion by Azamri et al. (2011), that giving

Trichoderma spp. can increase the number and width of leaves and can increase chlorophyll content in leaves and seeds.

Table 4. Results of ANOVA analysis on the number of leaf parameters by boron administration

Treatment	Age of Observation				
	7 hst	14 hst	21 hst	28 hst	35 hst
Without boron	9,40 a*)	13,67 a*)	16,33 a*)	18,13 a*)	16,93 a*)
Boron (0,238 g/ polybag)	11,93 b	18,93 b	21,53 b	24,93 b	21,93 b
BNJ 5%	1,36	1,01	2,40	1,01	2,58

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of the analysis in Table 4 show that administration of boron at the age of 7, 14, 21, 28 and 35 HST can significantly increase the number of leaves by 32.85% compared to the treatment without boron.

This is because boron provides stimulation in stimulating cell growth, especially in leaf buds contained in onion seed tubers, so the higher the boron content, the more leaves will grow. If the increasing number of leaves, the process of photosynthesis progresses more and the production results increase. Like the research conducted by Sarah (2015), boron application of 2 kg per hectare was able to increase the number of leaves of melon plants by 11.7 strands from before the boron treatment. While the use of boron applications with a dose of 3 kg per hectare only increases the number of leaves by 8.1 strands. This condition is caused by the availability of boron in the soil is too high for vegetative growth of plants, so that the boron available in the soil is sufficient. Conversely, if the availability of boron in the soil a little it will inhibit the growth process in plants, especially leaves. Young leaves can experience chlorosis on the surface of the lower leaves and then spread to all edges of the leaves until the leaf tissue dies. New leaves that are still small cannot develop, causing growth to become stunted (Setiawan, 2010).

Effect of Trichoderma Bioactivator spp. and Boron Against the Number of Tillers (Tubers)

The results of observations and analysis of the various effects of giving Trichoderma spp. and boron on the number of tillers (tubers) of onions can be seen in appendix 7. The results of a variety of analysis indicate no interaction between the bioactivator Trichoderma spp. and boron to the number of tillers. The results of further tests of the average number of tillers using BNJ at the 5% level are seen in Tables 5 and 6.

Table5.Results of ANOVA analysis on the number of tillers parameters by giving biochivator Trichoderma spp.

Treatment	Observation Results (Bulbs)
Without Trichoderma spp.	8,33 a*)
Trichoderma spp. (5 ml dose) / poly bag	10,33 ab
Trichoderma spp. (10 ml dose) / poly bag	10,66 ab
Trichoderma spp. (15 ml dose) / poly bag	11,66 ab
Trichoderma spp. (20 ml dose) / poly bag	12,66 b
BNJ 5%	3,68

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of the analysis in Table 5 show that, the bioactivator treatment of Trichoderma spp. on the number of tillers at 5 ml, 10 ml, 15 ml and 20 ml doses can significantly increase the number of tillers by 34.20% compared to control treatments. But between the bioactivator treatment Trichoderma spp. dose of 5 ml, 10 ml and 15 ml found no significant effect with a percentage of 29.19%, while in the bioactivator Trichoderma spp. dose of 5 ml, 10 ml, 15 ml significantly affected 15.78% of the amount of shallots tillers compared to the treatment dose of 20 ml Trichoderma spp bioactivator.

From the results of this percentage, it can be seen the use of Trichoderma spp. can increase the number of tillers more than without using the bioactivator Trichoderma spp. That is because the absorption ability of nutrients is more optimal if using Trichoderma spp. so that it can produce more number of tillers in onions. As stated by Berlian and Rahayu (2004), that in each tuber there will be new shoots of plants. For the development of these new shoots requires a lot of nutrients for food reserves and tuber enlargement, while the ability to absorb nutrients depends on the ability of cells and plant genes to carry out the absorption process. Other studies according to Fatchullah et al. (2018), suggested that the number of shallots tubers increased by the use of NPK fertilizer application with a dose of 250 kg per hectare with a combination of Trichoderma spp. + Aspergillus is 16.00 pieces. Whereas when using Trichoderma spp. Biofertilizers, the tuber weight per clump of onion plants and the total weight of onion bulbs significantly increased. Trichoderma spp. proven to help extract nutrients and water so that the growth and yield of individual tuber weights, tuber weights per plant, and total tuber weights increase.

Table 6. Results of ANOVA analysis on the number of tillers by boron administration

Treatment	Observation Results (Bulbs)
Without boron	9,00 a*)
Boron (0,238 g/ polybag)	12,46 b
BNJ 5%	1,57

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of the analysis in Table 6 show that the treatment of boron significantly affected 38.44% of the number of shallots tillers compared to the control treatment (without boron).

The results of this study are consistent with research conducted by Rosliani (2013) on chili plants, that boron with a dose of 1-4 kg per hectare can increase the number of tubers by 3,4-3,6 tubers per clump, more when compared to control plants as much as 2.9 tubers per clump. Furthermore Sumarni et al. (2012), stated that the administration of boron at 2-4 kg per hectare increases the germination capacity above 77% and the maximum growth potential above 80%.

An increase in the number of tillers occurs due to how much absorption of boron is absorbed by plant roots. In accordance with the statement of Brown and Hu (2017), that the absorption of boron by plant roots takes place through diffusion (B (OH) 3) due to differences in the concentration gradient of boron which in turn forms new cell tissues in the stem due to the presence of the auxin hormone, the formation of parts - parts of interest and induction of fruit formation. Other research by Dell and Malajzcuk (2017), which states if the amount of boron used is small in wheat plants, will cause photosynthate transport to the seeds to be less than optimal. Therefore the administration of boron in increasing the number of tillers (tubers) in this study was achieved in accordance with some of the statements above.

Effect of Trichoderma Bioactivator spp. and Boron against Wet and Dry Weight

The results of observations and analysis of the various effects of giving Trichoderma spp. and boron on wet weight and dry weight of onion can be seen in appendix 7. The results of the analysis of the variance show that there is no known interaction between the bioactivator Trichoderma spp. and boron against the onion wet and dry weight. The results of further tests of the average amount of wet weight and dry weight of shallots using BNJ at a level of 5% can be seen in Tables 7 to 8.

Table 7. Results of ANOVA analysis on the wet weight parameters by giving biochivator Trichoderma spp.

Treatment	Observation Results (g)
Without Trichoderma spp.	21,66 a *)
Trichoderma spp. (5 ml dose) / poly bag	26,45 ab
Trichoderma spp. (10 ml dose) / poly bag	27,81 ab
Trichoderma spp. (15 ml dose) / poly bag	30,21 ab
Trichoderma spp. (20 ml dose) / poly bag	32,53 b
BNJ 5%	9,24

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

Table 7 above shows that in the bioactivator treatment Trichoderma spp. doses of 5 ml, 10 ml, 15 ml and 20 ml were found to have a significant effect on producing a wet weight of 50.18% compared to the control treatment. But between the administration of Trichoderma spp. dose of 5 ml, 10 ml and 15 ml did not significantly affect the wet weight of 28.99%. Bioactivator Trichoderma spp. dose of 5 ml, 10 ml, 15 ml significantly affected 15.96% of wet weight compared to the dose of 20 ml. From the percentage above shows the bioactivator Trichoderma spp. able to increase the amount of wet weight of onion significantly compared to the control treatment.

The increase in wet weight weights above is in line with the research of Kusuma (2016), which states that the influence of Trichoderma spp. the overall wet weight of onion plants is higher than the control treatment. Wet weight indicates the ability of plants to absorb organic material used for plant growth. Another thing was conveyed by Suwahyono (2004), that with the administration of Trichoderma spp. able to remove the active substance in the form of the auxin hormone, which can stimulate the formation of lateral roots and indirectly able to increase the growth of the number of tubers. Furthermore according to Sudantha and Suwardji (2016) found biocompost fermented with Trichoderma spp. can spur growth and increase the onion yield. Furthermore Sudantha and Suwardji (2017) stated the use of organic fertilizer in the form of fermented biocompost with Trichoderma spp. can also increase the weight of dry corn harvest in dry land.

Table 8. Results of ANOVA analysis on the wet weight parameters by boron administration

Treatment	Observation Results (g)
Without boron	23,43 a *)
Boron (0,238 g/ polybag)	32,04 b
BNJ 5%	4,06

Note: *) The numbers in each column followed by the same letter in each treatment were not significantly different in the BNJ test level of 5%.

Table 8 shows the boron treatment was able to significantly increase the wet weight of onions by 36.74% compared to the control treatment (without boron).

Increased wet weight due to the availability of sufficient boron and can significantly increase the number of tubers and onion crop production. The statement is in line with Sudaryono's research (2017), that the application of boron at a dose of 6 kg / ha is able to produce the shallot plants with the highest number of tubers per clump, ie 15.13 cloves and the highest tuber production, which is 25.20 tons / ha wet tubers and 22.83 tons / ha dry tubers. This shows the relationship or correlation between plant growth, namely plant height and number of leaves with the number of tubers per clump in onion production.

Table 9. Results of ANOVA analysis on dry weight parameters by giving biochivator Trichoderma spp.

Treatment	Observation Results (g)
Without Trichoderma spp.	15,39 a*)
Trichoderma spp. (5 ml dose) / poly bag	20,10 ab
Trichoderma spp. (10 ml dose) / poly bag	21,59 ab
Trichoderma spp. (15 ml dose) / poly bag	23,13 ab
Trichoderma spp. (20 ml dose) / poly bag	26,22 b
BNJ 5%	8,85

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of further tests in Table 9 show that the treatment of Trichoderma spp. at doses of 5 ml, 10 ml, 15 ml and 20 ml significantly affected the dry weight of 70.37% compared to the control treatment. But between the administration of Trichoderma spp. dose of 5 ml, 10 ml and 15 ml produce no significant effect of 32.11%. Bioactivator Trichoderma spp. dose of 5 ml, 10 ml, 15 ml significantly affected the dry weight of 14.72% compared to the dose of 20 ml.

With the administration of Trichoderma spp. able to increase the amount of dry weight compared to without giving Trichoderma spp. Furthermore according to Burhanudin (2018) explained that, the application of biocompost and bioactivators resulting from fermentation of endophytic fungi and Trichoderma spp. able to increase the dry weight of soybeans with significant results. The weight of soybean seeds tested was influenced by biocompost and bioactivators fermented by the fungus Trichoderma spp. where the average dry weight of seeds in the treatment of biocompost and bioactivator applications is higher than without the application of biocompost and bioactivators.

Table 10. Results of ANOVA analysis on dry weight parameters by boron administration

Treatment	Observation Results (g)
Without boron	16,98 a*)
Boron (0,238 g/ polybag)	25,59 b
BNJ 5%	3,89

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

Table 10 shows the results of further tests of the treatment of boron administration that was significantly different from the dry weight of onion by 50.70% compared to the treatment without boron. These results prove that administration of boron can increase the dry weight of onions.

This is consistent with Sudaryono's research (2017), that boron has a direct influence on the number of tubers per clump, tuber production (wet and dry weights) per hectare on shallot plants. The more boron doses given, the number of tubers per clump and onion production increases. At a dose of 6 kg boron fertilizer per hectare, can produce onion plants with the highest number of tubers per clump and is able to produce the highest compared to other doses.

Other studies according to Sugianto (2014), the calculation of the weight of 100 pea seeds with the application of B2O3 boron can improve the quality of crop yields. Further test results showed significantly different results in all treatments with the addition of boron, because boron can enhance photosynthesis through its role in carbohydrate and protein metabolism in plants. This is what causes the results of peas with the addition of boron show increased weight, which means peas seeds become more pithy, so the above statement is able to support the idea of this study.

Effect of Trichoderma Bioactivator spp. and Boron on the total population of Trichoderma spp.

The results of observations and analysis of the various effects of giving Trichoderma spp. and boron to the population of Trichoderma spp. can be seen in appendix 7. The results of the variance analysis show that there is no known interaction between the bioactivator Trichoderma spp. and boron to the population of Trichoderma spp. Further test results mean population of Trichoderma spp. by using a BNJ level of 5% can be seen in Tables 11 and 12.

Table 11. Results of ANOVA analysis on the parameters of Trichoderma spp. with the administration of Trichoderma spp.

Treatment	Total Population (Propagul)
Without Trichoderma spp.	21,16 a*)
Trichoderma spp. (5 ml dose) / poly bag	29,50 ab
Trichoderma spp. (10 ml dose) / poly bag	39,66 ab
Trichoderma spp. (15 ml dose) / poly bag	45,00 b
BNJ 5%	6,90

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

The results of the analysis from Table 11 above can be seen that the bioactivator treatment of Trichoderma spp. at a dose of 5 ml significantly different from the total population of 43.95% compared to the bioactivator Trichoderma spp. doses of 10 ml, 15 ml and 20 ml. But it is different with the bioactivator Trichoderma spp. at a dose of 10 ml was not significantly different from the increase in the population of Trichoderma spp. with a treatment dose of 15 ml which produces a percentage of 34.44%. Bioactivator Trichoderma spp. doses of 10 ml and 15 ml were significantly different from the total population of 53.68% compared to the bioactivator Trichoderma spp. at a dose of 20 ml. Therefore more and more doses of Trichoderma spp. the number of Trichoderma spp. which exists.

Table 12. Results of ANOVA analysis on the parameters of the population number of Trichoderma spp. with the administration of Trichoderma spp.

Treatment	Total Population (Propagul)
Without boron	18,41 a*)
Boron (0,238 g/ polybag) + Trichoderma spp.	49,25 b
BNJ 5%	3,21

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

Likewise in Table 12 above it was found that the treatment of boron administration to the population of Trichoderma spp. significantly affected 16.75% compared to the treatment without boron. In other words, boron administration can increase the population of Trichoderma spp. amounted to than treatment without boron.

Boron has an important role in the growth of Trichoderma spp. Population, it is in line with the research of Saraswati (2007), that decomposer agents including mushrooms can be used to accelerate and improve the quality of composting results, generally in the form of a consortium of microorganisms (commonly called bioactivators). Decomposers are living things whose function is to decompose organic material both from plants and animals, so that the material described can be absorbed by plants. The content of boron can be used as a growth medium for Trichoderma spp. However, the composition and nutrient content of a medium for microbial growth must be balanced so that plant growth is optimal (Febriansyah, 2011). From some of the studies above, it can be seen the influence of boron is very important in increasing the population of Trichoderma spp. because boron functions as one of the growing medium of Trichoderma spp.

Effects of Boron Levels in Shallot Networks

The results of observations and analysis of various amounts of boron levels in shallots can be seen in Appendix 7. The results of the analysis of variance indicate the effect of boron was not significantly different from the treatment of boron coupled with bioactivator Trichoderma spp. to the amount of boron content. The results of further tests of the average content of boron to the amount of boron content in the onion tissue by using a BNJ level of 5% can be seen in Table 16.

Table 13. Results of anova analysis on the amount of boron in the onion tissue

<table>
<tr><td colspan="2">Treatment</td><td rowspan="2">Observation result</td></tr>
<tr><td>Boron</td><td>Trichoderma spp.</td></tr>
<tr><td colspan="2">Without boron dan without Trichoderma spp.</td><td>0,45 a*)</td></tr>
<tr><td colspan="2">Boron (0,238 g/ polybag)</td><td>0,91 b</td></tr>
<tr><td rowspan="4">Boron
(0,238 g/ polybag)</td><td>Without
Trichoderma spp.</td><td>0,95 b</td></tr>
<tr><td>Trichoderma spp.
(5 ml dose) / poly bag</td><td>0,99 b</td></tr>
<tr><td>Trichoderma spp.
(10 ml dose) / poly bag</td><td>1,08 b</td></tr>
<tr><td>Trichoderma spp.
(15 ml dose) / poly bag</td><td>1,12 b</td></tr>
<tr><td colspan="2">BNJ 5%</td><td>0,58</td></tr>
</table>

Note: *) The numbers in each column followed by the same letter in each treatment are not significantly different in the BNJ test level of 5%.

Table 13 above shows that the treatment of boron has a significantly different effect on the amount of boron content of 14.88% compared to the treatment without boron (control). While the effect of boron treatment was not significantly different by 35.49% compared to the treatment of boron added with Trichoderma spp bioactivator.

Giving boron gives the same effect or not significantly different compared to not given boron. This is because the amount of boron content in the soil is sufficient for nutrient requirements in onions, so that if the dose of boron is added the effect will not be much different. The statement is in line with the opinion of Camacho-Crist´obal et al. (2008), that the availability of boron in the soil is 0.5 - 2.0 ppm but only 0.5 - 2.5% is available for plants. The addition of micro elements such as boron with the right dose will be good for plants, but can be toxic if added excessively in other words plants will be poisoned.

Furthermore, other research that supports this opinion is Pratama (2017), that the use of boron applications at high altitudes of 1,650 masl and medium altitude of 700 masl has a significant effect on grain yield per wheat crop. Significant effect of crop seeds in the highlands of 1,650 masl is shown by the level of boron concentration of 0.49 ppm compared to the concentration level of 0.23 ppm and without the application of boron. The real effect of grain yield per wheat plant in plain medium 700 meters above sea level is shown by the level of boron concentration of 1 ppm compared to the application of boron.

Conclusion

Based on the results and discussion described above, the following conclusions can be drawn:

1. From the research that has been done, it was found that the administration of Trichoderma spp. and boron can stimulate plant growth and be able to increase the yield of onion productivity.

2. Provision of Trichoderma spp. and boron has a significant effect between each treatment, both in terms of the various dose doses that exist in each treatment. Provision of Trichoderma spp. and boron also have a significant effect on each variable of onion growth in the form of; plant height, number of leaves, number of tillers (tubers), wet weight and dry weight of onion, total population of Trichoderma spp., total boron content and an increase in the amount of nutrients in soil characteristics.

3. There is no interaction between the administration of Trichoderma spp. and boron as a trigger for the growth of shallots on various growth variables; plant height, number of leaves, number of tillers (tubers), wet weight and dry weight of onion, population of Trichoderma spp., and total boron content.

4. Trichoderma bioactivator spp. with the highest dose of 20 ml and boron with a concentration of 0.238 g / cm3 can increase the amount of nutrients, including; organic C content was 0.83%, total N was 0.076%, P was available 110.76 ppm, K was exchanged for 77.73 meq%, soil pH was 7.21 and soil CEC was 14.12 meq%.

References

Azza AMM, Zanghloul SM, Yaseen AA. 2006. Impact of boron fertilizer on growth and chemical constituents of Taxodium distichum grown underwater regime. World J. Agric. Sci 2: 412-420.

Azamri, R., B. Hajieghrari, and A. Giglou. 2011. Effect of Trichoderma isolates on tomato seedling growth response and nutrient uptake. African Journal of Biotechnology. 10 (31): 5850-5855.

Berlian and Rahayu. 2004. Shallots, Know of Superior Varieties and Continuous Cultivation Methods. Penebar Swadaya, Jakarta.

Burhanudin. 2018. The Use of Biocompost and Bioactivators of Granulated Formulations Containing Trichoderma spp to Increase Soybean Results in Entisol Soil.(Online) http://download.portalgaruda.com. Access October 25, 2018.

CPM. 2015. Shallot Annual Data. (Online) http://ntb.bps.go.id. Access December 24, 2017.

CPM. 2017. Data of Shallots in West Nusa Tenggara. (Online) http://ntb.bps.go.id Access October 24, 2018.

Brown, P.H., and H. Hu. 2017. Boron Uptake by Sunflower, Squash and Cultured Tobacco Cells. Physiology of Plant 91 (4): 1329-1340.

Camacho-Crist´obal, J. J., Rexach, J., and Gonzalez-Fontes, A. 2008. Boron in Plants: Deficiency and Toxicity. Journal of Integrative Plant Biology ,, 50 (10), 1247-1255. doi: 10.1111 / j.1744-7909.2008.00742.x.

Cartika, Ika; Dani, Umar; Asminah M. 2016. Effect of Trichoderma sp. and Nitrogen Fertilizer on Growth and Production of Curly Red Chili (Capsicum annuum L.). (Online) http://jurnal.unma.ac.id. Access December 18, 2017.

Dell, B., and N. Malajczuk. 2017. Boron Deficiency in Euacalypt Plantations in China. Can. J. Forest Resource 24 (193): 2409-2416.

Dermawan,R.2018.Application of Boron Fertilizers and Trichoderma Enrichment in Planting Media on Growth and Production of Large Chili Varieties (Capsicum Annuum L.). (Online) http://jurnal.unsyiah.ac.id. Access August 23, 2019.Fatchullah; D, Masnenah E;

Rahman R.A. 2018. Optimizing the Use of NPK 15-15-15 Synthesis of Compound Fertilizers with Trichoderma sp. For Shallots (Allium ascolanicum). (Online) http://journal.uinsgd.ac.id. Access July 31, 2019.

Fadila, Sarah. 2015. The Effect of Boron Dose and Determination of Appropriate Plant Segments for IPB Hybrid Melon Seed Production. (Online) http://repository.ipb.ac.id Access July 26, 2019.

Febriyansyah, R.A. 2011. The Function of Biodecomposers as Nutrition for Biological Microbes. (Online) http://etheses.uin-malang.ac.id. Access 29 July 2019.

Mardhiansyah. 2007. Potential of Trichoderma spp. In composting organic waste as a growing medium in support of the survival of Tusam seedlings. Journal of the Faculty of Agriculture, University of Riau. Vol: 6, No.1, 29-33.

Maryam, S 2014, 'Identification of agricultural problems in Padang Pangrapat Village, Tanah Grogot District, Pasir Regency (Identification of farming problems in Padang Pangrapat, Groyot Land, Sand Grout Dirt Land, Sand)', EPP, vol.3, no.1 , pp.6-8.

Nurul, R.M. 2017. Analysis of Shallot Farming Efficiency in Majalengka Regency, West Java. (Online) http://repository.ipb.ac.id. Access October 24, 2018.

Oyinlola EY. 2007. Effect of boron fertilizer on yield and oil content of three sunflower cultivars in the Nigerian Savanna. Journal of Agronomy. 6 (3): 421-426.

Pratama, Faris F. 2017. Effect of Height of Place and Application of Boron on Fertilization of Pollen and Wheat Results (Triticum aestivum L.). (Online) http://repository.ub.ac.id Access July 26, 2019.

Saraswati, R. 2007. Development of Multipurpose Soil Microflora Technology for Fertilizing Efficiency and Sustainability of Agricultural Land Productivity. Center for Land and Agro-climate Research and Development. Bogor.

Setiawan B. 2010. Effect of essential elements on plant growth and production. (Online) http://Badrussetiawan1.Blogspot.Com/2010/03/ Influence- Essentials- Essentials Against Growth and Production-Plants.html. Access May 20, 2018.

Sudantha, I.M. 2011. Regional Seminar Paper on Potential Development of Organic Agriculture as One of the Integrated Sustainable Agriculture Models. Faculty of Agriculture University of Mataram. Mataram.

Sudantha, I. M., Suwardji. 2013. "Utilization of Biocompost, Bioactivator and Biochar to Increase Corn Yields and Fresh Breeding in Dry-Soil Land with Big Gun Sprinkler Irrigation Systems". Strategic Leading Research Themes: Food Security & Security. National Strategic Research, University of Mataram.

Sudantha, I. M. and Suwardji. 2016. Growth and Yield of Onion (Allium Cepa Var. Ascalonicum) as CA Result of Addition of Biocompost and Boactivity Fermented with Trichoderma spp. In: The 1st International Conference on Science and Technology (ICST) 2016, 1-2 December 2016, University of Mataram.

Sudantha, I. M., Suwardji., Fauzi, M.T. 2017. Test Various Ways and Doses of Application of Compost Extract Solutions Fermented with Trichoderma Spp. Against the growth and yield of soybeans. (Online) http://eprints.unram.ac.id. Access July 14, 2019.

Sudaryono, T. 2017. Response of Shallot Plants To Boron Fertilization. (Online) http://publishing-widyagama.ac.id. Access April 30, 2018.

Sumarni, N, Sopha, GA & Gaswanto, R 2012, ‘Improved flowering and seeding of several varieties of shallots by providing transparent plastic shade and application of gibberelat acid, 'J. Hort., Vol. 22, no. 1, p. 14-22.

Soedjana TD. 2013. Participation in consumption as a measurement of meat food security status. Bartazoa. 23 (4): 166-175.

Soetiarso,TA.2009.Innovative onion technology and its development.Proceedings National Seminar on Marginal Land Agricultural Innovation Development, pp. 293 - 324, downloaded December 26, 2009, http: // sulteng. R&D Ministry of Agriculture. go en / ind / images / stories / bptp / Proceedings% 2007 / 2-33pdf.

Sugianto, Hermawan. 2014. Use of Boron to Increase Yield and Content of Peanut Oil. (Online) http://jurnal.uns.ac.id Access 26 October 2019.

Sumarni, N & Hidayat, A 2005, PTT onion technical guide, no. 3, Vegetable Crops Research Institute, Bandung.

Suwahyono 2004. Trichoderma harzianum Indigeneous for Biological Control. Basic Study Towards Commercialization in the Biology Seminar Guide. Yogyakarta: Faculty of Biology. UGM.

Syukur, A. 2005. Absorption of Boron by Corn Plants in Bugel Beach in Relation to the Frequency of Watering and Provision of Organic Materials. Journal of Soil and Environmental Sciences. 5 (2): 20–26.

Utami, Yulani. 2015. Productivity and Quality of Forage Indigoferazollinge riana Inoculated with Arbuskula Mycorrhizal Fungi with Various Boron Levels. (Online) http://repository.ipb.ac.id Access 24 December 2017.

Yulipriyanto, H. 2010. Soil Biology and its Management Strategy. Graha Science. Yogyakarta.